Perspectives in Pragmatics, Philosophy & Psychology 23

Antonino Pennisi
Alessandra Falzone *Editors*

The Extended Theory of Cognitive Creativity

Interdisciplinary Approaches to Performativity

Springer

Perspectives in Pragmatics, Philosophy & Psychology

Volume 23

More information about this series at http://www.springer.com/series/11797

Antonino Pennisi • Alessandra Falzone
Editors

The Extended Theory of Cognitive Creativity

Interdisciplinary Approaches to Performativity

Springer

Editors
Antonino Pennisi
Department of Cognitive Science
University of Messina
Messina, Italy

Alessandra Falzone
Department of Cognitive Science,
Psychology, Education and Cultural Studies
University of Messina
Messina, Italy

ISSN 2214-3807 ISSN 2214-3815 (electronic)
Perspectives in Pragmatics, Philosophy & Psychology
ISBN 978-3-030-22089-1 ISBN 978-3-030-22090-7 (eBook)
https://doi.org/10.1007/978-3-030-22090-7

This Springer imprint is published by the registered company Springer Nature Switzerland AG.
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Contents

Chapter 1
Presentation

Antonino Pennisi and Alessandra Falzone

This volume presents the results of the research PRIN project (Projects of significant national interest) “Perception, performativity, and cognitive sciences”, which has been financed by MIUR (Ministry of Education University and Research) over the three years period 2016–2019 and carried out by a team of academics: Antonino Pennisi (University of Messina – Principal Investigator), Vittorio Gallese (University of Parma), Ruggero Eugeni (Catholic University of the «Sacred Heart» of Milan), Claudio Paolucci (University of Bologna), Pietro Montani (the «Sapienza» University of Rome), Marco Mazzone (University of Catania), Franco Lo Piparo (University of Palermo), Guglielmo Tamburrini (University of Naples «Federico II»). During 2017 Nunzio Allocca has joined the roman unity, while Marco Carapezza joined the unity of Palermo. All the news about the state of research and the scientific initiatives involving our research group are available on the web (https://sites.google.com/view/perception-performativity/project) and described in 2/2017 of “Reti Saperi Linguaggi. Italian Journal of Cognitive Sciences” (Pennisi 2017).

An early debate on the subjects of the research took place on 1 March 2016, during a conference that was held at the Sapienza University of Rome. One year after the project was started, another convention on such matters was held: the tenth edition of the CoDiSco International Conference, named “Performative Dimensions in Cognitive Sciences” (see Pennisi 2017), which took place from 27 to 30 September 2017 in Noto, at the premises of CUMO (Consorzio Universitario del Mediterraneo Occidentale). This conference led to a lot of theoretical reflections that you can read about on this volume. Most of all, it has enlightened the inexhaustible strength of the methodology of cognitive sciences: a strength represented by its

A. Pennisi (✉) · A. Falzone
Department of Cognitive Science, University of Messina, Messina, Italy
e-mail: apennisi@unime.it; amfalzone@unime.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*,
Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_1

interdisciplinarity, a lot of approaches and philosophies being focused on one particular problem. The problem we discuss is to make up an exhaustive theory of performativity and its relationship with cognitive crativity. The theme will be further investigated in the International Conference to be held at the University of Bologna from 24 to 26 June 2019 which will be titled *Embodied Creativity: the role of performativity* and which will close the cycle of events related to the research project.

The aim of this research project is to focus on (and test) the hypothesis that performativity is not a property confined to certain specific human skills, or to certain specific acts of language, nor an accidental enrichment due to creative intelligence. Instead, the executive and motor component of cognitive behavior should be considered an intrinsic part of the physiological functioning of the mind and as endowed with self-generative power. It is thought to have evolutionarily developed in close correlation with processes of natural selection leading, in the human animal, on the one hand, to the species specificity of articulate speech and, on the other, to embodied simulation as a model of perception. In this perspective, cognition is considered a mediated form of action rather than a relationship between inner thought and behavior occurring in the outside world. In this model of performativity, action is never considered mere externalization of a mental process, but is a cognitive process through which the body produces it. Every species-specific embodied form is a way to know reality available to all human beings.

Performativity, in this theoretical context, can be defined as a constituent component of cognitive processes. The material action allowing us to interact with reality is both the means by which the subject knows the surrounding world and the one through which he experiments with the possibilities of his body. This proposal is rooted in models now widely accepted in the philosophy of mind and language; in fact, it focuses on a space of awareness that is not in the individual, or outside it, but is determined by the species-specific ways in which the body acts on the world. It is the body to determine the cognitive ability of the individual, not mental abstract internal procedures, nor just environmental inputs.

This theoretical hypothesis will be pursued in this book through the latest interdisciplinary methodology typical of cognitive science. On the one hand, in fact, it needs to clarify some philosophical positions brought to light by thesis of Embodied Cognition and numerous interpretations of the extended mind, often at odds with the most internalist and mentalist hypotheses on cognitive psychology and computationalism. On the other hand, it has to clarify the philosophical problems investigated, because, in line with the naturalist presuppositions of the cognitive neuro-scientific investigation, they require experimental investigation in different fields of application. Thus, a significant part of the project will try to clarify the contribution of an extended theory of performativity to experimental research on perception, performative arts and the creative use of media devices.

Summing up, the project aims to narrow down and clarify a unified theory of cognitive performativity both from a philosophical and from an experimental perspective. Its purpose is to find the common thread that keeps together active behaviors in distinct cognitive activities (language, visual perception, use of media, practice of performing arts) that cannot be attributed either to general computational principles nor be explained by involuntary (unconscious) recourse to biological algorithms.

The essays that you will read in this book deal both with the key issues of a theoretical and empirical investigation on an extended theory of performativity and with the criticality that such theory still has.

The critical aspects of a theory of performativity have been highlighted, for example, by Vittorio Gallese, who assessed the results of the interaction between the embodied simulation and a cognitive science paradigm which is well rooted in sensorimotor and bodily activity. This is the direction taken even by Guglielmo Tamburrini's and Roberto Prevete's studies on the neuromodulation of performative abilities and by Alessio Plebe's research on the relation between context and neural representations. Pietro Perconti, who argued around a moderate mindreading priority, dealt with the more purely philosophical aspects; as well as Claudio Paolucci, who tried to imagine radical enactivist approach to social cognition.

Other critical aspects emerged from Alessandro Minelli's and Alessandra Falzone's reflections on the evolutionary implications of performativity, the first in relation to the evolutionary development of individual's uniqueness, the second in relation to natural performativity, a central component of the human mind that determines the relationship between the individual and the external world. Also in this context takes place the reconstruction of the contribution that the history of biolinguistics has brought to the debate on performativity, in the essay by Laura Giallongo and Giovanni Pennisi.

A great contribution came even from the fields of esthetics and neuromedia: for example, Ruggero Eugeni's research on the temporality of neurofilmological approach to the subjective experience of moving-image time; Pietro Montani gave a philosophical interpretation of narrative imagination both in presence and in absence of language deepening a (post)Kantian approach; Giovanni Matteucci depicted in remarkably vivid detail the idea that creativity correspond to the performativity intrinsic to our extended mind; while Marco Mazzone and Marco Carapezza focused on the boundaries of performativity; the first analyzing the relationship between performativity and the ideological construction of the self, the second its strictly bio-cognitive elements.

Possible applications of performativity in the field of linguistic theories have been proposed by Alessandro Capone, on the role of the first person implicit indirect reports in disguise; by Paola Pennisi on performative acts in the acquisition of L2 and psychopathological behaviors; and by Francesco Lamantia on an Enactive grammar's insight. Finally, we need to address the precious reconstructions of the historical contexts of a theory of performativity made by Stefano Gensini in relation to the ancient link between semiotics and ethology and by Franco Lo Piparo on the nature of bodies in Aristotle.

Last but not least, Mark Turner's and Mathew McCubbins' contributions shed light on the most critical aspects of the project and put forward alternative solutions, which however are problematic as well. Turner and McCubbins (*Collective Action in the Wild*) underlined the incompatibility between game and decision theory and a theory of performativity, suggesting to rely on an alternative, testable theory of flexibility, inspired by some recent experiments carried out by cognitive neuroscientists. In their essay they argue that game-theoretic models of human collective action must find new foundations, given the evidence that human behavior in experimental settings and in the wild does not conform to theoretical predictions. They therefore propose an alternative, pragmatic theory of decision-making, founded on different conceptions of selves and decisions, conceptions that are consistent with new cognitive neuroscience.

In conclusion We cannot fail to talk about the essay written by Shaun Gallagher (*Mindfulness performance*), that deals with a crucial issue for Embodied Cognition: the accusation of being a sort of "behaviorist epistemology in disguise" (Shapiro 2011, 2014). Similar allegations have been made by Hirstein, who talks about enactivism and the extended mind theory as "new forms of behaviorism" (Hirstein 2015, 250) and by Aizawa (2014), who links the impossibility of putting forward a theory of representation with the behaviorism underpinning Embodied Cognition. Since he is a firm believer in the embodied perspective, Gallagher contrasts such criticism resorting to a neo-phenomenological theory based both on Merleau-Ponty's ideas and on a theory of performativity. In his "phenomenology of performance" Gallagher points out that, if we analyze studies on athletics, dance and musical performance, we can find many deeply embodied and intersubjectively modulated forms of consciousness in the experts' performance, rather than the "mindlessness" described by the critics of enactivism. This is the core concept of Gallagher's hypothesis: actions and behaviors are intrinsically cognitive and based on a *performative self-awareness* which is linked both to the aim of the action and to the pre-reflexive sense of the body-as-subject.

If, on the one hand, Gallagher's and Turner's and McCubbins' essays are capable of mitigating the most reductionist claims of the classical cognitive perspective, on the other hand they promote a view of corporeity as "weak cognition" ("behavior cognition" or "lower cognition" or "minimal cognition" – Calvo and Keijzer 2009; Chemero 2009; Stewart 2010; Di Paolo et al. 2010; Hutto and Myin 2013); in other words, albeit they contribute to the overcoming of the classical dualism between mind and body, the assumptions of the authors shape a new dualism between the parts of the body involved in the higher functions and the ones that are involved in perceptual, motor and emotional functions. Against this background, Gallagher himself wonders if it's not the case to talk about a "philosophy of nature" (Gallagher 2017, 21) instead of an "enactive science of mind". A theory of performativity would therefore appear to be a "commentary on the whole image of the natural world" (Godfrey-Smith 2001: 284), "an accurate philosophical redescription of the image of the world offered by science"; in such case, despite its philosophical flexibility, the theory of performativity would inevitably stay out of Cognitive Sciences (Pennisi 2016; Pennisi and Falzone 2016). It is an important and controversial topic, which I also discuss in my introductory essay to this volume (*Dimensions of the bodily creativity. For an extended theory of performativity*) and which we will certainly return to in future research developments.

Antonio Pennisi – Alessandra Falzone
Noto 15/04/2019

References

Aizawa, K. (2014). The enactivist revolution. *Avant*, 5(2), 1–24.

Calvo, P., & Keijzer F. (2009). Cognition in plants. In F. Baluska (Ed.), *Plant-environment interactions: From sensory plant biology to active plant behavior* (pp. 247–266), Berlin: Springer.

Chemero, A. (2009). *Radical embodied cognitive science*. Cambridge, MA: MIT Press.

Di Paolo, E., Rohde, M., & De Jaegher, H. (2010). Horizons for the enactive mind: Values, social interaction, and play. In J. Stewart, O. Gapenne, & E. Di Paolo (Eds.), *Enaction: Towards a new paradigm for cognitive science.* Cambridge: MIT Press.

Gallagher, S. (2017). *Enactivist interventions rethinking the mind.* Oxford: Oxford University Press.

Godfrey-Smith, P. (2001). On the status and explanatory structure of developmental systems theory. In P.E. Griffiths, & R.D. Gray (Eds.), *Cycles of contingency: Developmental systems and evolution* (pp. 283–298). Cambridge, MA: MIT Press.

Hirstein, W. (2015). Consciousness despite network underconnectivity in autism: Another case of consciousness without prefrontal activity? In R.J. Gennaro (Ed.), *Disturbed consciousness: New essays on psychopathology and theories of consciousness* (pp. 249–264), Cambridge: MIT Press.

Hutto, D., & Myin, E. (2013). *Radicalising enactivism*. Cambridge, MA: The MIT Press.

Pennisi, A. (2016). Prospettive evoluzioniste nell'embodied cognition: il cervello "inquilino" del corpo. *Reti, saperi, linguaggi. Italian Journal of Cognitive Sciences*, 1/2016, 179–202.

Pennisi, G. (2017). What space for performativity in Cognitive Science? Insights from CODISCO 2017. *Reti, saperi, linguaggi. Italian Journal of Cognitive Sciences*, 2/2017, 381–86.

Pennisi, A., & Falzone, A. (2016). *Darwinian biolinguistics. Theory and history of naturalistic philosophy on language*. Berlin/Heidelberg/New York/Cham: Springer.

Shapiro, L. (2011). *Embodied cognition*. London: Routledge.

Shapiro, L. (2014). Book review: Radicalizing Enactivism: Basic minds without content. *Mind*, *123*(489), 213–220.

Stewart, J. (2010). Foundational issues in enaction as a paradigm for cognitive science: From the origin of life to consciousness and writing. In J. Stewart, O. Gapenne, & E. Di Paolo (Eds.), *Enaction: Towards a new paradigm for cognitive science* (pp. 1–31). Cambridge, MA: MIT Press.

Part I
General Introduction

Chapter 2
Dimensions of the Bodily Creativity. For an Extended Theory of Performativity

Antonino Pennisi

Abstract In our project the performance is a *product of performativity*. Performativity is the cognitive ability to produce physical or mental actions. Studying performance and studying performativity sets different scientific activities. Studying how to enhance the perfòrmances belongs to the behavioral science. On the contrary, studying performativity belongs to a general cognitive procedure that must not be confused with the description of behaviors, requiring a specific theorization in the cognitive sciences instead. The aim of this research project is to focus on the hypothesis that performativity is not a property confined to certain specific human skills, or to certain specific acts of language. Instead, the executive and motor component of cognitive behavior should be considered an intrinsic part of the physiological functioning of the mind and as endowed with self-generative power.

Performativity as a physiological tool of cognitive creativity has precise neural correlates and procedural properties. The firsts are summarized briefly in the central part of the essay. The latter are more widely discussed in the following chapters. From the point of view of procedures, instead, it is argued that performativity is a cognitive property that arises from the absence of an algorithm designed to carry out a given performance. Acting in a non-planned way, learning by trial and error, applying familiar behavioral patterns to new situations: these are just a few examples of what is performativity and of how it works. Thus, performativity is intrinsically creative because its nature is to face situations that cannot be solved by the application of already known algorithms. In a nutshell, performative creativity is a procedural system that is somewhere between what Chomsky called "rule governed creativity" and "rule-changing creativity". Performativity however bears a peculiar kind of creativity, which is different from the one generated by the competence but still shares some features with the latter: in fact, it is a fully embodied and free-from-rules process that is carried out through trial and error, that is to say it depends on the bodily practice (locomotion, language, perception, etc.) made in everyday experience.

A. Pennisi (✉)
University of Messina, Messina, Italy

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*,
Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_2

It is for this reason that Embodied Cognition (EC) should be the theoretical framework to explain the functioning of the performativity. EC indeed is the answer to all those cerebrocentric theories that consider only the computational function of the brain and ignore the role of the body as the main responsible for all the abilities of humans, animals and machines, describing performance just as an executive function. The EC however addresses the issue of performativity from the point of view of the individual rather than from that of the species. From this perspective it makes difficult to incorporate performativity into a general theory of cognition. Its phenomenological instances come into conflict with the naturalism of cognitive sciences. On the contrary, an extended theory of performativity cannot do without ethological and evolutionist perspectives. These perspectives are addressed in the second part of the essay, both from the point of view of the historical reconstruction and from that of the current debate.

In the light of the considerations made in the last part, the final hypothesis that we support is that performativity is not an attribute belonging to some human abilities only, nor to the faculty of language, nor to uniquely creative intelligence of homo sapiens. On the contrary, it can be defined as a fundamental element for *any species'* cognitive process. From an evolutionary point of view, performativity probably developed in parallel with the structural and functional transformations occurred in homo sapiens that led to the species-specificity of language and let embodied simulation be our model of perception. For what concerns other species, performativity had a different development for any of them and led to other kinds of cognitive abilities.

2.1 Introduction

This volume presents the results of the research PRIN project (Projects of significant national interest) "Perception, performativity, and cognitive sciences", which has been financed by MIUR (Ministry of Education University and Research) over the 3 years period 2016–2019 and carried out by a team of academics that I have the honor to coordinate: these academics are Vittorio Gallese (University of Parma), Ruggero Eugeni (Catholic University of the «Sacred Heart» of Milan), Claudio Paolucci (University of Bologna), Pietro Montani (the «Sapienza» University of Rome), Marco Mazzone (University of Catania), Franco Lo Piparo (University of Palermo), Guglielmo Tamburrini (University of Naples «Federico II»). During 2017 Nunzio Allocca has joined the roman unity, while Marco Carapezza joined the unity of Palermo. All the news about the state of research and the scientific initiatives involving our research group are available on the web (https:// sites.google.com/view/perception-performativity/project) and described in 1/2018 of "Reti Saperi Linguaggi. Italian Journal of Cognitive Sciences" (Pennisi 2018a).

An early debate on the subjects of the research took place on 1 March 2016, during a conference that was held at the Sapienza University of Rome. One year after the project was started, another convention on such matters was held: the tenth edition of the CoDiSco International Conference, named "Performative Dimensions in Cognitive Sciences" (see Pennisi, G. 2017), which took place from 27 to 30 September 2017 in Noto, at the premises of CUMO (Consorzio Universitario del Mediterraneo Occidentale). This conference led to a lot of theoretical reflections that you can read about on this volume. Most of all, it has enlightened the inexhaustible strength of the methodology of cognitive sciences: a strength represented by its interdisciplinarity, a lot of approaches and philosophies being focused on one particular problem. The problem we discuss is to make up an exhaustive theory of performativity and its relationship with cognitive creativity.

2.2 What Is the Performativity: Perfòrmance vs. Performativity

We need to start from the difference between Perfòrmance and Performativity.

The term *performativity* doesn't even exist in philosophical English. In philosophy of language, the founder of the term – J.L. Austin – never spoke about "performativity", but spoke about "performative utterances" (1962): classes of verbs, nouns and expressions that replace the action. This definition of the word *performativity* gained a foothold in linguistics and pragmatic semantics (Searle 1979, Lakoff and Johnson 1980), but has completely disappeared from the dictionary of contemporary philosophies like phenomenological philosophy of mind (Gallagher and Zahavi 2008; Gallagher 2017a, b; Gallagher 2018- cfr. Pennisi, G. 2018, 2019), enactivism (Noë 2004, 2009, 2015; Menary 2006, 2010; Hutto and Myin 2013) and every other philosophy inspired by Embodied, Extended or Embedded Cognition (Varela et al. 1991; Gibbs 2005, 2008; Anderson 2015; Chemero 2009; Rowlands 2003, 2006, 2010; Shapiro 2004, 2011, 2014; Clark 2008a, b, 2016).

Of course we can attribute this "negationism" to linguistic issues even if I don't think this is the case. The term "performativity" is not officially approved in English, French, Spanish, German and Italian but is currently used in philosophical literature, and also in England it is widely employed in social sciences. We are not dealing with a grammatical or lexical problem but rather with a theoretical one.

In social sciences (anthropology, gender sociology, economics, law) the term "performativity" is theoretically essential and has an exclusively externalist value. The term has the specific function to show the great power of language to influence political, economic, legal, social and gender relations. In these sciences, the category of "performativity" or "performative power" is irreplaceable.

Special considerations apply instead to the study of arts and media marked by the "performative turning" (Robert Wilson, Jerzy Grotowski, Marina Abramovic, Richard Schechner, Neil Harbisson, Stelarc – or Stelios Arkadiou), which led to the establishment of perfòrmances studies, a theoretical approach all focused on the performative challenge of what bodies can do. In this case, the externalist approach (the effect of the perfòrmances on the enjoyers) is complemented by a more embodied aspect that would affect the structural possibilities of the bodies: today this is a topic dear to the heart of Evo-Devo. However, this range of performative practices is rarely included in scientific dimensions.

What unifies all these primarily social meanings of performativity, putting them in contrast with cognitive sciences, is that the firsts focus primarily on external conditions (environment, society, culture, prosthesis, technologies, etc.), while the latter are always tormented by the centrality of the internalist perspectives (mind, conscience, psychic states, etc.). In the internalist perspectives there is no space for the major aim of our project: to consider performativity a specific cognitive ability. This is what I will try to show in the following pages.

In our project the performance is a *product of performativity*. Performativity is the cognitive ability to produce physical or mental actions. Studying performance and studying performativity sets different observational or scientific activities.

For example a performance is:

1. An action that can be inhibited, favored, induced, etc. (ex: athletic performance, cognitive performance, etc.);
2. An executive plan of a project (performing a musical score, performing a theatrical screenplay, etc.);
3. A mental procedure that allows the execution of algorithmic behavior (reciting a poem, counting, executing a multiplication, etc.)
4. An action that executes a project.

Studying how to enhance these perfòrmances belongs to the behavioral science. On the contrary, studying performativity belongs to a general cognitive procedure that must not be confused with the description of behaviors, requiring a specific theorization in the cognitive sciences instead.

The hypothesis we want to put forward is that performativity is a cognitive property that arises from the absence of an algorithm designed to carry out a performance. Acting in a non-planned way, learning by trial and error, applying familiar behavioral patterns to new situations: these are just a few examples of what is performativity and of how it works.

I.e. walking is for children a merely performative activity which is necessary due to the lack of a genetic algorithm regulating the bipedal locomotion. A child will never be able to prove to himself he can walk until his musculoskeletal system will be fully developed. The neuromotor control needed for walking can be exercised in a physiologically mature body; however, the outcome of such process is not obvious. The predisposition and the development of a genetic structure apt to bipedalism do not guarantee the function to be triggered. The same is true for the control of the vocal tract of children between 18 and 24 months of age. No child is able to articulate his voice correctly until his musculoskeletal structure is not fully mature. Nonetheless, even when the development of the latter is complete, there is no program that makes the child aware of how to move his vocal tract to produce the vocalisms typical of human language. Our considerations on bipedalism and on the production of articulated sounds are proven by the statistics on the enfants sauvages: among them, the 71% is quadruped, the 46% does not show any kind of vocal articulation and only the 3% articulates properly (Pennisi 2006).

The abilities to walk and to produce articulated sounds depend on something more than just the genetic makeup and the algorithms determined by it. More specifically, every man needs to live along with a group of conspecifics to learn how to move and talk. Above all, man needs the cognitive ability to carry out operations in absence of a set of instructions, a performative activity which depend on many factors: the observation of others' target-behaviors, the effort to imitate the conspecifics, the use of well-known strategy to solve new problems, the physiological interaction between little used body parts and neuromotor stimuli, direct and indirect dialogue, etc.

All the aforementioned activities are not the result of random attempts, but the outcome of processes which are analogous to the ones that occur in other cognitive tasks and that are adapted to new situations and environments. Thus, performativity is intrinsically creative because its nature is to face situations that cannot be solved by the application of algorithms. In a nutshell, performative creativity is a procedural system that is somewhere between what Chomsky, in 1964, called "rule governed creativity" and "rule-changing creativity" (1964:22).

The first kind of creativity has a syntactical-formal nature. It arises from the possibility of using recursive procedures for any reasoning and/or behavior, that is to say it depends on rules that can recall themselves within an algorithmic or a simply combinatory structure. This is the kind of creativity that allows to make an "infinite use of finite means", paving the way for the research of an unlimited number of possible solutions for a problem (Chomsky 1965, 1966). Such creativity is part of the "Competence"; it can raise some "issues", but it should never become a "mystery" (Chomsky 1982). On the other hand, the "rule-changing creativity" is a mystery to Chomsky, something outside the ordinary cognitive procedures: it is, in fact, "an aspect of the 'use of language' (i.e., performance), which is 'not to be confused' with competence" (id.:430).

It's then in the field of cognitive sciences that performativity gets downgraded to perfòrmance. This downgrade has been realized for the first time from Chomsky, who established the dicotomy between *Competence* and *Perfòrmance*. According to Chomsky, *competence* is the perfectly internalized knowledge of all rules that determine the accuracy of movements and actions, while *perfòrmance* is what constantly spoils the perfection of this mental project. Thus, *perfòrmance* is a reflection of embodiment's limits, while *competence* is purely free-from-body project.

Performativity bears a peculiar kind of creativity, which is different from the one generated by the competence but still shares some features with the latter: in fact, it is a fully embodied and free-from-rules process that is carried out through trial and error, that is to say it depends on the bodily practice (locomotion, language, perception, etc.) made in everyday experience.

It is for this reason that Embodied Cognition should be the theoretical framework of the elective theoretical framework to explain the functioning of the performativity. Embodied Cognition indeed is the answer to all those essays and theories (like Chomsky's) that consider only the computational function of the brain and ignore the role of the body as the main responsible for all the abilities of humans, animals and machines, describing performance just as an executive function.

Susan Hurley (2001) exemplifies this idea using the metaphore of "the sandwich model": in traditional cognitive models mind is considered the "highest" function, because of its role in elaborating informations, while perception just carries inputs and action transforms them into exhibition. In philosophy of language, Chomsky exasperated this position by describing morphological and semantic aspects of language as "externalization device" (2005: 10) that are independent from it. Recently, Chomsky said that we should think "the externalization of narrow syntax like the printer attached to a computer, rather than the computer's CPU" (Berwick and Chomsky 2016:35, cfr. 72 e 108). Lawrence Shapiro (2004: 165) named "separability thesis" the main hypothesis of cognitive neuroscience, according to which "from knowledge of mental properties it is impossible to predict properties of the body. Therefore, a human like mind could very well exist in a nonhumanlike body" (cfr. p. 167): this is the opposite of what happens in evolution, and it's a position too close to Putnam's idea of "the brain in a vat" (1981).

In contrast to this cerebrocentric vision of the first cognitive science and in partial analogy with the opposite one of the Embodied Cognition, the hypothesis that we would like to propose here is that the performativity constitutes a specific cognitive tool of the bodily creativity, in the bio-cognitive and evolutionist sense of the term. The hypothesis we are advancing here is that performativity is not an attribute belonging to some human abilities only, nor to the faculty of language, nor to uniquely creative intelligence of homo sapiens. On the contrary, it can be defined as a fundamental element for *any species'* cognitive process. Performativity is an attribute of every mind's physiological functioning, and has its own generative power. From an evolutionary point of view, performativity probably developed in parallel with the structural and functional transformations occurred to homo sapiens that led to the species-specificity of language and let embodied simulation be our model of perception. For what concerns other species, performativity had a different development for any of them and led to other kinds of cognitive abilities.

Performativity as a "physiological tool" of cognitive creativity has precise neural correlates and procedural properties. The latter differ according to the many fields of application of performativity: language (syntactical and semantic properties), images (kinetic and visual properties), performing arts etc. The neural correlates of performativity depend on the role of the different brain areas. The neural mapping of the performative function of such areas was the core of many researches carried out within the context of neurolinguistics.

A large amount of neurolinguistic literature has been devoted to the aforementioned mapping process, carried out through both brain imaging (Monchi et al. 2001, 2006; Nagano-Saito et al. 2008) and the study of the biochemical reactions involved in the plasticity of synaptic processes (Thivierge et al. 2007; Ko et al. 2013). Such researches have demonstrated "that the caudate nucleus and the putamen are particularly important, respectively, in the planning and the execution of a self-generated novel action, whereas the subthalamic nucleus may be required when a new motor program is solicited independently of the choice of strategy" (Monchi et al. 2006, 257). Examining the biolinguistic aspects of these discoveries in depth, Lieberman and his team have shown that the neural circuits connecting different brain parts during human speech exploit the putamen for neuromotor control, changing "on the run" – that is, during verbal action performance – "the direction of our thought processes based on new stimuli such as the understanding of meaning conveyed by the syntax of language" (Lieberman and McCarthy 2007, 16).

Furthermore, a similar activation of brain motor components is registered when language data are processed in the absence of grammatically well-tested algorithms, such as when a second language is learned (Klein et al. 1994), or when a subject switches from listening to informal speech to a more formal one (Abutalebi et al. 2007).

In short, the management of neurocerebral performative strategies seems to be responsible for the most dynamic processes of linguistic behavior. This kind of behavior needs an attempt, or an active effort, that cannot be accomplished only through the mechanical application of already known and stabilized rules because it requires "the execution of a self-generated action among competitive alternatives" (Lieberman 2013, 80): an activity that is prolonged virtually forever, after the first acquisition step of ontogenetic speech, moving from mechanical physiology to the physiology of thought.

This overall framework also explains why the paths of speech often follow the hesitational phenomena of breaking up, recomposition, reunion, syncretism, propositional chiselling, semantic and lexical refinement: that is, all that is stigmatized by Chomsky's idea of performance as the deposit of cognitive junk produced by externalization devices (to repeat his words: "numerous false starts, deviations from rules, changes of plan in mid course, and so on", 1960: 530). On the contrary, the most advanced neurolinguistic research reveals the close interconnection between motor performativity and the continuous reorganization of propositional and abstract thinking: "the cortico-striatal regions that regulate language comprehension also regulate many aspects of behavior such as motor control and abstract reasoning" (Simard et al. 2010, 1092). Evolutionarily, in fact, the performative motricity of thought could have been decisive for understanding the subsequent development of human language, "because it indicates that our modern brains may actually have been shaped by an enhanced capacity for speech motor control that evolved in our ancestors" (Lieberman and McCarthy 2007, 16).

2.3 From Cerebrocentrism to Embodied Cognition

Embodied Cognition played a major role both in contrasting all the theory based on the centrality of the brain and in fighting against the dualism competence-perfòrmance. This dualism is the reason why no one ever managed to make up an extended theory of performativity. Now we know that the first axiom of this theory is that performativity can't be separated from all the cognitive processes that realize it; on the opposite, we know performativity *is* a cognitive process, irreplaceable both for human and not human animals thanks to its involvement in easing the natural selection of ethological and cultural behaviors' creative aspects.

More than any other theoretical approach, EC suggested that no natural intelligence can be conceived as a brain in a vat. The principles EC is based on are nowadays considered as cornerstones of the debate involving new cognitive sciences.

These principles can be summarized as follows:

1. Today it's impossible for cognitive sciences to ignore the involvement of body structures in cognitive processes (Rowlands 2010; Shapiro 2011). This is the end of the dualistic idea of the functional independence of the brain from its physical substructure.
2. Different body structures correspond to different cognitive systems (Shapiro 2004). The ethological comparison of cognitive systems acquires a structural value.
3. Cognitive processes are not limited to internal operations of the brain but include large body structures and interaction with the environment (Lakoff and Johnson 1999; Noë 2004; Clark 2008a, b; Chemero 2009). Embracing an evolutionary and evolutionist perspective is essential to understand this aspect.

The embodied perspective is articulated and fragmented in different, often extreme positions. Shaun Gallagher and Mark Rowlands coined the term "4E cognitions": embedded, embodied, enacted, extended. The ambiguity of the embodied perspectives produced some relevant problems.

The first problem is the potential danger of returning to behavioral epistemologies. For example. in the most extreme enactivist theses such as the dynamic approach to cognition of Chemero (2009) or the post-artificialist models of R. Brooks (1991and 2002) the danger of returning to behavioral epistemologies manifests itself in the hypothesis according to which self-organization of systems in continuous dynamic interaction can explain the entire cognitive process. What is important is not our nature but *the way we act*.

The second potential danger is the overcoming of every form of representationalism by assuming that cognition does not require internal semantic states. Gibson (1977), for example, denies any cognitive function of symbolic processing by attributing to perceptive systems the ability to capture the affordances directly from objects.

The third huge problem is what I would like to name "emotionalism", that considers physicality a form of "lower cognition" or "minimal cognition" (Calvo and Keijzer 2009, Chemero 2009, Stewart 2010, Di Paolo et al. 2010): it not body against mind but that parts of the brain that concern computational functions against the ones that operate perceptive, motor and emotional functions. Many have talked about this topic, like Antonio Damasio (1994, 1999, 2004) and Joseph LeDoux (1998, 2003).

Shaun Gallagher talks about this issues is his last work, adding new topics to discuss about.

- The so called fallacy of casual constitution (C-C-Fallacy), that concerns the hypothesis of the extended mind. According to Aizawa (2010 and 2014), the person who extends the space of cognition to devices, protheses and environmental influences, make an unjustified inference from causal dependence to a constitutive dependence. For instance, the use of a notebook or a smartphone as a support for memory can help cognitive process but it is not the cognitive process itself. It is essential to make up a "plausible theory of what distinguishes cognitive processes from non-cognitive processes" (2010:332).
- The primacy of the function in the distributed cognition is supported by the extended-mind perspective and denied by enactivism. The hypothesis of the extended-mind accepts the existence of a certain space for representation since it supports the idea that specific differences in body and shape can be "neutralized" and transformed into similar representations, instead of enactivism, that denies this possibility. According to enactivism, the biological aspects of body, including its regulatory emotional process, have a permanent effect on cognition, just like the sensorimotor matching processes between organism and environment.
- Tests conducted by Libet prove that brain receives a signal 800 milliseconds before every physical movement and that it needs 350 millisecond to make a person conscious of his decisions and movements. Thus, the brain of a person is already working before the movement even starts. In conclusion, "conscious acts are enacted by unconscious processes" (Libet 2004, 529).

All these problems are a huge price to pay for the EC perspective in Cognitive Science since they aren't in line with the fundamental principle of Cognitive Science itself: a theory does not have to describe behaviors and their rules but has to test analytic models in order to falsify them through experimentation (Chomsky vs. Skinner 1959).

It is no accident that Gallagher wonders if it still makes sense to accept the idea of enactivism as a science of mind. Enactivism is not a scientific research program but it is a "philosofy of nature" (Gallagher 2017a:21; Godfrey-Smith 2001), a sort of "comment about the overall image of the natural world made by scientific and non-scientific research" (Godfrey-Smith 2001: 284) that, as "a form of naturalism, does not endorse the mechanistic definition of nature" (Gallagher 2017a: 23).

It is clear that we are therefore faced with a situation of strong theoretical weakening, if not a true epistemological collapse. As Aizawa writes:

> one cannot argue that cognition is embodied and extended, by observing that behavior is embodied or extended. And, one cannot show that not all cognition involves representation by providing instances of behavior that do not involve representation. (Aizawa 2014: 40).

2.4 What Is a Body

I believe that the main cause of the contradictions and the issues intrinsic to contemporary EC is the ideological confusion over the notion of "body". I call it "ideological" because I want to stress that no theory on the embodied mind can afford to omit or forget that the brain – unlike the mind – is a part of the body. What Embodied Cognition really fights against is the cognitive neuroscience's key principle, that is the brain's dominance over the other bodily organs. Such belief is the result of the influence of the dualism that still underpins some mentalist theories, but that was strongly rejected by the cognitive-oriented naturalistic philosophies. One of the latter is neo-phenomenological enactivism, which however struggled to "rethink the mind" (Gallagher 2017a) due to the lack of a precise hierarchy among the levels of its analysis.

Every time someone tries to face the philosophical issue of the body, the framework becomes fuzzy and unclear.

Is the brain a part of the body? Does the perceptual properties belong to the nervous system? Does nerves, muscles, bones and soft tissue have a role in cognitive processes? Moreover, what body we are talking about? A social animal's or a solitary species' individual's one? Bee's or octopus', horse's, bonobo's or sapiens' one? Are we talking about Shaun's, Mark's, Franco's or Pietro's body, about the young sprinter's or the old man's, Kant's or an Alzheimer patient's one? Are we talking about the body of a mathematically gifted child or about the child with autism's one, about the body of who wears a prothesis or the one of who uses tools that might extend cognition, such as smartphones or notebooks?

I could go on forever. The first thing I want to emphasize is that bodies are highly variable phenotypes. Such variability is enhanced by the individual development and by the natural and cultural environment in which people live. Culture and learning can take individual and collective differences to the extreme. However, one thing is for sure: when people die, all the environmental and cultural differences disappear. The heirs of a writer might be illiterate, the son of a racer might never learn how to walk. A woman who knows how to use a smartphone or a tablet will not automatically give birth to a person with good technological or digital skills.

As we have seen, similar arguments were used by Gallagher to remedy shortcomings in the extended mind hypothesis, such as the "Coupling-Constitution fallacy". An example of such fallacy is the mistaken belief that the artificial protheses have a constitutive role in the cognitive processes: technological tools are, in fact, the cause of the empowerment of mental processes, not the processes themselves (Aizawa 2010 and 2014).

I think we have to be even more precise. In order to establish what a body can or cannot do regardless of its development, we need to look at the embryogenesis of the brain-body system. Such level of analysis corresponds to the philosophical concept of "Korper" developed by Husserl, that is the body considered as an object with physical and measurable properties (height, weight, biochemical activity, the functioning of the nervous, cardiovascular and respiratory systems etc.). Basically, we need to look only at the properties that are heritable by the genotype.

The physical bodies, however, experience the world in different and subjective ways. Such level of analysis is the one of “Leib”, Merleau-Ponty’s and phenomenological tradition “object veçu”, that is the body as it is lived and used within the environment by the individual. Here is where we need to apply the theories on body and its performativity in order to shift from the epistemological level of the individual to the one of the species.

Whoever wants to deal with EC while remaining within the frame of Cognitive Science needs to address the relationship between Korper and Leib. Where does Korper meet Leib? Can Cognitive Science put the study of bodily structures together with the description of the subjective experience people make through their body, or do physics and biology have to remain separated from psychology and philosophy? In the first case, Cognitive Science would finally achieve the aim of the Embodied Cognition and enter a new phase; in the latter, the scientific research is likely to remain stuck in the cartesian dualism for a long time.

The idea I’d like to put forward is that we need to incorporate a theory of performativity in the framework of Cognitive Science; in order to do that, we have to:

1. Investigate the body through an ethological approach.
2. Establish an evolutionary framework.
3. Put (a) together with (b) in order to develop a theory of performativity.

In the following pages we will try to deal with these points following an approach that, starting from some naturalistic reference points of the past, reaches the theoretical developments of contemporary problems and their possible solutions.

2.4.1 Body Ethology: From the History of Ideas to Cognitive Ethology

Two great precursors of the modern idea of embodied cognition were certainly Aristotle and Spinoza (Pennisi 2016, 2017a, b, 2018b, 2019; Pennisi and Falzone 2016).

Aristotle, as a true biologist and coherent monist, does not separate different substances but thinks that the visible and invisible elements of the same body are inextricably intertwined. In De Anima, he identifies the body and mind as a single mass of wax stamped by patterns: the wax and its imprint cannot be conceived separately in the same way in which the function of seeing cannot be separated from the organ of the eye. Each function is inseparable from what makes it possible. This view, compatible with any modern epistemological conception, greatly complicates the work of the scientist. One must no longer describe speculative assumptions that exclusively deal with their own philosophical needs, but we must reconstruct with utmost precision the way in which the visible and the invisible, structures and functions, connect in the concrete observable behavior. These rigorous scientific ethics can, of course, result in errors, since they are virtually unfalsifiable. Aristotle, who has provided an unparalleled description of the physiology of animals and explained the operation of a great quantity of organs in detail, now needs to explain how these are connected in a unitary body, which is more than the whole of its parts. And since this link cannot be vague and indistinct, but must be placed in the visible body, he locates it in the only network present in animal bodies known before the dissection of corpses, which is the network of blood vessels with a single afferent and efferent centre: the heart. This is why, on the basis of empirical evidence, it is pretty reasonable for Aristotle to arrive at the cardiocentric fatal error.

This fatal error renders Aristotelian physiology of higher functions useless for the purpose of contemporary reconstruction. In fact, it reveals a surprising novelty. The analysis of the bodily technology of language is independent from the super-power of the invasive brain. In this way, however, it is reconstructed for the best in its most analytical ethological and comparative dimension. It is in this way that the most species-specific biological functions of the most constraining parts of the language faculty can emerge and be described in a manner still unsurpassed. In particular, we can consider the role of linguistic articulation as a function taking input from the hardware of the auditory-phonic systems to reach the logico-semantico-syntactic compositionality of more sophisticated mental procedures of human cognition. Such a role no longer relegates vocal articulation to the auxiliary position given to it by the hegemony of cerebrocentrism in contemporary cognitive science.

In terms of modern philosophy, Spinoza's conception of the mind as "idea corporis" means that the union of Korper – the bodily extension – and Leib – the subjective experience of the body – is the foundation of the only existing human "natura naturata" (1663-DCPP: II, 9, 267 – CW:202). Such unity also encompasses God: "extension is an attribute of God; i.e., God is an extended thing" (1677-EOGD: II, II, 87 – CW:245).

The separation between Korper and Leib, thus, doesn't fall within the interest of naturalist philosophers and, today, of cognitive scientists. Among all the naturalist approaches to the body, ethology is the one which is the most aware of the importance to overcome the dichotomy between Korper and Leib. Ethology doesn't take into account the individual bodily differences, but rather the differences among the bodies of the many animal species. According to ethology, the development of all the species-specific cognitive structures depends on the species-specific bodily structures. In such monistic theoretical framework, all the aforementioned inconsistencies of the Embodied Cognition disappear.

But how does Spinoza get to this point?

The pars destruens of his hypothesis is the deconstruction of cartesian mentalism, that is the position embraced by those who are strongly "convinced that at the mere bidding of the mind the body can now be set in motion, now be brought to rest, and can perform any number of actions which depend solely on the will of the mind and the exercise of thought" (1677-EOGD: III, II, 142 – CW:279). In mentalists' view, the body doesn't have any knowledge ability. They claim that "unless the mind is in a fit state to exercise thought, the body remains inert. (. . .) that it is solely within the power of the mind both to speak and to keep silent, and to do many other things which we therefore believe to depend on mental decision" (1677-EOGD: III, II, 143 – CW:280).

Conversely, according to Spinoza: "if the body is inert, the mind likewise is not capable of thinking" (ib.), in the same way it's impossible to speak words if the brain cannot recall them from the memory (Op. 1325).

This happens because even the brain is a part of the body and belongs to the rex extensa, not to the res cogitans. In contrast to Descartes' opinion, Spinoza claims that we should conceive the *res cogitans* as *res extensa*, since the cerebral and sensorimotor operations are brought forth by the body and correspond to measurable cognitive effects. As Thomas Cook says, "I think that he was committed to the view that there is at least a token-token identity between any functionally described bodily state and a state described in purely fine-structure physical terms" (1991:86). This is possible for Spinoza since he believes that "the order and connection of ideas is the same as the order and connection of things" (1677-EOGD: II, VII, 89 – CW:247) and that body and thought are a single substance.

Let's come to the pars costruens.

According to Spinoza, not only philosophy is "thinking action, acting that is one with the idea that generated it" (Sangiacomo 2010a:7), but even thought is movement that brings joy: "as the mind is more active, so is the feeling more perfect" (1661-KV: II, 19n – CW:89); even God is conceived as an enactive entity, as pure action: "he does what he does, and omits not to do it" (1661-KV: I, 5, 39 – CW:53).

Spinoza's God-Nature is performatively creative: rather than preserving things, He "continues to create them" (1663-CM, II, 11, 274 – CW:207). He doesn't alter the quantity and the movement of the matter, but "in a sense it can be said that something new is added to it" (ib). Conversely, action always depends on the body. Even when action seems not to be goal-oriented, it is always "subordinate to other ends which another has in view, who is above them, and lets them act thus as parts of Nature" (1661-KV: II, 24, 105 – CW:97). Thus, enaction is always bound to the biological structural constrains, even if it manifests itself through different emotional and perceptual acts, and through complex processes such as reasoning and language.

Spinoza often addressed the issue of the variability of language and opinions. Topics such as the imperfection of language, the *abus des mots* etc. were very common among Bacon's, Hobbes', Locke's and Port-Royal Logic's philosophies. In Vico's thought, the acceptance of the imperfections of human language might give life to a new metaphysics: "metaphysicam humana imbecillitate dignam" (Vico 1710:131).

Spinoza shares Vico's position. Human language follows "other laws which are quite different from the laws of the intellect (. . .). [The words] are merely symbols of things as they are in the imagination, not in the intellect" (1656-TIE, 86–89, 33 – CW:24). Even the acts of denying and affirming are profoundly imperfect: "we affirm and deny many things because it is the nature of words to admit those affirmations and negations, not the nature of things; therefore ignoring the latter, we will easily take the false truth" (ib.).

The difference between Spinoza's and his contemporaries' thought lies in the above assertion. It doesn't matter if the nature of words is different from the nature of things: the only true wisdom is the scientific knowledge about the bodily structures, which remain constant over time and do not depend on human affects, passions and language.

Men can express themselves only through language: "how else, I ask, can we show the idea of some thing than by giving its definition and explaining its attributes?" (1663-DCPP: I, 6, 161 – CW:134); however, there are some knowledge abilities that are close to natural omniscience, like the scientific understanding (more geometrico) of the functioning of the bodies and of their interactions, what we may call the bio-physics of bodily technology.

Let's be clear: we can't do without words. Man is ethologically marked by the need of representing, even if the purpose of the representation is not to achieve the perfect understanding of the mind-body unified structure. The language as a biological constrain – which is part of our natura naturata – is something different than the scientific knowledge of the bodies, which corresponds to the overlapping between divine thought and Spinoza's naturante thought.

> my purpose is to explain not the meaning of words but the nature of things, and to assign to things terms whose common meaning is not very far away from the meaning I decide to give them (1677-EOGD: III, def.20, 195 – CW:314)

However, Spinoza is not a philosopher of language; if anything, he is a philosopher of mind. Spinoza, in fact, is particularly interested in the functioning of the cognitive system – the propositional-linguistic representation – that forces us to think in a certain way, but doesn't conceive it as a substance, and in doing so he gives new insights to the EC.

However, there is an unsolved issue. Like Della Rocca claims, "for Spinoza, the representation of a thing is intimately connected to that thing's essence". (Della Rocca 2008:92)". How can any philosopher get to the essence of a representation that is only contingency?

What I find very innovative in Spinoza's thought is that he detected the exact link between Korper and Leib, that is the level where we can determine what a body can do, regardless of how we subjectively experience it or we describe it through language. Such level is the ethological one, and is intrinsically evolutionary. Contrary to what the traditional philosophy of mind taught, in fact, the phenotypical differences between the individuals cannot account for the differences between the bodies: "the mind is more capable of perceiving more things adequately in proportion as its body has more things in common with other bodies" (1677-EOGD: II, 39, 120 – CW:266), since it "dwells among individuals who are in harmony with man's nature" (1677-EOGD: IV, Ap7, 269 – CW:359).

Against this background, we can claim that the bodily possibilities are bound by the intrinsic species-specific constitution:

> I say that there pertains to the essence of a thing that which, when granted, the thing is necessarily posited, and by the annulling of which the thing is necessarily annulled; or that without which the thing can neither be nor be conceived, and, vice versa, that which cannot be or be conceived without the thing. (1677-EOGD: II, D2, 85 – CW:244).

> Whatever can be taken away from a thing without impairing its integrity does not constitute the thing's essence (1663-DCPP: II, Das2, 184 – CW:149)

> to produce, in "substantial" thought, such an idea, knowledge, mode of thought as ours now is, what is required is, not anybody you please (then it would have to be known differently from what is it), but just such a body having this proportion of motion and rest, and no other (1661-KV: II, Pn11, 53 – CW:61)

> to determine the difference between the human mind and others and in what way it surpasses them, we have to know the nature of its object (. . .), that is, the nature of the human body (1677-EOGD: II, 13, 97 – CW:252)

> we shall presuppose (. . .) that extension contains no other modes than motion and rest, and that every particular material thing is nothing else than a certain proportion of motion and rest (. . .): the human body, therefore, is nothing else than a certain proportion of motion and rest. Now the "objective essence" of this actual ratio of motion and rest which is in the thinking attribute, this (we say) is the mind of the body (1661-KV: II, A2, 121 – CW:106).

Therefore, bodies cannot be defined by comparison: we should not wonder what a body can do, but what a body cannot do. Such bodily constrains, rather than being determined by individual, cultural, technological, social or environmental factors – these are domains characterized by the limitlessness of uses, which has a historical-cultural nature – have an ethological ontology, that is to say they do not depend on the history of the interactions, but on the biology of the latter. The difference between historical and biological interactions is that the latter remain constant despite the changes that occur over time, while the firsts are destined to an ephemeral existence. Bodily possibilities and impossibilities concern the species, not the individuals; whereas the genotypes are persistent, the phenotypes disappear with death. The topic of the persistence in the existence (in existendo perseverantia) is one of the most recurrent in Spinoza's work. According to the philospher, permancence is the ability to incorporate changes while retaining the ethological nature unaltered:

> as soon, then, as a body has and retains this proportion [which our body has], say e.g., of 1 to 3, then that mind and that body will be like ours now are, being indeed constantly subject to change, but to none so great that it will exceed the limits of 1 to 3; though as much as it changes, so much also does the mind always change. (. . .) But when other bodies act so violently upon ours that the proportion of motion [to rest] cannot remain 1 to 3, that means death, and the annihilation of the mind, since this is only an idea, knowledge, etc, of this body having this proportion of motion and rest (1661-KV: II, P, 53 nn.12-14 – CW:61).

> Therefore by life we for our part understand the force through which things persevere in their own being (1663-DCPP: II, 6, 261 – CW:197)

The distinction between human and animal mind, rather than being ontological, is evolutionary: it depends on a different degree of complexity and specificity that the human body has in comparison to the animal one (cfr. Jaquet 2004; Sangiacomo 2010b, 2011):

> "the emotions of animals (. . .) differ from the emotions of men as much as their nature differs from human nature. Horse and man are indeed carried away by lust to procreate, but the former by equine lust, the latter by human lust. So too the lusts and appetites of insects, fishes, and birds are bound to be of various different kinds. So although each individual lives content with the nature wherewith he is endowed and rejoices in it, that life wherewith each is content and that joy are nothing other than the idea or soul of the said individual, and so the joy of the one differs from the joy of another as much as the essence of the one differs from the essence of the other" (1677-EOGD: III, 57, 187 – CW:309)

> when I say that somebody passes from a state ofless perfection to a state of greater perfection, and vice versa, I do not mean that he changes from one essence or form to another (for example, a horse is as completely destroyed if it changes into a man as it would be if it were to change into an insect), but that we conceive his power of activity, insofar as this is understood through his nature, to be increased or diminished (1677-EOGD: IV, Pref. – CW:322)

> no individual thing can be said to be more perfect on the grounds that it has continued in existence over a greater period of time. The duration of things cannot be determined from their essence, for the essence of things involves no fixed and determinate period of time. But any thing whatsoever, whether it be more perfect or less perfect, will always be able to persist in existing with that same force whereby it begins to exist, so that in this respect all things are equal (1677-EOGD: IV, Pref. – CW:322)

We cannot assume that Spinoza's thought had a direct impact on the field of contemporary cognitive studies. There's no doubt, however, that, from a philosophical point of view, Aristotle' and Spinoza's ideas are the only ones which provide EC with a natural-scientific validity, allowing it to be embraced by a biologically and evolutionarily oriented Cognitive Science.

The ethological perspective is the main responsible for the transformation of the mind-body problem. Ethology – and, more specifically, cognitive ethology – showed better than any other scientific approach that the study of bodily properties is relevant only if the body of the species, rather than the body of the individual, is taken into account.

Only by studying the species-specific universal properties of the bodies we can understand the actual relation between bodily technologies and cognitive states. The body has a direct effect on cognition. I.e. the "olfactory" cognition of dogs or the "visual" one of eagles are one with the animals' nervous systems and with their highly specialized cortexes. In the human animal, the most distinctive cognitive abilities are language and bipedal locomotion, which in turn are made possible due to the presence of a vocal tract that allows to articulate distinct and combinable sounds and to a musculoskeletal structure that doesn't prevent the torso from lifting. It is no coincidence that the most developed areas of the motor cortex are the ones of tongue and hand.

The human language would therefore be a biological form of embodied species-specific intelligence based on the evolution of the overall body structure of Homo sapiens.

The brain is a fundamental part of these structures and, in order to develop articulated language, has allowed human evolution to perform a complete rewiring of respiratory, muscular and nervous physiology. It has monitored fine control of articulatory features and has functionalized them to new cognitive tasks (semantic categorization, syntax and logical representation of the world) and radical transformations of social behaviour (hyperextension and articulation of cooperation between conspecifics, pragmatic adaptability, moral normativity and aesthetics). Of all the different corporeal structures of Homo sapiens, the brain, however, constitutes the biologically less constrained part. In conjunction with certain trends of thought matured in the Evo-Devo, we must consider, in fact, the specific constraints of Bauplan, the "constraining" character of the shape of the body, which is much less flexible than the brain structure and is plastically the most adaptable organ of the whole living machine.

Yet such power and freedom has a price: the brain that can adapt and coordinate, synchronize and schedule everything, which can infuse intentionality and finalize it, cannot "invent" the lowly bodily organs, its suburbs. Indeed, in a sense, from an evolutionary point of view, it is completely dependent on them. If unusual genetic mutations of the body, conforming to the laws of development and form, should in time be beneficial for the fitness of the species, the brain will certainly be able, in a short evolutionary time, to exploit and tame the possibilities, cabling with extraordinary precision, and operating procedures. But without the slow and continuous transformation of those forms, change (that particular change) would never take place. The most important evolutionary transformations always start from modifications of the structures: the functions will follow, as well as their performative algorithms. The adaptation and control principles – specific to the brain – are opposed to those of autonomy and generation – and are typical of other structures. And this, among other things, explains what to Michael Tomasello seemed to be the biggest mystery of human evolution: the discrepancy between the cumulative cultural evolution speed, and its inexorably slow character of "normal processes of biological evolution involving genetic variation and natural selection" (1999, 2).

2.4.2 The Evolutionary Framework for an Extended Theory of Performativity

In functional terms, hence, the brain is a powerful biological instrument permitting continuous reorganization of the activity of organisms. An incessant activity of biological agents that move and act, that perceive and explore the world around them through a network of sensors and nerves, whose complexity of articulation is directly dependent on the species-specific structure. This activity relentlessly stimulates the rewiring of sensorimotor networks and remodeling of cognitive interactions. Our mind is the result of this close cooperation between the performative competence triggered by sensory-motor systems and the readjustment of the computational procedures of our deep brain to allow the survival and growth in the fitness of individuals and the entire species within environmental variation.

In the functional reconstruction we have so far tried to propose, performative competence describes the individual and collective behaviors that seem geared to different procedures from those originally considered by cognitive sciences. Incoming stimuli are not processed by a set of internal computing mechanisms, i.e. autonomous rules that are entirely intrinsic to innate mechanisms of thought, which always produce calculable output, except for errors or alterations of the machine procedure. Conversely, the performative inputs redetermine the rules and their countless combinations implemented by the "black box" create unexpected behaviors. This behavior should be tested in more or less extended temporal spaces by generating adaptation and fitness for the organisms. On the one hand, this mechanism starts from the "flaw" of performative competence, and proceeds in the absence of algorithms which have already been formalized and are available for application. On the other hand, it highlights the possibility of producing innovative types of behaviour: in fact, these unexpected cases "oblige" the central structure by reincorporating them within our knowledge, in new and broader coordination and control systems, creating new algorithms that could automatically produce (but it is not obvious that this will occur) new knowledge gained from exploratory activities. Essentially, it is the motor activity of our bodies that generates innovations that are ruled by our plastic brains. Change is always triggered by the bodily organs; the brain intervenes functionally later supporting the organism to free it from the anguish of uncertainty, from the horror vacui of the inapplicability.

Of course, the brain is also part of our body, as well as the mind generated by this continuous cooperative processing. If we didn't think so, we would remain fatally trapped in the dualistic residues and the Platonism typical of the first phase of cognitive sciences. However, it is the biological status, the specific type of constraints which the brain obeys, that makes it functionally different in nature from other parts of organisms:

> our brains are set in gray matter, not in stone; their parts are predisposed but not absolutely preset for particular functions. They are built of general-purpose bioprocessors that, after being formed, become specialized in response to their inputs and outputs – not of preevolved, rigidly specialized processors. There may be a protomap specifying which is to happen, yet this is easily rubbed out. Thus, neural abilities may be fated, but they are not determined (Skoyles and Sagan 2002, 26).

The structural plastic difference in cytological nature, between that part of the body we call the "brain" and all the other parts (muscular, skeletal, ligament, respiratory, digestive, integumentary system, etc.) that in symbiotic interaction determine the survival and adaptability of organisms, plays a biological decisive importance not only, as we have seen, in functional terms, but also, and perhaps most importantly, under an evolutionary profile. If the brain and, more generally, the nervous system, have to be subjected to the same slow, progressive modification of the mechanical components, organisms could not survive.

The brain's development is so fast because its loop of continuous monitoring of sensorimotor events does not allow individual strips of behaviour to be negatively affected for a long time by performing indeterminacy, to suffer the pain of insecurity or the danger of extinction without the intervention of a specific adaptation to the kind of stress that comes from activation of the modified body (by endogenous or environmentally induced mutations). The neural rewiring timing modification and the structural evolutionary modification are immeasurably different. Any slight body modification can take millions of years, it can go through thousands of intermediate stages, and it can mark a variety of overt or silent evolutionary events. But meanwhile, at every stage, it will be constantly assisted by the plasticity of the nervous systems that do not function for even a moment without continually reformatting the cognitive systems as a whole.

The birth of a new species can be thought of as a discrete state of this continuous process, a stage marked by the achievement of a new and stable order of bodily and cognitive ergonomics technology. This state is not inscribed in any predictable historical process. Natural selection and random populational variation may have been modelled, for a significant time, by the mechanical components of organizations, assisted by new functions of the neurocerebral systems. Only when these structures, shaped by time and the environment, and by individual and socialized use, have reached a certain random or historically unpredictable combination, only when a series of organic gears, levers, wheels, cams, pistons, lubricants and whatever can support the living mechanics, will these be fitted together in a structure that allows organisms to have different interactions with the world thanks to the evolutionary plasticity of the nervous systems, then and only then an unedited species-specific cognition will enter into competition with other species.

Considering the plasticity of neurocerebral systems to be a permanent support to the evolutionary continuum of structures until they achieve the discrete stage (i.e. speciation) that constitutes a ratchet in the life of biological organisms is a truly Darwinian theoretical starting point, since it would cover all animal species, regardless of the complexity of their cognitive systems. Similarly, it may also serve to explain the specificity, if not the functional uniqueness, of all species, not just the human one. In other words, brain plasticity could minimize what the previous articulated theories split into inefficient and consistent dichotomies (structures/functions; nature/culture; gradualism/saltation; continuous properties/emergent properties, etc.).

However, a significant price is paid for these advantages in a new philosophy of biology that is no longer based on cerebrocentric models, such as those now demanding the priority of cognitive neuroscience in the cognitivist galaxy. In fact, the brain (the nervous system, more generally) fully takes responsibility in supporting the relentless evolution of bio-mechanical structures, but, accordingly, it cannot determine the directions of development, nor be the original cause of the functions they control. Brains do not cause developmental changes but allow the establishment of them. The body-brain always comes after the body-structure.

2.4.2.1 The Brain and the Chrono-Logical Causalism

This sort of principle of chrono-logical causalism has always been the core of Darwinism. Darwin, in the first note of the fourth edition of *The Origin of Species,* admitted that he had learned it from Aristotle, even if he objected that the philosopher did not understand the role of natural selection. Actually Aristotle seems to substitute the matter's intrinsic finalism with the logical causalism of succession: that is, the evolutionary causalism of "before and after", the irrefutably chronological sequence of states of biological life. This eradicates any possible eschatology: it is not at all certain what will evolve in a certain way, predictable because designed or functionally inevitable.

However, a certain functional outcome would not simply exist if its antecedent did not exist: in this sense the cause of a given state of affairs is always its previous state: "where a series has a completion, all the preceding steps are for the sake of that" (Aristotle PH, II B, 8, 199a, 8–10 – ed. Ross, 647) in fact "artificial products are for the sake of an end, so clearly also are natural products. The relation of the later to the earlier terms of the series is the same in both" – (Aristotle PH, II B, 8, 199a, 18–9 – ed. Ross, 648). So there would be no saw for cutting if there was no iron to make it, or there are no houses where one can live if there are no bricks and stones to build them (Aristotle PH, II B, 8, 200a, 10–25). Similarly, in nature, the roots of the plants grow down because there exists before them "Mother Earth" that is rich in nutrients. And so, in order to define a human being, it is essential to assume the continuity of its states which, once occurred, we can only reconstruct by describing how they are embedded within each other: "if man is this, then these; if these, then those" (Aristotle PH, II B, 8, 200b, 3–4 – ed. Ross, 651).

In naturalistic thinking, both scientific and philosophical, the principle of chronological causalism has always been a fixed point, the firm anchoring of man to his animal roots. In *De Rerum Natura,* by Lucretius – opposing the finality of the Stoics – it is claimed that functional facilities are unpredictable:

> since nothing was born in the body that we might use it, but that which is born begets for itself a use : thus seeing did not exist before the eyes were born, nor the employment of speech ere the tongue was made; but rather the birth of the tongue was long anterior to language and the ears were made long before sound was heard, and all the limbs, I trow, existed before there was any employment for them : they could not therefore have grown for the purpose of being used (DRN IV, 822–857, ed. Munro, 190).

This anti-Lamarckian ante litteram profession is backed up by a tight logical and biological argument that is still very current. The sharpness of the eye vision is not the result of an intelligent design, nor the locomotor apparatus, nor the human organization in the lower limbs and upper limbs respectively used to move and to produce tools, but owes something to the generosity of a God dominating nature and conditioning it: "other explanations of like sort which men give, omnia perversa praepostera sunt ratione, one and all put effect for cause through wrongheaded reasoning" (DRN IV, 822–857 – ed. Munro, 190).

The correct relationship between the before and after, between the chronological causality and unpredictable outcomes of social uses of the possible functions determines the direction of evolutionary history. As in any naturalistic philosophy, this causality is beyond the control of individual subjects and exclusively relies on the adaptation that only can avoid extinction in a regenerating alternation of life and death. In the same way, our brains can only control and direct the bodily apparatus but cannot prevent the apotheosis or the collapse of the species.

Perhaps, the philosophical voice that insisted most on these brain limitations is that of Henri Bergson, many centuries after Greek-Latin classicism. We assume that his idea about the neurocerebral apparatus is much more mechanistic than his spiritualist vitalism. In *Matière et memoire*, the brain is considered "a kind of central telephonic exchange", (Bergson 1896, 10) that takes care of dispatching notices, inhibiting them, fostering them, making them wait. It "adds nothing to what it receives" (10): it coordinates the stimulus and decentralizes the answers; it connects through cord and peripheral nerve excitations with central mechanisms; it directs and chooses the motor pathways. In short "the brain appears to us to be an instrument of analysis with regard to the movement received, and an instrument of selection with regard to the movement executed" (10), but in no case it can be considered an organ designed to prepare or explain a representation. Similar judgments have been confirmed, even in later writings. It is treated as a "crossroads" of vibration, a "switch" that addresses possible actions (Bergson 1911), and as an "organ of pantomime" of mental life (Bergson 1912, 58 and 1913, 92).

Despite these limitations, its continuous supervision work of motor activity and, above all, its selective role with respect to the virtual possibilities offered by the rest of the body, transform the brain into an organ of survival and adaptation. So at the same time, the brain becomes "the organ of attention of thought to life" (Bergson 1913, 93) and the organ of "racial [species] attention" (Bergson 1913, 95 and 1908, 178). Attention to life, for Bergson, is the ultimate subordination of mental life to practical activities, to the selective primary needs: the most important cognitive function for self-preservation. Therefore, at the same time, thanks to its ability to select only what is essential for survival contextualized in a precise moment of time, space, and psychological and social environment, and its capability of "masking", and ignoring everything that is extraneous to pragmatic contingency, the brain locates the existence of individuals and species, it locates them in action and focuses on behavioural opportunities.

We can find few developments in the area of philosophical speculation. For example, one of the pioneers of current neuroscience, Ramachandran, translates the brain's "negative" capacity, first identified by Bergson, to obscure that which is not essential to the pragmatic behavior of selection, in a precise neurophysiological pattern. According to Ramachandran, many bizarre types of behaviour such as synaesthesia, the manifestations of hysteria, phantom limbs, blind vision, spatial neglect, the extensive catalogue of expressions of autism spectrum disorders, result from the fact that the brain is not capable of overlapping its modules: "here is a bottleneck of attention. You can only allocate your attentional resources to one thing at a time" (Ramachandran 2003, 76).

The principle that "less is more" allows our brain to focus entirely on what it needs to survive. This "principle of modular isolation" (Ramachandran 2003, 55) would explain, at the same time, the ability to enable some autistic subjects to excel in design, numerical computation, or other modular specializations, and the logic of evolutionary selection that circumscribes and improves the behavior of the species by solely optimizing the behaviors best suited to survival, for example, protection from predators, hunting prey, foraging in general and reproduction. In either case, it is never a choice. In diseases we are forced to divert optimization towards the modules of intact behaviors because (probably) some parts of our neurocerebral system, which are normally used to control those behaviors, are somehow compromised or neutralized. In selective logic we are constrained by neurocerebral systems that are in constant contact with the environmental sensors and that hierarchize the answers on the basis of context requests. It would be a serious evolutionary disorder that would make animal brains indifferent to “attention to life”.

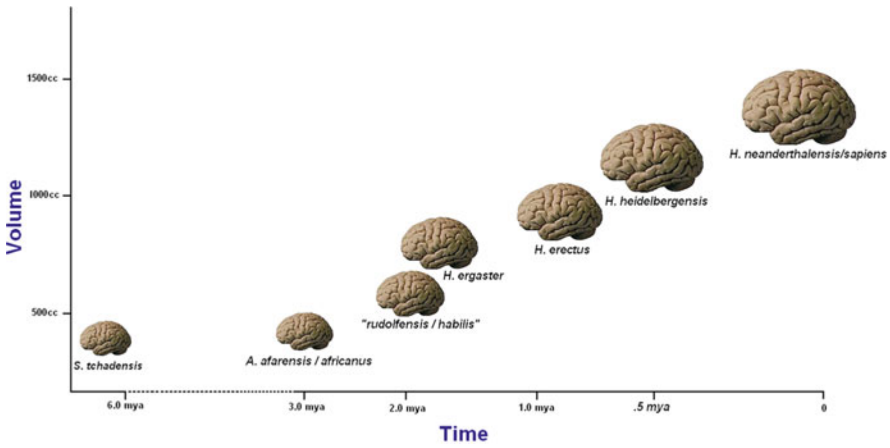
In carrying out this essential monitoring attentional work, under both functional and evolutionary profiles, the neurocerebral system is facing not only external enemies but also, and perhaps above all, inside antagonists: the rest of the body where “he lives”.

The relationship between the bodily technology of a species and its cognitive ergonomics, that monitor and regulate it, is at the origin of all manifestation of genotypic (before) and phenotypic (after) plasticity; then it always prioritizes the relationship between the species and its cognitive ergonomics. According to Ramachandran (2003): “in the biological sphere, opportunistically abduction of a structure to induce it to perform a different function from that it was originally evolved to carry out is not the exception, but the rule”.

2.4.2.2 The Brain Tenant of the Body

This effective expression was formulated by the founder of modern evolutionary paleoanthropology, Leroi-Gourhan (1964, 37 and 47; 1983, 25). To understand the meaning of the term, it should be noted that its creator was the first scholar to propose the idea that human lithic technology, the art of artificially modifying the matter, and more generally cognitive evolution, is the result of a complex transformation not only of the brain but of the body as a whole. Often, Leroi-Gohuran formulated provocative paradoxes to highlight the importance of these scientific issues, as illustrated by one of his mottos: “human evolution did not begin with the brain but with the feet” (Leroi-Gourhan 1964, 229).

Leroi-Gourhan wanted to prove that many philosophical or religious theories of evolution – starting from those of the theologian Teilhard de Chardin – had started to proceed, often unintentionally, to finalistic paths with little critical spirit, and embraced the idea that evolution was characterized by a gradual increase in the size of the brain that caused an automatic development of increasingly complex cognitive faculties.



According to this hypothesis – that still exists today, see the picture taken from a recent essay by Chomsky and collaborators (Bolhuis et al. 2014) – evolution manifests itself firstly in the improvement of brain functional dispositions, and secondly in the resulting adaptation of mechanical dispositions: "the relations between the contained and the container" (Leroi-Gourhan 1964, 59). According to Leroi-Gourhan's reconstruction, the flaw in this degeneration of evolutionary thought is due to the excesses of finalism, a convenient but very risky shortcut that only a rigorous analysis of the species' mechanical consistency can avoid to derail by scientifically acceptable paths. In fact, the evolution of the neurocerebral system follows the constraints imposed by the evolution of the mechanical parts. We can image a carnivore skull with a brain the size of a nut and the rest of the skull being filled with bone crests and muscles, or a skull with the same shape and size as the first skull but filled with cluttered grey matter to the roof of the cranial vault. This allows us to understand the case of the evolution of hominids who can share the same bodies but not the same brain development (Leroi-Gourhan 1964, 31 et seq.).

Therefore, the teleological assumption that, as brains get bigger then cognitive abilities increase, must be subjected to a comprehensive review, as one must take into account the inseparable relationship between the structural morphology of the mechanical organs, and the specific morphology of the brain and the nervous system and that of the functional adaptations that enable the survival of the species.

It is here that the chrono-logical causalism that had secretly permeated the history of evolutionary thought, and that we have discussed above, plays an important role. This involves the renunciation of ruling cerebrocentrisms: "the 'cerebral' view of evolution now appears mistaken, and there would seem to be sufficient documentation to demonstrate that the brain was not the cause of developments in locomotory adaptation but their beneficiary" (Leroi-Gourhan 1964, 26). As in the Aristotelian game of "before and after", according to Leroi-Gourhan, brain development can never be the cause of the development of the rest of the body:

> although this has been at least implicitly supposed in the past, the expansive force of the brain cannot have acted as the motive force in the evolution of the skull. The number of nerve cells cannot increase before the edifice has been enlarged. Even we regard cerebral expansion and spatial improvement of the skull as a single phenomenon, we have to acknowledge that the brain 'followed' the general movement but did not generate it (Leroi-Gourhan 1964, 81).

From one point of view, such a clear position seems to be illustrated by Columbus' egg. The mechanism of every evolutionary change has to be sought in the history of the changes of the mechanical structures of the body: primarily bones, muscles and all that regulates their growth and metabolic functioning. The genetic mutations that can cause these variations will be filtered by populational selection, of course, and those that will survive throughout the course of many generations will have determined a new stable genotype and, at the conclusion of a complete morphogenetic restructuring, a new species.

In the case of the human species, this complex process is pivotal to the achievement of the upright position. In fact, it causes a double "catastrophe": firstly it frees the upper limbs establishing a new special relationship between them and the brain, and secondly, it allows the increase in skull size with subsequent development of the cortical fan. Recent studies have reported that this structural transformation also favoured the lowering of the larynx and the formation of a supralaryngeal vocal tract with two curved portions with a 1:1 length ratio (Ghazanfar and Rendall 2008). Then, starting from the feet and cascading upwards, the rest of the body was developed including the brain. However, when one considers the role of structure and brain function, there is no doubt that, under the principle of chrono-logical causality, without the revolution in bone structure, cognitive revolution would never have existed.

Therefore, far from being mere externalizing devices of computational algorithms that belong to a predestined mind, the mechanical components – but more broadly all body structures – determine the cognitive opportunities that the neurocerebral system has to manage in the best way possible.

Therefore, in relation to the randomness of chronological evolution, the brain evolves after the rest of the body, i.e. the brain must follow the body and be recruited for its survival. For this reason, the brain is the "tenant" of the body:

> the brain, whose role as coordinator is obviously a primordial one but which functionally appears the 'tenant' of the rest of the body. This situation of the brain, which could be described as subordinate to the edifice as a whole, has been noted and recorded many times without its significance being wholly clarified (Leroi-Gourhan 1964, 37).

> the brain, modest 'tenant' of the cranial cavity, plays a mechanically passive role. The apparatus that it will presently animate is there at its disposal, but its role in the evolution of forms is not immediate or direct, making itself no doubt felt in the Darwinian selection of the fittest forms but not, so far as we can see, providing any mechanical impetus. It is in this sense that I regard the development of the brain as an element incidental to evolution in general. This in no way detracts from the well-established truth of the nervous system's evolution toward increasingly complex structures. Between the evolution of the brain and that of the body there has been a dialogue from which both sides have benefited. Evolution can of course be viewed as the triumph of the brain, but it is a triumph subordinated to

> certain overriding mechanical realities. In the progression of the brain and the body, at every stage the former is but a chapter in the story of the latter's advances (Leroi-Gourhan 1964, 47).

The thinking behind this reverse order (compared to the evolutionary thought of that time) in chronological randomness is not limited to the problem of priorities of the bone structures in determining brain shape. Since the bipedal revolution and liberation of the hands, an extraordinary series of unexpected visual, postural and sensory-motor possibilities have been derived with the brain guiding a new machine capable of unexpected cognitive ability. Man's vertical position caused revolutions in "terms of neuropsychological development; the development of the human brain was something other than just an increase in volume" (Leroi-Gourhan 1964, 19).

Take, for example, the change for hominids in their front horizontal field of view compared to that of quadrupeds, that are limited in this regard by the horizontal position of the trunk relative to the head, by the insertion of the neck muscles and by the inability to have a wide rotation of the visual axis. Or consider the changes in bodily technology applicable to extracorporeal technologies: hands capable to beat, cut, make autonomous and micrometrically controlled movements thanks to increasingly sophisticated sensorimotor rewiring: hands that can dismantle bombs, clocks, precision devices and that can use large, small and very small tools with an unthinkable accuracy. And finally, new specialized structures dedicated firstly to breathing and then to vocal production which provide greater and better control of articulated vocalizations (which we will see in detail in the following chapter).

Therefore, functions are completely redefined by the brain based on the opportunities provided by the new structure and induced by the body's live mechanics (*the Mécanique vivant,* 1983). In fact, during the evolutionary processes of any species "we observe a gradual enhancement of the brain and an improvement of the mechanical apparatus by a series of adaptations in which the brain obviously plays a role, but as a determinant of advantages in the natural selection of solutions rather than as a factor directly orienting physical adaptation" (Leroi-Gourhan 1964, 60).

Another essential aspect of the evolution of the brain is cortical structure. This is not directly dependent on the brain size but it is linked to the ability to determine behavioural functions and, therefore, functional mapping, which is better understood now than during Leroi-Gourhan's time. From the work of Penfield and Rasmussen (1950) on the mapping of the neocortex, he concludes a very pertinent fact with his assumption of interdependence between the nervous system and the musculoskeletal system. If in human primates much of the cortical surface is occupied by the areas controlling manual skills and linguistic articulation, it is evident that the bipedal revolution and the consequent settling of the entire body structure have fostered a development of the nervous system functional to technologies and word use (hence the title of his whole book Gesture and speech). In fact most recent research has constructed a species-specific map of the human laryngeal phonation area (the larynx-phonation area) which has been derived from a migration from the homologous primate (zone 4 of the premotor cortex) to the specific human one (zone 6 of the premotor cortex).

Once this interdependence between the nervous system and other parts of the body causing evolutionary change is recognized, it is clear that increased brain size, in addition to its more complex internal structure (gyrification of the cerebral cortex, increased connectivity between functional areas of the cortex, enhanced interneurons in modulating functional connectivity, lateralization), although inherited and modified over time, represents a huge indirect step forwards in the history of hominization (Rakic 2009, García-Moreno et al. 2011, Clowry 2014). Species with "liberated" hands are the same species in which the skull is capable of containing the largest brain: "manual liberation and the reduction of stresses exerted upon the cranial dome are two terms of the same mechanical equation" (Leroi-Gourhan 1964, 60).

In general terms, the human situation is a special case of a universal law. For each species, in fact, "a cycle is established between its technical ability (its body) and its ability to organize itself (its brain)" (60), the outcome of which opens the way to an ever more effective and selective adaptation. It is then true that a quantitatively more developed brain, thanks to a bodily device which has allowed it to expand, ends up being able to develop neural and mental functions, and therefore more elaborate and complex functions, but always in relation to the limits that the type of species-specific body structure establishes. In this way – Leroi-Gourhan concludes – "the brain does control evolution, but it remains ineluctably dependent upon the possible range of selective adaptation of the body" (60).

2.5 Conclusion: Evolution and Performativity

I have tried to prove that a theory of *performativity*, rather than a theory of *performance*, should be combined with a strongly naturalistic cognitive hypothesis on the bodily and, consequently, cognitive constraints of the animal species, man included. The theory of performativity explains how every species' cognitive ability creatively carries out the adaptation processes within the environment. We must therefore ignore what the body of a single individual can do: an extended theory of performativity should deal with the genotype, not the phenotype.

At the same time, I have pointed out that performativity is a universal faculty which shapes not only the structure of the *Korper*, but even its relationship with the *Leib* within every species-specific niche. The way in which we cognitively experience the world is one with its internal structure. There is no state of consciousness or mental procedure that allows us to experience the world in a non-species-specific cognitive way. Every life is *ethologically unique*, even if different individuals might share some features that their offspring will not inherit.

Lastly, I have highlighted that such theory of performativity must be framed within an evolutionary context useful for assessing its extension and potentialities. I believe it's undeniable that any transformation process of the bodies and of the cognitive systems that adapt to them occur via genotype, that is to say that the slow mutation of the bodily structures, at some point, gives life to new species through the cerebral embodiment of the performative experience of the bodies. No novelty is possible without the performative exploration and a complete cerebral refunctionalization of the bodies. This is the reason why, in order to understand the nature of the performative processes, we need to get the real meaning of creativity: it is an evolutionary force which generates new arrangements through the combination of unpredictable bodily transformations and an equally unpredictable conjunction of cognitive systems.

It's important to stress that the theory of performativity we have discussed must not be confused with the description of different kinds of performance. In this respect, we believe that Chomsky was right when he claimed that the study of performance is an end in itself. The literature on the empowerment of performance, despite being interesting, is a product of the pre-cognitive behavioral psychology. We believe that the confusion between performativity and performance is the main cause of the inaccuracy of the embodied and enactive hypotheses we have discussed here.

The aim of the theory I put forward is to provide the Embodied Cognition with a naturalistic and evolutionary background which might ease its framing within Cognitive Sciences. A methodology based on such approach should be an experimental and intensive study on the algorithms-free procedures used by the cognitive systems to face new situations or to solve problems. The purpose of a future ETCP (Extended Theory of Creative Performativity) might be to analyze:

1. Intraspecific procedures of *problem solving*, namely the cognitive abilities used by the biological organisms to get from a given condition to a desired one, with a particular interest in the intraspecific sub-procedures of:

   (i) *problem finding* (the identification of the problematic situation, which starts from the decision to stop and solve it).
   (ii) *problem shaping/framing* (overcoming the vagueness of the problem in order to solve it).
   (iii) *Performative solution of problems* (analysis of previous experiences, trial and error method, the use of analogies and comparisons, the calibration of any action on the basis of the effects on the environment, etc.)

2. Intraspecific procedures of cognitive learning in relation to the development, the formation and the control of the species-specific structures of the peripheral and central sensorimotor systems, with a particular interest in:

   (i) *neural relational systems* (procedures of recognition of the conspecifics; impact of the limbic system on the control of feelings, affects and emotions; effects of the mirror neuron system and of other species-specific neural structures for social control; etc.)
   (ii) *locomotor and kinetic-proxemic systems* (control of the balance of the body; coordination of motor actions and of the bodily technologies used to carry them out)

(iii) *communication and semiotic systems* (control of the executive activity related to the use and the development of linguistic, semiotic and communication systems; adaptation of the organs to the species-specificity of communication, whether it is vocal, visual, olfactory etc.; progressive adjustment of cognitive controls

Furthermore, the ECTP should encompass a hypothesis on the functioning of a *Universal Device for the Enactive Cognition* (UDEC), that is a generator of non-random solutions for any kind of problem that cannot be solved through algorithms.

Methodologically, the UDEC should aim at unifying the computational methods based on evolutionary algorithms by using them to establish intraspecific performative heuristics useful for simplifying the creative procedures: evolutionary algorithms are a class of randomized heuristics inspired by natural evolution. They are applied in many contexts, in particular in the optimization and in the analysis of the algorithms responsible for the evolutionary success of a species (cfr. Jansen 2013). I am talking about a *multi-objective evolutionary algorithm design* (Coello et al. 2007), which might help to frame the differences caused by the vague nature of the performative heuristics of the animal cognition within the context of the universal performative properties of the biological systems. To this end, "the use of evolutionary algorithms for mining pattern enables the computation capacity to be reduced, providing sufficiently good solutions" (Ventura and Luna 2016).

From an evolutionary point of view, the UDEC is intended to enable switching from a logical-mathematical based computational cognition to a naturalistic cognition based on the performative embodiment. The aim of the UDEC is to explain how the biological systems use the bodily technologies to creatively find a way to survive. The UDEC, in fact, is what is generated by the species-specific bodily experience and by the ability to reuse the neuro-cerebral inputs to create structures devoted to the cognitive, pragmatic and social refunctionalization. In a nutshell, the UDEC should explain how we get from the "rule changing creativity" to the "rule governed creativity", which is exactly what Chomsky was warried about.

Lastly, from a philosophical point of view, an extended theory of performativity might be useful for erasing the dangerous dichotomies intrinsic to modern naturalism. If we'd read the distinction between Korper and Leib through the lens of Spinoza's performativity we could easily understand why there shouldn't be any gap between mind and body, brain and nervous system, creative and executive functions of the cognitive systems, culture and nature. The biological evolution tells us that the cognitive refunctionalization always depends on the alteration of the bodily structures following random genetic mutations: thus, the history of cognitive evolution proves that the creativity of the ideas is conditional upon the performative creativity of the bodies that generate them.

References

Abutalebi, J., Brambati, S.M., Annoni, J.M., Moro, A., Cappa, S.F., & Perani, D. (2007). The neural cost of the auditory perception of language switches: An event-related functional magnetic resonance imaging study in bilinguals. *The Journal of Neuroscience, 27*(50), 13762–13769.

Aizawa, K. (2010). The coupling-constitution fallacy revisited. *Cognitive Systems Research, 11*, 332–342.

Aizawa, K. (2014). The enactivist revolution. *Avant, 5*(2), 1–24.

Anderson, M. (2015). *The renaissance extended mind*. London: Palgrave Macmillan.

Aristotle. (PH) Physica. In P. H. Wicksteed & F. M. Cornford (Eds.), *The physics: II vol*. Cambridge, MA: Harvard University Press. (1957)

Austin, J.A. (1962). *How to do things with words*. Oxford: Oxford University Press.

Bergson, H. (1896). *Matter and memory (1896)* (Trans.: N.M. Paul & W. Scott Palmer). London: George Allen and Unwin (1911).

Bergson, H. (1908). Memory of the present and false recognition. In *Bergson 1919* (pp. 134–185). Westport: Greenwood Press.

Bergson, H. (1911). Life and consciousness. In *Bergson 1919* (pp. 3–36). Westport: Greenwood Press.

Bergson, H. (1912). The soul and the body. In *Bergson 1919* (pp. 37–74). Westport: Greenwood Press.

Bergson, H. (1913). "Phantasms of the living" and psychical research. In *Bergson 1919* (pp. 75–103). Westport: Greenwood Press.

Bergson, H. (1919). *Mind-energy: Lectures and essays*. Westport: Greenwood Press.

Berwick, R.C., & Chomsky, N. (2016). *Why only us. Language and evolution*. Cambridge, MA: The MIT Press.

Bolhuis, J., Tattersall, I., Chomsky, N., & Berwick, R. (2014). How could language have evolved? *PLoS Biology, 12*(8), 1–6.

Brooks, R.A. (1991). Intelligence without representation. *Artificial Intelligence, 47*(1), 139–159.

Brooks, R. (2002). *Flesh and machine: How robots will change us*. New York: Pantheon.

Calvo, P., & Keijzer, F. (2009). Cognition in plants. In F. Baluska (Ed.), *Plant-environment interactions: From sensory plant biology to active plant behavior* (pp. 247–266). Berlin: Springer.

Chemero, A. (2009). *Radical embodied cognitive science*. Cambridge, MA: MIT Press.

Chomsky, N. (1959). A review of B.F. Skinner's verbal behavior. In L.A. Jakobovits, & M.S. Miron (Eds.), *Readings in the psychology of the language* (pp. 142–143). Prentice-Hall, 1967.

Chomsky, N. (1960). Explanatory models in linguistics. In *Studies in logic and the foundations of mathematics* (Vol. 44, pp. 528–550).

Chomsky, N. (1964). *Current issues in the linguistic theory*. The Hague/Paris: Mouton.

Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge, MA: The MIT Press.

Chomsky, N. (1966). *Cartesian linguistics: A chapter in the history of rationalist thought*. New York: Harper & Row.

Chomsky, N. (1982). A note on the creative aspect of language use. *The Philosophical Review III, 1982*, 423–434.

Clark, A. (2008a). *Supersizing the mind. Embodiment, action, and cognitive extension*. New York: Oxford University Press.

Clark, A. (2008b). *Surfing uncertainty. Prediction, action, and the embodied mind*. New York: Oxford University Press.

Clark, A. (2016). *Surfing uncertainty. Prediction, action and the embodied mind*. New York: Oxford University Press.

Clowry, G.J. (2014). Seeking clues in brain development to explain the extraordinary evolution of language in humans. *Language Sciences, 46*, 220–231.

Coello, C.A., Lamont, G.B., & Van Veldhuizen, D.A. (2007). *Evolutionary algorithms for solving multi-objective problems*. Cham: Springer.

Cook, J.Th. (1991). Spinoza's science of the 'idea of the body. In J.C. Smith (Ed.), *Historical Foundation of Cognitive Science* (pp. 81–98). Dordrecht/Boston/London: Kluwer Academic Publishers.

Damasio, A. (1994). *Descartes' error: Emotion, reason and the human brain*. New York: Penguin Books.

Damasio, A. (1999). *The feeling of what happens: Body and emotion in the making of consciousness*. Mariner Books.

Damasio, A. (2004). *Looking for Spinoza: Joy, sorrow, and the feeling brain*. London: Vintage.

Della Rocca, M. (2008). *Spinoza*. London/New York: Routledge.

Di Paolo, E., Rohde, M., & De Jaegher, H. (2010). Horizons for the enactive mind: Values, social interaction, and play. *Enaction: Towards a new paradigm for cognitive science*.

Gallagher, S. (2017a). *Enactivist interventions rethinking the mind*. Oxford: Oxford University Press.

Gallagher, S. (2017b). Theory, practice and performance. *Connection Science, 29*(I), 106–118.

Gallagher, S. (2018). Mindfulness and mindlessness in performance. *Reti, saperi, linguaggi. Italian Journal of Cognitive Sciences, 1*, 5–18.

Gallagher, S., & Zahavi, D. (2008). *The phenomenological mind. An introduction to philosophy of mind and cognitive science*. London/New York: Routledge.

García-Moreno, F., Vasistha, N.A., Trevia, N., Bourne, J.A., & Molnár, Z. (2011). Compartmentalization of cerebral cortical germinal zones in a lissencephalic primate and gyr-encephalic rodent. *Cerebral Cortex*, bhr312.

Ghazanfar, A.A., & Rendall, D. (2008). Evolution of human vocal production. *Current Biology, 18*(11), R457–R460.

Gibbs, R.W. (2005). *Embodiment and cognitive science*. New York: Cambridge University Press.

Gibbs, R.W. (2008). *The Cambridge handbook of metaphor and thought.* Cambridge, MA: Cambridge University Press.

Gibson, J. (1977). The theory of affordances. In R. Shaw & J. Bransford (Eds.), *Perceiving, acting, and knowing* (pp. 67–82). Hillsdale: Erlbaum.

Godfrey-Smith, P. (2001). On the status and explanatory structure of developmental systems theory. In P. E. Griffiths & R. D. Gray (Eds.), *Cycles of contingency: Developmental systems and evolution* (pp. 283–298). Cambridge, MA: MIT Press.

Hurley, S. (2001). Perception and action: Alternative views. *Synthese, 129*, 3–40.

Hutto, D., Myin, E. (2013). *Radicalising enactivism*. Cambridge, MA: The MIT Press.

Jansen, T. (2013). *Analyzing evolutionary algorithms. The computer science perspective*. Cham: Springer.

Jaquet, C. (2004). *L'unité du corps et de l'esprit. Affects, actions et passions chez Spinoza.* Paris: Puf.

Klein, D., Zatorre, R.J., Milner, B., Meyer, E., & Evans, A.C. (1994). Left putaminal activation when speaking a second language: Evidence from PET. *Neuroreport, 5*(17), 2295–2297.

Ko, J.H., Antonelli, F., Monchi, O., Ray, N., Rusjan, P., Houle, S., et al. (2013). Prefrontal dopaminergic receptor abnormalities and executive functions in Parkinson's disease. *Human Brain Mapping, 34*(7), 1591–1604.

Lakoff, G., & Johnson, M. (1980). *Metaphors we live by.* London: The University of Chicago Press.

Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh. The embodied mind and its challenge to western thought.* New York: Basic Books.

LeDoux, J. (1998). *The emotional brain. The mysterious underpinnings of emotional life*. Touchstone: Simon & Schuster.

LeDoux, J. (2003). *Synaptic self: How our brains become who we are*. New York: Penguin Books.

Leroi-Gourhan, A. (1964). *Le geste et la parole* (Vol. 2) (trad: Bostock, A., Gesture and speech. Cambridge, MA: MIT Press, 1993). Paris: Albin Michel.

Leroi-Gourhan, A. (1983). *Mécaniques vivant. Le crâne des vertébrés du poisson à l'homme*. Paris: Fayard.

Libet, B. (2004). Mind time. The temporal factor in consciousness. Cambridge, MA: Harvard University Press.

Lieberman, P. (2013). *The unpredictable species. What makes humans unique*. Princeton: Princeton University Press.

Lieberman, P., & McCarthy, R. (2007). Tracking the evolution of language and speech: Comparing vocal tracts to identify speech capabilities. *Expedition: The magazine of the University of Pennsylvania, 49*(2), 15–20.

Lucretius, C.T. (DRN). In H.A.J. Munro & J.D. Duff (Eds.), *Titi Lucreti Cari De rerum natura libri sex*. London: G. Bell and Sons. (1903)

Menary, R. (2006). *Radical Enactivism. Intentionality, phenomenology and narrative*. Amsterdam: Benjamins.

Menary, R. (2010). *The extended mind. New Edition*. Cambridge, MA: MIT Press.

Monchi, O., Petrides, M., Petre, V., Worsley, K., & Dagher, A. (2001). Wisconsin card sorting revisited: Distinct neural circuits participating in different stages of the task identified by event-related functional magnetic resonance imaging. *The Journal of Neuroscience, 21*(19), 7733–7741.

Monchi, O., Petrides, M., Strafella, A.P., Worsley, K.J., & Doyon, J. (2006). Functional role of the basal ganglia in the planning and execution of actions. *Annals of Neurology, 59*(2), 257–264.

Nagano-Saito, A., Leyton, M., Monchi, O., Goldberg, Y.K., He, Y., & Dagher, A. (2008). Dopamine depletion impairs frontostriatal functional connectivity during a set-shifting task. *The Journal of Neuroscience, 28*(14), 3697–3706.

Noë, A. (2004). *Action in perception. Representation in mind.* Cambridge, MA/London: MIT Press

Noë, A. (2009). *Out of our heads. Why you are not your brain.* New York: Farrar-Straus-Giroux.

Noë, A. (2015). *Strange tools. Art and human nature.* New York: Farrar-Straus-Giroux.

Penfield, W., & Rasmussen, T. (1950). *The cerebral cortex of man: A clinical study of localization of function*. New York: Macmillan.

Pennisi, A. (2006). Patologie e psicopatologie del linguaggio. In A. Pennisi & P. Perconti (Eds.), *Le scienze cognitive del linguaggio*. Bologna: Il Mulino.

Pennisi, A. (2016). Prospettive evoluzioniste nell'embodied cognition: il cervello "inquilino" del corpo. Reti, saperi, linguaggi. *Italian Journal of Cognitive Sciences, 1*(2016), 179–202.

Pennisi, A. (2017). Cosa può un corpo. Spinoza e l'Embodied Cognition, Bollettino del centro di studi filologici e linguistici siciliani, 28/2017, Special Issue In ricordo di Tullio De Mauro, F L. Piparo (Ed.) (pp. 237–264).

Pennisi, G. (2017). What space for performativity in cognitive science? Insights from CODISCO 2017. Reti, saperi, linguaggi. *Italian Journal of Cognitive Sciences, 2*(2017), 381–386.

Pennisi, A. (2018a). Performative dimensions in cognitive sciences. *Reti, saperi, linguaggi Italian Journal of Cognitive Sciences, 1*(2018), 25–30.

Pennisi, A. (2018b). Laicità e diritti, Scritti in onore di Demetrio Neri. In F. A. e. L. Formigari (Ed.), *Spinoza, Darwin e Nietzsche. L'etica come etologia dei corpi o biopolitica* (pp. 61–87). Roma: Aracne.

Pennisi, G. (2018). Towards a deeply embodied Enactivism. Reti, saperi, linguaggi. *Italian Journal of Cognitive Sciences, 2*(2018), 271–280.

Pennisi, A. (2019). Spinoza e l'Embodied Cognition, in Atti del Convegno internazionale di studi del CISPELS. Storia del pensiero linguistico e semiotico (Roma 17–19 Settembre 2018), In print Roma: Sapienza University Press.

Pennisi, A., & Falzone, A. (2016). *Darwinian biolinguistics. Theory and history of naturalistic philosophy on language*. Berlin/Heidelberg/New York/Cham: Springer.

Putnam, H. (1981). *Reason, truth and history*. Cambridge, MA: Cambridge University Press.

Rakic, P. (2009). Evolution of the neocortex: A perspective from developmental biology. *Nature Reviews Neuroscience, 10*(10), 724–735.

Ramachandran, V.S. (2003). *The emerging mind: The Reith lectures 2003*. London: Profile.

Rowlands, M. (2003). *Externalism: Putting mind and world back together again*. Montreal: McGill-Queen's University Press.

Rowlands, M. (2006). *Body language: Representation in action.* Cambridge, MA: MIT Press.

Rowlands, M. (2010). *The new science of the mind: From extended mind to embodied phenomenology*. Cambridge, MA: MIT Press.

Sangiacomo, A. (2010a). *Saggio introduttivo* a Spinoza (Op.), pp. 7–100.
Sangiacomo, A. (2010b). Gli strani confini della coscienza: Spinoza e gli animali. *Giornale Critico di Storia delle Idee*, A.2, n.4, 2010, pp. 145–162.
Sangiacomo, A. (2011). Adequate knowledge and bodily complexity in Spinoza's account of consciousness*, Methodus, 6*(2011), 77–104.
Searle, J. (1979). *Expression and meaning. Studies in the theory of speech acts*. Cambridge, MA: Cambridge University Press.
Shapiro, L.A. (2004). *The mind incarnate*. Cambridge, MA: MIT Press.
Shapiro, L.A. (2011). *Embodied cognition* London/New York: Routledge.
Shapiro, L.A. (2014). *The Routledge handbook of embodied cognition* London/New York: Routledge.
Simard, F., Joanette, Y., Petrides, M., Jubault, T., Madjar, C., & Monchi, O. (2010). Fronto-striatal contribution to lexical set-shifting. *Cerebral Cortex, 21*, 1084–1093.
Skoyles, J.R., & Sagan, D. (2002). *Up from dragons: The evolution of human intelligence*. New York: McGraw-Hill.
Spinoza, B. (1656-TIE). *Tractatus de Intellectus Emendatione.* In Spinoza CW, pp. 1–30.
Spinoza, B. (1661-KV). *Korte Verhandeling van God, de Mensch, en dezself Welstand.* In Spinoza CW, pp. 31–107.
Spinoza, B. (1663-CM). *Cogitata Metaphysica.* In Spinoza CW, pp. 177–212.
Spinoza, B. (2002). (CW) *Complete works.* Edited, with Introduction and Notes, by Michael L. Morgan, Translations by Samuel Shirley, Indianapolis/Cambridge: Hackett Publishing Company.
Spinoza, B. (1663-DCPP). *Renati Des Cartes Principiorum Philosophiæ.* In Spinoza CW, pp. 108–177.
Spinoza, B. (1677-EOGD). *Ethica Ordine Geometrico Demonstrata.* In Spinoza CW, pp. 213–382.
Stewart, J. (2010). Foundational issues in enaction as a paradigm for cognitive science: From the origin of life to consciousness and writing. In J. Stewart, O. Gapenne, & E. Di Paolo (Eds.), *Enaction: Towards a new paradigm for cognitive science* (pp. 1–31). Cambridge, MA: MIT Press.
Thivierge, J.P., Rivest, F., & Monchi, O. (2007). Spiking neurons, dopamine, and plasticity: Timing is everything, but concentration also matters. *Synapse/New York, 61*(6), 375.
Tomasello, M. (1999). *The cultural origins of human cognition*. Cambridge, MA: Harvard University Press.
Varela, F., Thompson, E., & Rosch, E. (1991). *The embodied mind: cognitive science and human experience*. Cambridge MA/London: MIT Press.
Ventura, S., & Luna, J.M. (2016). *Pattern mining with evolutionary algorithms.* Cham: Springer.
Vico, G.B. (1710). De antiquissima Italorum Sapientia ex linguae latinae originibus eruenda. In N. Badaloni & P. Cristofolini (Eds.), *GB Vico, Opere filosofiche, G*. Firenze: Sansoni. (1971).

Part II
Embodied, Enactivist, Philosophical Approaches

Chapter 3
Mindful Performance

Shaun Gallagher

Abstract In this chapter I explore several variations of mindfulness in performance, and I focus specifically on variations of self-awareness in these practices. I take an enactivist approach, clarifying first why enactivism is not a form of behaviorism. I argue that phenomenologically inspired enactivist conceptions of perception and action are neither mindless, in a naïve behavioristic way, nor overly cognitivist, but do involve aspects of mindfulness that support embodied performance. I'll look at examples from athletics, dance and musical performance. Finally, I'll consider the status of *self* in mindful practices that are sometimes described as attaining mindless or selfless states.

Keywords Mindfulness · Mindless · Self · Athletics · Dance · Musical performance

On a path that stretches from the *Via Contemplativa* to the *Via Activa* one encounters a variety of forms of mindful performance. On this path one may find practices of mindfulness meditation (including analytic meditation, sitting meditation, walking meditation, and so on), yoga, Tai Chi, and other embodied practices that extend into everyday action and the specialized practices of athletics and the performing arts. In this chapter I want to explore several of these different variations, and ask specifically about the variations of self-awareness that one might find among these practices.

I take an enactivist approach to this investigation. This may be surprising only because enactivist approaches to cognition are sometimes accused of being a form of mindless behaviorism (see, e.g., Shapiro 2011, 2014; Hirstein 2015, 250; Aizawa 2014). Hubert Dreyfus, for example, might be thought to represent a version of

S. Gallagher (✉)
Department of Philosophy, University of Memphis (USA), Memphis, TN, USA

Faculty of Law, Humanities and the Arts, University of Wollongong (AU), Wollongong, Australia
e-mail: s.gallagher@memphis.edu

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_3

enactivism that defends a mindless form of everyday coping and expert action. Let me begin, then by showing why this gets enactivism wrong, especially the conception of enactivism that follows from the work of Merleau-Ponty. I'll argue that phenomenologically-inspired enactivist conceptions of perception and action are neither mindless, in a naïve behavioristic way, nor overly cognitivist, but do involve aspects of mindfulness that support embodied performance.

3.1 Between Mindlessness and Reflection

Dreyfus (2005; Dreyfus and Dreyfus 1985) defines a set of stages involved in achieving expert performance modeled on embodied coping. Whereas a novice may depend on "rigid adherence to taught rules or plans," an expert practitioner has an "intuitive grasp of situations based on deep, tacit understanding." The expert knows what to do without thinking, and without having to explicitly follow rules. On Dreyfus's account engagement in embodied practice leads to habit formation where doing becomes automatic, without the necessity of reflection or thought. That is, the expert practitioner, in any realm, from playing tennis, to playing chess, to doing mathematics, does not have to think about what to do – she has an intuitive and automatic insight into how to move or what needs to be done. Indeed, reflective consciousness of one's doing may in fact disrupt the practice (Beilock 2010). For Dreyfus, accordingly, expert performance is mindless, if we understand "mind" in the traditional way. Dreyfus (2002) argues that for practiced or skillful intentional action one does not require representation.

> A phenomenology of skill acquisition confirms that, as one acquires expertise, the acquired know-how is experienced as finer and finer discriminations of situations paired with the appropriate response to each. Maximal grip [a concept discussed by Merleau-Ponty] names the body's tendency to refine its responses so as to bring the current situation closer to an optimal gestalt. Thus, successful learning and action do not require propositional mental representations. They do not require semantically interpretable brain representations either. (2002, p. 367)

Dreyfus associates the idea of representation, and the traditional concept of mind, with a failed Cartesian philosophy – bound up with epistemic states of knowing-that (propositional knowledge), when everything about intelligent action and knowing-how depends on being in the situation (rather than standing back and representing the world).

Dreyfus models this conception on Aristotelian *phronesis* (practical wisdom), which, he explains, is the result of practice, and involves the ability to be mindlessly in the flow. In one example, he suggests that the downhill skier who is engaged in expert performance is in the flow and requires no reflection. Once reflective thinking is introduced, the skier loses his expertise (see Gallagher 2017a for this example).

I think there are several problems with Dreyfus's concept of *phronesis* as he uses it in his discussion of expertise. I'll indicate two problems directly relevant to our considerations. First, for Dreyfus, in contrast to Aristotle, *phronesis* is seemingly without a social dimension. Aristotle indicates that we gain *phronesis* only by hanging around with the right sort of people, and this intersubjective dimension is an important aspect that comes to be embodied in this virtue. Dreyfus, as a number of critics have pointed out (e.g., Collins 2004; Young 1998; and Sheets-Johnstone 2000), ignores the importance of the intersubjective dimension in his account of gaining expertise or exercising it. Second, whereas Aristotle allows for the idea that the person with *phronesis* is someone who may deliberate in order to discern between possible actions, and indeed is someone who is excellent at this practice of deliberation, Dreyfus emphasizes only the non-deliberative, mindless aspect of an immediate intuitive sense within practice.

The same issues arise in the debate that Dreyfus has with McDowell. McDowell argues that perception and embodied coping is conceptual/rational, and not as 'mindless' as Dreyfus contends. For McDowell, however, rationality does not have to be situation independent. Indeed, he also appeals to the Aristotelian notion of *phronesis* as a model for situated rationality. According to McDowell, *phronesis* involves an initiation into conceptual capacities. The person with *phronesis* engages in a practical rationality, even if he does not explicitly decide to act as the result of reasoning understood as a kind of means-end rationality, the activity of explicitly deciding which affordances to respond to and how to go about responding to them. (McDowell 2007, 341). For McDowell, reasoning involves a kind of "stepping back."

Dreyfus rejects the idea of stepping back:

> I agree with McDowell that we have a freedom to step back and reflect that non-human animals lack, but I don't think this is our most pervasive and important kind of freedom. Such stepping back is intermittent in our lives and, in so far as we take up such a 'free, distanced orientation', we are no longer able to act in the world. I grant that, when we are absorbed in everyday skillful coping, we have the capacity to step back and reflect but I think it should be obvious that we cannot exercise that capacity without disrupting our coping. (Dreyfus 2007, 354).

Dreyfus draws from Merleau-Ponty as his inspiration for the notion of a mindless absorbed coping. Merleau-Ponty, however, actually defends the idea of a *minded* coping where the notion of mind is not the traditional disembodied notion, but rather an embodied mind. Mind and reason are not excluded from movement, but redefined as the expression of an embodied intelligence.

> [. . .] a directed activity that is neither blind mechanism nor intellectual behavior, and which is not accounted for by classic mechanistic accounts or intellectualism . . . . Behavior, inasmuch as it has a structure, is not situated in either of these two orders. (Merleau-Ponty 1964, 45).

That is, Merleau-Ponty attempts to work out a position between naïve behaviorism and rational intellectualism, a position that would be located between Dreyfus and McDowell. On this view there may be different kinds of mindful self-awareness practices, not all of which would involve a 'stepping back' or explicit reflection. A certain type of situated awareness, in the down-hill skier, for example, is not disconnected from his performance, but part of his skill and expertise – a dimension of the flow rather than something different from it – a practice in continuity with embodied coping. It seems reasonable to think that an expert should be aware of the situation and perhaps even know when to reflect and when not to; and what to reflect about. This would be closer to Aristotle's model of *phronesis*.

3.2 The Phenomenology of Performance

I think we can find good phenomenological evidence for this kind of middle position that allows for a mindful performance in practices such as athletics, dance, and music performance (Gallagher 2016). Richard Shusterman (2008), for example, argues that explicitly conscious somatic self-awareness, including "distinct feelings, observations, visualizations, and other mental representations of our body and its parts, surfaces, and interiors" can play an important role in performance. Such "mindfully conscious somatic perceptions can help us to perform better. A slumping batter, by looking at his feet and hands could discover that his stance has become too wide or that he is choking up too far on the bat. A dancer can glance at her feet to see that they are not properly turned out" (2008, 53).

In athletic performance, for example, self-awareness can be an important factor. John Sutton et al. (2011) develop a model they call 'applying intelligence to the reflexes' (AIR). On this view, expert performance is not without some sort of self-awareness. For example, a cricket player draws not only on smoothly-practiced batting, but also on context and conditions relevant to the game, in order to hit a shot with extraordinary precision targeting a slim gap in the field. This performance is "fast enough to be a reflex, yet it is perfectly context-sensitive. This kind of context-sensitivity, we suggest, requires some forms of mindedness – [an] interpenetration of thought and action exemplified in open skills" (Sutton et al. 2011, 80). This is not a matter of being on automatic pilot. Rather, although the player has trained up her body-schematic control of movement, in the context of the game she needs more than that since she has to strategically take into account the precise situation (the layout of the field, the position of other players, the speed of the ball, and so forth) that involves a mindful sense of where she is going to put the ball. This is elective "target control for some features, such as goal, one or more parameters of execution, like timing, force, a variation in the sequence, and so on" (Christensen et al. 2016, 50). The cricket player can see the potential shot in the situation and "can 'feel' when her motor system has the right configuration" (Christensen et al. 2016, 59; also see Christensen et al. 2015). These researchers suggest the model of a "meshed" architecture which integrates perceptual and cognitive elements with body-schematic control. "Expert performers precisely counteract automaticity, because it limits their ability to make specific adjustments on the fly.... Just because skillful action is usually pre-reflective, it does not have to be mindless."(Sutton et al. 2011, 95).

Just as cricket is different from football, different types of awareness may be involved. Shusterman (2008) argues that both explicit exteroceptive consciousness, and more implicit proprioceptive and kinaesthetic awareness can help to improve performance. Concerning the latter, he claims that "through systematic practice of somaesthetic awareness this proprioceptive consciousness can be significantly improved to provide a sharper and fuller picture of our body shape, volume, density, and alignment without using our external senses" (53–54). With respect to explicit consciousness he identifies two types: conscious somatic perception and reflective somatic perception with explicit awareness. The first includes a visual or proprioceptive sense of one's body parts, their relations with other body parts, posture and with objects in the environment. We can also be aware of breathing, or of tensions in the body. In the second type of explicit reflective consciousness "we are not only conscious of what we perceive as an explicit object of awareness but we are also mindfully conscious of this focused consciousness as we monitor our awareness of the object of our awareness through its representation in our consciousness" (55). That is, we are self-consciously aware of our own perceptual monitoring.

In some sports that involve high-speed action, for example, there may not be time for measured reflection; still, they may require full attention rather than mindlessness (Eriksen (2010). In long-distance running, body self-awareness may be important. Gunnar Breivik (2013) quotes ultra-marathoner Bernd Heinrich:

> I often noticed that muscle tenseness could be relaxed by conscious effort. I then focused attention on my calves, thighs, arms, trying to relax them even during training runs, so that the most essential running muscles would be exercised. For a mile or so I would monitor and hence try to control the kick of my arm swings, to make sure no energy was wasted in side-to-side motion. (Breivik 2007, 129)

Olympic swimmer Jim Montgomery provides another example.

> As soon as I jump in the water, I begin to concentrate on my stroke deficiencies. Am I carrying my head too high, dropping my right elbow midway through the pull, or not finishing through with my left arm? All these things can occur in my freestyle stroke when fatigue sets in. (Montgomery and Chambers 2009, 35)

Elite performers can discriminate among stimuli that may be lost as a blur for others (Gallagher and Ilundáin-Agurruza 2018). They can shift across the full register between explicit conscious control and pre-reflective consciousness, between automatic and spontaneous focus, improvising in some cases to adjust their attunement to changing conditions.

In studies of dance performance, the philosopher Barbara Montero, drawing on her own experience as a professional ballet-dancer, rejects the idea that expert performance somehow is effortless or thoughtless. She argues that although certain types of bodily awareness may interfere with well-developed skills, it is typically not detrimental to the skills of expert athletes or performing artists. Montero (2010, 2015) examines a number of scientific studies that purport to show that paying attention to certain bodily aspects of performance will interfere with performance. As she makes clear, these studies are not ecological – they introduce different types of cognitive effort that are simply not found in usual practice – for example, the instruction to pay constant attention to your feet as you dribble a soccer ball (Ford et al. 2005). Montero also cites qualitative studies that indicate that certain types of conscious monitoring (different in different performances) improve performance.

In some cases, the way one is self-aware during expert performance involves a pre-reflective pragmatic self-awareness that does not take the body as an intentional object; it rather involves a "performative awareness ... that provides a sense that one is moving or doing something, not in terms that are explicitly about body parts, but in terms closer to the goal of the action" (Gallagher 2005a, 73). Dorothée Legrand (2007) distinguishes this kind of performative self-awareness from opaque and transparent awareness. By opaque she means a thematic, reflective awareness that objectifies the body – something that would characterize a novice performance when someone is learning to move in dance or music. By transparent she means that the body is experienced nonthematically, prereflectively and as an aspect of the acting subject – as in everyday walking. Legrand describes performative self-awareness as follows: "while dancing [a dancer] is intensively attending to [his body]. But he is not attending to it reflectively as an object. Rather, his [pre-reflective] awareness of his body as subject is heightened" (2007, 512).

Likewise, although Montero allows for the possibility that expert performers, in dance or musical performance, stay pre-reflective, and even occasionally enter a mindless zone, she also thinks that optimal performance often coincides with thoughtful performance, perhaps involving even a step up from enhanced pre-reflective or performative awareness. Shusterman proposes that one reason these explicit kinds of self-awareness can improve performance is the inaccuracy involved in pre-reflective awareness. On the basis of pre-reflective awareness, or simply not having an awareness at all, "I may think I am keeping my head down when swinging a golf club, though an observer will easily see I do not. I may believe I am sitting straight when my back is rounded" (2008, 64). Without a trained explicit attention to one's posture, performance could easily decline.

In contrast to Dreyfus, then, the phenomenology of performance suggests variable and trained forms of awareness. This "*trained awareness model*" (Gallagher and Ilundáin-Agurruza 2018) suggests that not just any old form of awareness will do. Trained awareness may include a range of possible foci posited in varying circumstances, as in the thick of a performance or competition, from kinaesthetic-proprioceptive pre-reflective awareness, to something closer to a reflective attention to a body part.

3.3 Deeper Structures

Things can get more complicated in cases of team or cooperative performance. In this section I'll consider an example of musical performance that involves playing with others. In this example Simon Høffding also suggests some ways to think about the deeper structures involved in the different types of awareness involved in such performance.

In the case of expert musical performance, we can find a variety of reflective and pre-reflective attitudes. Simon Høffding conducted a phenomenological study with the Danish String Quartet, using interviews that focused on the precise experiences the musicians have while playing their best. Each member of the quartet had different experiences while playing, and they reported that they could be thinking of or experiencing different things.

> [...] expert musicians can undergo a wide range of different experiences while playing, from thinking about where to go for beers after the performance, to worrying whether one's facial expression looks interesting to the audience, to enjoying the fact that the playing seems to be unfolding smoothly, and finally to a deep absorption in which one experiences a profound transformation of consciousness. (Høffding 2015, 11).

This is a surprising result if we were expecting some consistency among the players. Indeed, it seems to challenge both the Dreyfus model and the contrasting trained awareness model. Although Høffding (2015) himself takes this result to undermine claims made by Dreyfus, if a performer can start thinking about the pub, or about his facial expression, and yet not have this interfere with his playing, that playing must be a process that carries on precisely at the pre-reflective level that Dreyfus describes, in a way that frees the performer to think about whatever comes to mind. At the same time, it shows that Dreyfus is wrong to think that any kind of reflective thinking necessarily interrupts performance. We need to explicate some complexities, however, at both the phenomenological surface and in the deeper structures.

First, on the phenomenological surface, Høffding identifies four different states of awareness in expert performance: (1) *Absent-minded playing* (automatic performance); (2) *Playing under stress* (e.g., striving to get back to top performance after an interruption – "just barely keeping up without missing the notes, yet coping nevertheless, managing to perform without mistakes"; (3) deep absorption as a kind of *blackout* where there is a complete lack of self-awareness; and (4) deep absorption as a *heightened awareness* of self and surroundings. In cases of deep absorption, Høffding's musicians suggest they experience modulations in the sense of agency: a diminished sense of agency in blackout; an increased sense of agency in heightened awareness. More precisely, in both states of absorption there is a certain *letting go* that involves *passivity*. Even with an increased sense of control in heightened awareness, the performer doesn't intervene in the process, but lets it happen.

One member of the quartet describes heightened awareness as follows.

> You are both less conscious and a lot more conscious I think. Because I still think that if you're in the zone, then I know how I'm sitting on the chair, I know if my knees are locked, I know if I am flexing my thigh muscle, I know if my shoulders are lifted, I know if my eyes are strained, I know who is sitting on the first row, I know more or less what they are doing, but it is somewhat more, like disinterested, neutrally registering, I am not like inside, I am not kind of a part of the set-up, I am just looking at it, while I'm in the zone. (Høffding 2015, 116)

In terms of deeper structures, Høffding points to four factors that account for the performance being carried along without heavy reflective intervention: body schema; affect; the music itself; and the other players. The *body schema* is attuned by practice (Gallagher 2005b) – "playing from the body schema," as one of he musicians phrases it, allows you to forget about many details but this gives you a freedom to focus on selective target control. "You let the body function on its own . . . . You're surprised about how much the fingers remember themselves. Let the fingers play . . . . Let go and think about something else" (Høffding 2015, 181). Bowman explains this.

> Developing skillful musical agency entails assuming and assimilating embodied stances, postures, and movements. In becoming skilled musicians, students assimilate the corporeal postures and gestures of teachers – making them their own, weaving them into the dense fabric of their own embodied identity. (Bowman 2004, 4)

In some respects the training up of the body schema is thought to involve different forms of habit formation. John Dewey distinguishes between intelligent and routine habit, for example, and although habit may involve an aspect of mechanical repetition, he suggests:

> Repetition is in no sense the essence of habit. Tendency to repeat acts is an incident of many habits but not all . . . The essence of habit is an acquired predisposition to *ways* or modes of response . . . Habit means special sensitiveness or accessibility to certain classes of stimuli, standing predilections and aversions, rather than bare recurrence of specific acts. (1922, 42).

Like Dewey, Merleau-Ponty argues that a habit is developed when the body "acquires the power of responding with a certain type of solution to a certain form of situation" (2012, 143). Instead of a repetition of action, habit is an open and adaptive way in which the body learns to cope with familiar or unfamilier situations. This can be seen in the performance of music.

> How delicate, prompt, and varied are the movements of a violin player or an engraver! How unerringly they phrase every shade of emotion and every turn of idea! [. . .] If each act has to be consciously searched for at the moment and intentionally performed, execution is painful and the product is clumsy and halting. Nevertheless the difference between the artist and the mere technician is unmistakable. The artist is a masterful technician. The technique or mechanism is fused with thought and feeling (Dewey 1922, 71).

Accordingly, alone this body-schematic attunement is not sufficient for expert performance. *Affect*, as Dewey notes, is a second factor that contributes to the performance.

> If musical passivity could be reduced to the functioning of a body schema, it would follow that absorbed musicianship shouldn't be phenomenologically different from absorption in other arts or in sports. With . . . the emotions, however, *prima facie*, we have reason to differentiate the phenomenology of artistic absorption from athletic absorption. (Høffding 2015).

Høffding is not claiming that athletic performance lacks emotion, or any of the other factors under consideration, but rather that emotion and the other factors work differently in musical performance, in terms of how these *affective factors* are integrated. For example, we can distinguish between affectively-rich expressive and affectively-neutral instrumental movements (see Cole et al. 2002; Gallagher, Cole and McNeill 2001). In regard to emotional expression, affect can work like gesture and language and go beyond simple motor control related to instrumental action (primarily under body-schematic control). The affect-music relation goes in two directions: first, music allows us to explore or develop or regulate emotion in a new way; and second, we 'offload' some of the power of emotion in the playing of music (Krueger 2014). In addition, if emotion in some cases drives expressive movement during music performance, we shouldn't think that it does so independently of the body schema. That is, it's not that the body schema carries on independently, delivering technically proficient movement, to which we then add an expressive style motivated by specific emotions that may be occasion-relative. One could also think that emotion may have its effect directly on body-schematic processes – slowing down or speeding up such processes, for example, or leading to the adoption of certain initial postures that may influence the performance.

Third, affective and body-schematic processes are also integrated with *the music itself*. The music itself enters into the regulation of performance. In playing the music, we incorporate tools and instruments into our body schema (e.g. Maravita and Iriki 2004). On the one hand, therefore, we may think that body schematic processes add to the music itself as it is generated in the musical instruments. On the other hand, it goes deeper than this: music moves us; it is something that engages the body schema through its links to rhythm, material resonance, muscle, movement, and action. We get caught up in the music itself.

> The sounds of music enter the body and are sensed, felt, and experienced inside the body in a way that, on the whole, the media of other artistic and cultural forms are not. And if one accepts the notion of affordance, then it is not a big step to realizing that there is an element of direct material leverage in the manner in which the sounds of music serve to construct and position individuals in their embodied, everyday lives (Shepherd 2002).

Finally, Høffding considers *the other players*. This brings us back to the social dimension that is missing in Dreyfus's account. In the context of making music together, music and intersubjectivity are closely related (Salice et al. 2017). One way to explicate this relation is through recent research that shows while working (or playing) together (in joint action) we form "joint body schemas" (Soliman and Glenberg 2014), and that one's peripersonal space extends to include, not just instruments, but other people we are playing with. On the one hand, it may be that what changes are simply processes in each individual – individual body schemas expand, altering subpersonal processes that generate an *individual* sense of joint agency – a feeling of being in sync with the other. On the other hand, and on a more enactivist reading, it may be that the two bodies form a larger dynamical action system, so that the joint body schema belongs only to this larger system (two parts constituting a larger whole). These processes, whether confined to the individual's system, or extended to the larger, intercorporeal system, are clearly subpersonal, and if they generate some kind of feeling or experience, it would be a pre-reflective experience. One finds indications of this in accounts of the role of gestures and motor actions in joint musical performance (Glowinski et al. 2013; Gnecco et al. 2013), supporting the idea of an established entrainment or sensorimotor synchronization in performance (Repp and Su 2013).

3.4 Can We Be Mindfully Mindless?

Throughout these examples from various studies of athletics, dance and musical performance we can catalog a set of variations of deeply embodied and intersubjectively modulated forms of mindfulness in expert performance. In most cases these variations conflict with the kind of mindlessness described by Dreyfus. In some cases we can describe an embedded/situated reflection (down-hill skier), or selective target control (the cricket player), an implicit sense of rightly configured body, and even a conscious monitoring (in the dancer), amounting to a performative self-awareness that is goal-related but nonetheless pre-reflective; or a hightened awareness in deep absorption (in the music quartet). These are not high cognitivist or reflective interventions; they are grounded in deeply embodied, affective, situated, and intersubjectively attuned states that range from pre-reflective self-awareness to more explicit conscious monitoring.

Høffding points to one condition that motivates a different concern. What is the status of self-awareness in what his musicians call "blackout," or what others call trance, or non-dual forms of experience? Is this a mindless (self-less) experience? If so, in what sense is it reportable? This question also relates to meditative non-self experiences.

For the sake of clarity, let me offer a more precise concept of pre-reflective self-awareness. Pre-reflective self-awareness is a minimal (marginal, recessive) awareness of one's own experience, where one's experience is not taken as object. Phenomenologists consider it to be intrinsic to the structure of experience. It is sometimes linked to the sense of mineness or ownership.

> A non-observational, pre-reflective awareness of my own flowing consciousness, which delivers an implicit sense that this experience is part of my stream of consciousness. This sense of ownership [or mineness] for the experience involves no reflective, second-order metacognition. (Gallagher and Varela 2003).

Importantly, the sense of ownership or mineness applies not only to one's body or one's body parts; it also applies to one's movement, one's action, and even to one's experience itself. I may have a sense that this is *my* action, or *my* thinking, or, most basically, *my* experience. In terms of ownership for experience, Marie Guillot (2017) proposes a clarification by distinguishing between three phenomena.

- **For-me-ness** – the awareness of the *experience* as I live through it
- **Me-ness** – the awareness that *I* am the one living through the experience – an awareness of oneself
- **Mineness** – the sense that this is *my* experience (ownership), i.e., an awareness of the experience as my own.

Guillot (2017, 47) argues that in non-pathological, everyday typical experience we have all three. One can accept these distinctions as conceptual distinctions, however, without thinking that we actually experience such distinctions, or that these differences are experienced as such. I've argued that what is experienced is precisely a relational sense of mineness (ownership), i.e., one that is structured by the relation between me (as experiencer) and the experience itself. On this view for-me-ness and me-ness are abstractions from mineness that one can make in reflective judgment (Gallagher 2017b).[1]

The sense of mineness does not require an extra or transitive act of self-awareness that would take experience as an object – it is nothing over and above this pre-reflective self-awareness (Gallagher and Zahavi 2012, 2014). Indeed, phenomenologists, like Husserl and Sartre, claim that pre-reflective self-awareness is required (a condition of possibility) for reflective consciousness. Guillot argues, however, that in some pathological cases mineness goes missing, for example in depersonalization and schizophrenic delusions of control/thought insertion. If it is true that in some pathologies or exceptional circumstances mineness is missing, then clearly it's not a necessary or essential aspect of all experience. But this also implies that mineness does tend to pervade everyday normal experience.

Furthermore, if pre-reflective self-awareness is a necessary condition for reflective consciousness, then cases where there is a missing sense of mineness cannot be reflectively reported. That is, given that re-reflective self-awareness puts experience "in the line of sight" for reflection, if pre-reflective self-awareness is absent then one's report can only be something like, "I blacked out," but not "Here's what I experienced during that blackout." I can't say, for example, "I, myself, wasn't there, but here's what happened."

This is an important point that seems to place limitations on what can be said, phenomenologically, about states of blackout, or the kind of "mindless" in-the-flow experiences that Dreyfus references. To gain some grip on this point, I propose to make a short detour to consider some recent research on meditation states that involve self-less trance, since the phenomenological point would seem to apply to such states as well. On the one hand, of course, meditation does not necessarily involve trance or blackout; it can involve very specific forms of mindful experience. As a good example of an embodied and enactive practice (see Varela et al. 1991), for example, mindful meditation has been shown to improve performance in sports (Gardner and Moore 2012), as well as attention (Lutz et al. 2008; Zeidan et al. 2010; Moore and Malinowski 2009) and emotion regulation (Gregucci et al. 2015). In fact, long-term meditators have been found to improve their skills of reflective thought in ways that allow the practitioner to step back and "re-perceive" his or her own experience in a less reactive and judgmental way (Shapiro et al. 2006; see Francesconi and Gallagher 2018). Specific types of mindfulness during athletic or artistic performance can be increased using meditation practices.

On the other hand, in some specialized cases meditative practices might lead to something like trance or blackout. Consider studies of meditational trance states by Dor-Ziderman et al. (2016) and Ataria et al. (2015). They focus on the sense-of-boundaries (SB) – a division of the field of experience between a "self" versus a "world."

[1]On a slightly different reading Zahavi (2018) takes me-ness and mineness to involve forms of reflective awareness which are only occasional, or as he says, 'rare'. To be precise, Zahavi is right that we are not aware of the experience "as my own" if we take the 'as' to signify a conceptual grasp. I suggest we understand the 'as' to be a soft (non-conceptual) or bracketed 'as'.

> By collaborating with a uniquely qualified meditation practitioner [a male aged 64, mindfulness practitioner following the Satipatthana and Theravada Vipassana traditions for about 40 years with over 20,000 accumulated hours of meditation] ... the SB experience was volitionally and repeatedly produced as a graded phenomenon, from a normal SB (SB1) to a state where the SB began to dissolve (SB2) and finally to a state where the SB disappeared (SB3), while brain activity was recorded using magneto-encephalogram (MEG).

Specifically SB3 was defined as "a selfless mode of awareness where the sense of ownership [mineness] disappeared." In these studies, such states were investigated using both magnetoencephalogram (MEG) recordings, and "a first-person approach where in-depth phenomenological interviews were conducted, and the collected data were analyzed ... " (Dor-Ziderman et al. 2016). The researchers, citing Gallagher and Zahavi (2014), acknowledge the phenomenological point that reflective self-consciousness "presupposes the existence of a prior non-objectifying, pre-reflective self-consciousness" (Ataria et al. 2015). Nonetheless, they consider the following reports on the S3 selfless state. First, the practitioner provides a proviso: "it is quite hard to put it into language, because I don't know that we have a language for [it]" Second, he provides a set of negative descriptions:

- "there is no center ... there's really no address. I have no idea where I am in stage three, it's all background, I'm not there basically, just world, so there's no real location at all in stage three ... the body is so spread that it's very difficult to know where it is and what it is".
- "It was emptiness, as if the self fell out of the picture. There was an experience but it had no address, it was not attached to a center or subject ... "
- "I become absorbed into the background, meaning the whole world without any separate entity ... dropping distinctions, dropping interest in any boundaries or limits, dropping habit and automatic sensori-reality".
- "There's no personal point of view, it's the world point of view, it's like the world looking, not ME looking, the world is looking".
- "There is no sense of mine there is no sense of me .... 'There is no sense of controlling"

Third, the practitioner provides a set of positive descriptions.

- "Like in a dream. Like I'm not awake now but dreaming. Sensations of all kinds of things flickering ... A sort of meditative phenomena and flickering of light and darkness – difficult to describe in words."
- "Floating above the entrance door, between the room and the lab ... "
- "There was a feeling of a shift in alertness, a cessation of reflectivity. A different kind of quiet." (from Ataria et al. 2015; Dor-Ziderman et al. 2013)

These reports are problematic since, if we can get such descriptions of the experience that purports to be non-dual, selfless experience (without the sense of ownership), then there still must be some minimal pre-reflective self-awareness (and a sense of ownership for those experiences) present. The practitioner even suggests as much: "There's still a witnessing happening and that witnessing is what's left of me.... [I]t's like knowing it is happening without an object, or without a specific object" (Ataria et al. 2015, 142).[2] The possibility of reporting on such states suggests there is always some degree of pre-reflective self-awareness with some implicit and minimal degree of mineness in such "non-dual," or "selfless" processes. If that's right, then these types of experience are never truly mindless or selfless, but rather involve at least a minimal self-experience – the sense of mineness.

Can we not reach similar conclusions about what Dreyfus describes as mindless states of being in the flow, or what Høffding's musicians describe as blackout? If so, even such extreme states of expert performance are states (albeit perhaps minimal states) of mindful performance.

Acknowledgements Research on this paper was supported by the author's Anneliese Maier Research Award from the Humboldt Foundation, and by an Australian Research Council (ARC) grant, *Minds in Skilled Performance*. DP170102987.

References

Aizawa, K. (2014). The enactivist revolution. *Avant, 5*(2), 1–24.

Ataria, Y., Dor-Ziderman, Y., & Berkovich-Ohana, A. (2015). How does it feel to lack a sense of boundaries? A case study of a long-term mindfulness meditator. *Consciousness and Cognition, 37*, 133–147.

Beilock, S. (2010). *Choke: What the secrets of the brain reveal about getting it right when you have to*. New York: Simon and Schuster.

Bowman, Q. (2004). Cognition and the body: Perspectives from music education. In L. Bresler (Ed.), *Knowing bodies, moving minds: Toward embodied teaching and learning* (pp. 29–50). Dordrecht: Kluwer Academic Press.

Breivik, G. (2007). Skillful coping in everyday life and in sport: A critical examination of the views of Heidegger and Dreyfus. *Journal of the Philosophy of Sport, 34*(2), 116–134.

Breivik, G. (2013). Zombie-like or superconscious? A phenomenological and conceptual analysis of consciousness in elite sport. *Journal of the Philosophy of Sport, 40*(1), 85–106.

Christensen, W., Sutton, J., & McIlwain, D. (2015). Putting pressure on theories of choking: Towards an expanded perspective on breakdown in skilled performance. *Phenomenology and the Cognitive Sciences,* 14(2), 253–293.

Christensen, W., Sutton, J., & McIlwain, D.J. (2016). Cognition in skilled action: Meshed control and the varieties of skill experience. *Mind & Language, 31*(1): 37–66.

[2]The Buddhist scholar John Donne (2011, 74) points to more detailed descriptions in the Buddhist literature. "For practitioners to experience a non-dual state, however, there must be some form of knowing or experiencing that is not structured by subject–object duality. This form of knowing is 'reflexive awareness' (Skt. *Svasa mvitti*, Tib. *rang rig*), and it does not receive a robust theoretical treatment until the works of Dharmakírti and his major commentators (seventh to ninth centuries). Once a clear account of reflexive awareness is in place, Buddhist authors now have the tools to speak of truly non-dual meditative states, namely, those in which the meditator experiences consciousness in its true form as utterly devoid of subject–object structuring. And this is precisely the type of practice that emerges historically as Mahámudrá in India by the end of the first millennium (C.E.)."

Cole, J., Gallagher, S., & McNeill, D. (2002). Gesture following deafferentation: A phenomenologically informed experimental study. *Phenomenology and the Cognitive Sciences,* 1(1), 49–67.

Collins, H.M. (2004). Interactional expertise as a third kind of knowledge. *Phenomenology and the Cognitive Sciences, 3*(2), 125–143.

Dewey, J. (1922). *Human nature and conduct*. New York: Henry Holt & Co.

Dor-Ziderman, Y., Berkovich-Ohana, A., Glicksohn, J., & Goldstein, A. (2013). Mindfulness-induced selflessness: A MEG neurophenomenological study. *Frontiers in Human Neuroscience, 7*, 582.

Dor-Ziderman, Y., Ataria, Y., Fulder, S., Goldstein, A., & Berkovich-Ohana, A. (2016). Self-specific processing in the meditating brain: A MEG neurophenomenology study. *Neuroscience of Consciousness, 2016*(1), niw019. https://doi.org/10.1093/nc/niw019.

Dreyfus, H. (2002). Intelligence without representation: Merleau-Ponty's critique of mental representation. *Phenomenology and the Cognitive Sciences, 1*(4), 367–83.

Dreyfus, H.L. (2005). Overcoming the myth of the mental: How philosophers can profit from the phenomenology of everyday expertise. In *Proceedings and addresses of the american philosophical association* (pp. 47–65). Newark: American Philosophical Association.

Dreyfus, H.L. (2007). Why Heideggerian AI failed and how fixing it would require making it more Heideggerian. *Philosophical Psychology, 20*(2), 247–68.

Dreyfus, H., & Dreyfus, S. (1985). From Socrates to expert systems: The limits of calculative rationality. In C. Mitcham, & A. Huning (Eds.), *Philosophy and technology ii: Information technology and computers in theory and practice* (pp. 111–130). Boston: D. Reidel Publishing Company.

Dunne, J. (2011). Toward an understanding of non-dual mindfulness. *Contemporary Buddhism, 12*(1), 71–88.

Eriksen, J.W. (2010). Mindless coping in competitive sport: Some implications and consequences. *Sport, Ethics and Philosophy,* 4(1), 66–86.

Ford, P., Hodges, N.J., & Williams, A.M. (2005). Online attentional-focus manipulations in a soccer dribbling task: Implications for the proceduralization of motor skills. *Journal of Motor Behavior, 37*, 386–394.

Francesconi, D., & Gallagher, S. (2018). Embodied cognition and sports pedagogy. In M. Cappucio (Ed.), *Handbook of embodied cognition and sport psychology* (pp. 249–272). Cambridge, MA: MIT Press.

Gallagher, S. (2005a). *How the body shapes the mind*. Oxford: Oxford University Press.

Gallagher, S. (2005b). Dynamic models of body schematic processes. In H. De Preester, & V. Knockaert (Eds.), *Body image and body schema* (pp. 233–250). Amsterdam: John Benjamins.

Gallagher, S. (2016). The practice of thinking: Between Dreyfus and McDowell. In T. Breyer (Ed.), *The phenomenology of thinking* (pp. 134–146). London: Routledge.

Gallagher, S. (2017a). *Enactivist interventions.* Oxford: Oxford University Press.

Gallagher, S. (2017b). Self-defense: Deflecting deflationary and eliminativist critiques of the sense of ownership. *Frontiers in Human Neuroscience*, *8*, 1612. https://doi.org/10.3389/fpsyg.2017.01612.

Gallagher, S., & Ilundáin-Agurruza, J. (2018). Self- and other-awareness in joint expert performance. In E. Fridland, & C. Pavese (Eds.), *Routledge handbook on skill and expertise*. London: Routledge.

Gallagher, S., & Varela, F. (2003). Redrawing the map and resetting the time: Phenomenology and the cognitive sciences. *Canadian Journal of Philosophy*. Supplementary Volume, *29*. 93–132.

Gallagher, S., & Zahavi, D. (2012). *The phenomenological mind.* London: Routledge.

Gallagher, S., & Zahavi, D. (2014). Phenomenological approaches to self-consciousness. *Stanford Encyclopedia of Philosophy*. At http://plato.stanford.edu/

Gallagher, S., Cole, J., & McNeill, D. (2001). The language-thought-hand system. In C. Cave, I. Guaitella, & S. Santi (Eds.), *Oralité et gestualité: Interactions et comportements multimodaux dans la communication* (pp. 420–24). Paris: L'Harmattan.

Gardner, F., & Moore, Z.E. (2012). Mindfulness and acceptance models in sport psychology: A decade of basic and applied scientific advancements. *Canadian Psychology, 53*(4), 309–318.

Glowinski, D., Mancini, M., Cowie, R., Camurri, A., Chiorri, C., & Doherty, C. (2013). The movements made by performers in a skilled quartet: a distinctive pattern, and the function that it serves. *Frontiers in Psychology, 4*, 841. https://doi.org/10.3389/fpsyg.2013.00841.
Gnecco, G., Badino, L., Camurri, A., D'Ausilio, A., Fadiga, L., Glowinski, D., ..., Volpe, G. (2013). Towards automated analysis of joint music performance in the orchestra. In *International conference on arts and technology* (pp. 120–127). Heidelberg: Springer.
Gregucci, A., Pappaianni, E., Siugzdaite, R., Theuninck, A., & Job, R. (2015). Mindful emotion regulation: Exploring the neurocognitive mechanisms behind mindfulness. *BioMed Research International, 2015*(June), 670724. https://doi.org/10.1155/2015/670724.
Guillot, M. (2017). I me mine: On a confusion concerning the subjective character of experience. *Review of Philosophy and Psychology, 8*(1), 23–53.
Hirstein, W. (2015). Consciousness despite network underconnectivity in autism: Another case of consciousness without prefrontal activity? In R.J. Gennaro (Ed.), *Disturbed consciousness: New essays on psychopathology and theories of consciousness* (pp. 249–264). Cambridge, MA: MIT Press.
Høffding, S. (2015). *A phenomenology of expert musicianship*. Ph.D. dissertation, Department of Philosophy, University of Copenhagen.
Krueger, J. (2014). Affordances and the musically extended mind. *Frontiers in Psychology*, *4*, 1003.
Legrand, D. (2007). Pre-reflective self-consciousness: on being bodily in the world. *Janus Head, 9*(2), 493–519
Lutz, A., Slagter, H.A. Dunne, J.D., & Davidson, R.J. (2008). Attention regulation and monitoring in meditation. *Trends in Cognitive Sciences, 12*(4), 163–169. https://doi.org/10.1016/j.tics.2008.01.005.
Maravita, A., & Iriki, A. (2004). Tools for the body (schema). *Trends in Cognitive Sciences, 8*(2), 79–86.
McDowell, J. (2007). What myth? *Inquiry, 50*(4), 338–51.
Merleau-Ponty, M. (1964). *The structure of behavior*. (trans. Fisher, A.L.). Boston: Beacon Press.
Montero, B. (2010). Does bodily awareness interfere with highly skilled movement? *Inquiry, 53*(2), 105–122
Montero, B.G. (2015). Thinking in the zone: The expert mind in action. *The Southern Journal of Philosophy*, *53*(S1), 126–140.
Montgomery, J., & Chambers, M. (2009). *Mastering swimming*. Champaign: Human Kinetics.
Moore, A., & Malinowski, P. (2009). Meditation, mindfulness and cognitive flexibility. *Consciousness and Cognition, 18*(1), 176–186. https://doi.org/10.1016/j.concog.2008.12.008.
Repp, B.H., & Su, Y.H. (2013). Sensorimotor synchronization: A review of recent research (2006–2012). *Psychonomic Bulletin & Review, 20*(3), 403–452.
Salice, A., Høffding, S., & Gallagher, S. (2017). Putting plural self-awareness into practice: The phenomenology of expert musicianship. *Topoi*, 1–13. https://doi.org/10.1007/s11245-017-9451-2
Shapiro, L. (2011). *Embodied cognition*. London: Routledge.
Shapiro, L. (2014). Book review: Radicalizing enactivism: Basic minds without content. *Mind, 123*(489), 213–220.
Shapiro, S.L., Carlson, L.E., Astin, J.A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology, 62*(3), 373–386.
Sheets-Johnstone, M. (2000). Kinetic tactile-kinesthetic bodies: Ontogenetical foundations of apprenticeship learning. *Human Studies, 23*, 343–370.
Shepherd, J. (2002). How music works: Beyond the immanent and the arbitrary. In *Action, criticism, and theory (act) for music education* 1:2. (http://mas.siue.edu/ACT/index.html). 14.
Shusterman, R. (2008). *Body consciousness: A philosophy of mindfulness and somaesthetics*. Cambridge: Cambridge University Press.
Soliman, T.M., & Glenberg, A.M. (2014). The embodiment of culture. In L, Shapiro (Ed.), *The Routledge handbook of embodied cognition* (pp. 207–220). London: Routledge.

Sutton, J., McIlwain, D., Christensen, W., & Geeves, A. (2011). Applying intelligence to the reflexes: Embodied skills and habits between dreyfus and descartes. *Journal of the British Society Phenomenology, 42*(1), 78–103

Varela, F.J., Thompson, E., & Rosch, E. (1991). *The embodied mind: Cognitive science and human experience.* Cambridge, MA: MIT Press.

Young, I. (1998). Throwing like a girl. In D. Welton (Ed.), *Body and flesh: A philosophical reader* (pp. 259–273). Oxford: Blackwell Publishers.

Zahavi, D. (2018). Consciousness, self-consciousness, selfhood: a reply to some critics. *Review of Philosophy and Psychology*, 9(3), 703–718.

Zeidan, F., Johnson, S.K., Diamond, B.J., David, Z., & Goolkasian, P. (2010). Mindfulness meditation improves cognition: Evidence of brief mental training. *Consciousness and Cognition, 19*(2), 597–605.

Chapter 4
A Radical Enactivist Approach to Social Cognition

Claudio Paolucci

Abstract In this paper, a radical enactivist account of social cognition is given, showing how we move from neurons to mindreading skills without the need of introducing any idea of mental content or internal representation. In order to accomplish this task, a two-levels model that keeps together radical enactivism, interactive specialization and semiotics narrativity is introduced. Starting from the subpersonal action/perception/imagination matching mechanism implemented in mirror neurons and from the reward network – encouraging us to prefer the stimuli and the experiences that lead to a positive sanction – it is action with its narrative logic that turns a very general embodied matching system into a mindreading module tuned to the meaning of the actions of the others during interaction. An overview of the ontogenetic processes that lead to mindreading through joint attention, semiotic competence, deception skills, pretend play and language acquisition is also given.

Our everyday practice of making sense of intentional actions in terms of reasons (beliefs, desires etc.) is a skill that comes from social narrative practices in which we manipulate others, we try to make others do things inside a shared system of values, we gain the competences needed to do those kinds of things, we act and we get judged on our actions. This kind of activity grounds the relationship between caregivers and baby before verbal language shows up and is a pattern of action that can be found not only in primates, but probably in a variety of other social animals.

4.1 Radical Enactivism, Interactive Specialization and Social Cognition

In this paper I will give a radical enactivist account of social cognition, showing how we move from neurons to mindreading skills without the need of introducing any

C. Paolucci (✉)
University of Bologna, Bologna, Italy
e-mail: c.paolucci@unibo.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*,
Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_4

idea of mental content or internal representation. This will involve three steps: (i) an enactivist interpretation of the biological basis of social cognition; (ii) a semiotic reformulation of the enactivist Narrative Practice Hypothesis by Gallagher and Hutto (2008); (iii) an overview of the ontogenetic process that leads to mindreading through joint attention, semiotic competence, deception skills, pretend play and language acquisition.

The expression “mindreading” (or “theory of mind”) is generally used as a “shorthand for our ability to attribute mental states to self and others and to interpret, predict, and explain behaviour in terms of mental states such as intentions, beliefs and desires” (Gallagher and Zahavi 2008: 171). For classical cognitive scientists (Frith and Happe 1999; Currie and Sterelny 2000; Malle 2002), mindreading was thought to be the prerequisite for social cognition: in everyday life we have to infer the mental states of the others (beliefs, desires, knowledge) in order to shape their behaviour through meaning. Understanding if infants and apes were capable of mindreading meant asking if they could have social cognition skills like we do (Ruffman and Perner 2005; Butterfill and Apperly 2009, 2013; Povinelli and Vonk 2004; Buttelmann et al. 2009, 2017). A radical enactivst account of social cognition challenges the classical view of cognitive sciences, both in its Theory Theory (Baron-Cohen 1995; Wellman et al. 2001) and in its Simulation Theory versions (Goldman 2006), claiming that we also do not have social cognition skills like it was thought we do. We will move thus towards a new conception of social cognition that sees mindreading as a very specific skill developed from semiotic and prelinguistic narrative practices, that language extends beyond embodied interactions (Extended Theory of Mind) quite a long time before we are able to pass the false belief test (Theory of Mind).

Instead of being the condition of possibility of social cognition, mindreading can be thought as an effect of social cognition that develops starting with embodied interactions. Our thesis is inspired by the enactivist account of social cognition by Shaun Gallagher and Daniel Hutto and by the interactive specialization framework (Johnson 2000; Simion et al. 2011). We will start with the latter.

According to this neuroconstructivist point of view, “cognitive specialization is an activity-dependent and an experience-dependent process, strictly linked to the exposure to certain experiences occurring over a particular period of time, called a critical or sensitive period” (Simion et al. 2011: 174). Even if the human system begins life broadly tuned to detect social stimuli, there is no need to hypothesise dedicated abstract modules for detecting them. Newborns do not manifest any visual preference for a human face if compared to a scrambled face with more elements in the upper part (Simion et al. 2006), showing that it is not necessary to hypothesise the existence at birth of an experience-independent module of face recognition. Newborns do not have this skill. However, this general preference for some structural and mereological properties that faces share with other visual stimuli changes over development and become tuned to human faces, due to the extensive and repeated experience with this kind of elements provided by the environment within the very first months of life (Scott et al. 2007; Simion et al. 2011). This results in the development of expertise (we are generally better at discriminating between stimuli we have experienced). We share this "perceptual narrowing" phenomenon also with primates (Sugita 2008).

Our radical enactivist account of social cognition claims that the same thing goes with mindreading skills. Indeed, while some basic capacities for social navigation and interaction are undoubtedly built-in, others may be acquired or soft-assembled in ontogeny (see Hutto 2009: 19). Starting from the subpersonal action/perception/imagination matching mechanism implemented in mirror neurons and from the reward network – encouraging us to prefer the stimuli and the experiences that lead to a positive sanction – it is interaction, with its narrative logic, that turns a very general embodied matching system into a mindreading module tuned to the meaning of the actions of the others during inter-action.

4.2 Two Discoveries

In the last 15 years, there have been two discoveries that have shaken the primacy of the Theory of Mind in social cognition. On the one hand, the discovery of mirror neurons has led to very different accounts of social cognition, if compared to the mindreading-based ones. On the other hand, the Narrative Practice Hypothesis (NPH), grounded on a Radically Enactivist theory of Cognition (Hutto and Myin 2017) and on the Interactive Theory (Gallagher 2017; Menary 2006), has introduced an externalist, non-representationalist way of accounting for the kind of third-person, high level ways of thinking about others' intentional states that explain ostensible behavior (Hutto 2006, 2007, 2008, 2009).

It is not by chance that, in his fundamental paper on social cognition of 2007, Vittorio Gallese quotes Daniel Hutto in his first and in his last page, in order to move against "the traditional view in the cognitive sciences that holds that humans are able to understand the behaviour of others in terms of their mental states".

> It seems preposterous to claim that our capacity to reflect on the intentions, beliefs and desires determining the behaviour of others is all there is in social cognition. [. . .] A growing sense of discomfort towards a blind faith in folk psychology to characterize social cognition is indeed surfacing within the field of philosophy of mind. It has recently been stressed that the use of folk psychology in social cognition of the belief-desire propositional attitudes is overstated (see Hutto 2004). [. . .] Our sophisticated mind-reading abilities probably involve the activation of large regions of our brain, certainly larger than a putative and domain-specific theory of mind module. My point is that these brain sectors do encompass the premotor system and, in particular, the mirror neuron system [. . . which] might also be crucial in the course of the long learning process children require to become fully competent in how to use folk psychology. This learning process greatly benefits from the repetitive exposure to the narration of stories about the actions of various characters (for a putative role of narrative practices in the development of a competent use of folk psychology, see Hutto 2004). (Gallese 2007)

The Narrative Practice Hypothesis by Shaun Gallagher and Daniel Hutto (2008, 2018, see also Hutto 2007, 2009; Gallagher 2006) stressed that mindreading is a very specific skill developed from embodied interactions on the one side and from narrative competence on the other side. We make sense out of the action of other individuals based on what they believe, wish and know – not because we read their minds, rather because: i) we are able to read their intentions within embodied interactions; ii) we place them in narrative frameworks (Gallagher and Zahavi 2008; Gallagher and Povinelli 2012).

Is it possible to keep together these two views and move towards a new conception of social cognition that sees Mindreading as a very specific skill developed from semiotic and prelinguistic narrative practices, without introducing any kind of "in the head", representationalist view referring to mental states and contents?

In order to achieve that, we will introduce a two-levels model.

4.3 A Two-Levels Model. *Low-Level: Action/Perception/Imagination Matching*

Even if it has been interpreted as an "embodied simulation" (Gallese and Goldman 1998; Goldman 2006; Rizzolatti and Vozza 2011), the discovery of Mirror Neurons has shaken both the Theory Theory (TT) and the Simulation Theory (ST). It has pushed the Theory Theory to a minor role and has forced the ST to integrate a subpersonal level, giving birth to a hybrid view, according to which there are two routes to social cognition. The full version of Goldman's (2006) Simulation-Based approach to mindreading involves a distinction between *low*-level and *high*-level tasks of mindreading achieved by two distinct kinds of processes of mental simulation: whereas so-called processes of "mirroring" (exemplified by the activity of mirror neurons) underlie tasks of low-level mindreading, the so-called processes of "enactment-imagination" underlie tasks of high-level mindreading (Jacob 2011).

The radical enactivist account of social cognition I am defending claims that the "low-level", grounded on mirror neurons ("mirroring"), has to be reinterpreted in a different manner and that the "high-level" ("enactment-imagination") has to be replaced by a semiotic and narrative logic of inter-action.

Aside from the interpretation in terms of ST, the neuroscientific discovery of mirror neurons basically shows us a common neurobiological ground for action, perception and imagination (Rizzolatti and Craighero 2004). It tells us that specific social cognitive endowments of our species are the evolutionary outcome of the selection of mechanisms that are not intrinsically cognitive or, at the very least, certainly not mindreading-specific (Gallese et al. 2012; Gallese 2001). They come from action and, as we are about to see, from the action's motor and rewarding biological structures. The main claim is that key aspects of human social cognition are "underpinned by neural exploitation"; that is, the adaptation of sensory-motor and reward integrating brain mechanisms "to serve new roles in thought and language, while retaining their original functions as well" (Gallese 2007: 666, see also Gallese and Lakoff 2005).

Indeed, the discovery of mirror neurons tells us that the perception of others' actions automatically activates the same brain areas in the prefrontal cortex and in the Broca's area that become active when we ourselves perform a similar action. Moreover, overlapping of neural areas occurs in regions of the prefrontal and parietal cortices in the following conditions: (i) when I perform an intentional action; (ii) when I observe someone else performing an intentional action; (iii) when I imagine myself or someone else performing that action; and finally (iv) when I prepare to imitate someone else's action (Gallese 2005; Rizzolatti and Sinigaglia 2006). All this seems to go in the direction of an enactivist theory of perception (Noë 2006) rather than towards a Simulation Theory, since it poses a common ground for perception and action, which is the strong argument made by the enactivists (Menary 2006; Gallagher 2017, Hutto and Myin 2017). If perception is an enactive, sensory-motor process, and not simply a process of sensory reception, the resonance processes discovered by neuroscientists in Parma can be easily considered as being part of the perceptual process when perception focuses on others' actions. Shaun Gallagher (2007, 2017) has proposed an enactivist alternative to the ST interpretation: mirror neurons activation is not the beginning of a simulation, rather it is part of an intersubjective perception of what the other is doing. Neural systems do not activate themselves, but they are activated by the other's action. This is not a simulation, it is a perceptual event that is a response to the other's action (Gallagher and Zahavi 2008: 268–279). This seems to be just the opposite of what the Simulation Theory argues, namely that our mind is activated as a model in order to "put ourselves in the other's shoes".

The main difference that we need to underline is that for the "Embodied Simulation" interpretation of the mirror neurons discovery, we are dealing with a "first person-third person matching (i.e. link 'I do and I feel' with 'he does and he feels')" (Gallese et al. 2004: 396). On the contrary, for the enactivist point of view, we are dealing with a "first person-second person" matching, where the subject is not an observer of others' actions, but a "fellow character" interacting with others inside a practice. An action-oriented perspective on cognition (like enactivism is) changes the role of the individual from a passive observer to an actively engaged agent interacting in a closed loop with the world as well as with others. This is a key point, because for an enactivist account of cognition, interaction has to be the "model" for observation and not viceversa: it is through the understanding of interactions that we will cast light to the assignment of meanings during observations, because (i) we share an embodied biological system that matches action and perception; (ii) we spend our entire first two years of life interacting with others. Mirror neurons are crucial for that: matching action, perception and imagination, they ground meaning in our motor system and, through habits, are preparatory for action.

> By matching a perceived motor act with those contained in one's own motor repertoire, [the Mirror system] allows an inner, experienced, non-cognitively mediated, recognition of others' action goal. (Gallese et al. 2012: 17)

The fact that the "recognition of the others' goal" is "experienced" and "non-cognitively mediated" is the main point for an enactivist theory of social cognition and it is a common view in both "third person" and "second person" interpretations of the discovery of mirror neurons. However, no traces of mindreading can be seen here, since mindreading is a cognitively-mediated recognition and representation of the others' intentions, beliefs and desires. How can we deal with it calling attention to the importance of inherited and embodied practices and social interactions, without relying on the processing or manipulating of informational contents? In order to do that, we have to move to the "high-level" of our model.

4.4 A Two-Level Model. High-Level: Narrativity

In order to understand how narrativity leads us to minds and beliefs starting from basic perceptions, emotions and embodied enactive interactions without the need of representations, it is important to stress that humans are creators of stories. There is no human culture which is not founded on a set of stories and that, through narratives, does not elaborate explanations and teachings related to its world and its experiences, processed in the form of myths and legends. There is no single human child that does not grow up in an environment where stories represent a fundamental phase of its growth and development, a kind of main gateway to fuller intersubjectivity, which opens up to the realm of others' actions and the motivations that push them to act the way they do (Hutto 2007, 2009).

However, while narratives are cultural products, the ability of narrating stories (narrativity) is not. Narrativity is a cognitive skill by which we shape experience through meaning (Talmy 2000; Herman 2003; Paolucci 2012). This is an everyday experience in situations like anxiety or restlessness, when something important has happened and we still can't really focus on the main point. What do we do? We call a friend or a girlfriend and we need to tell her our story. This is because storytelling has its own logic and its own structure, so to tell what has happened to us means shaping it through the structure of narrative, and shaping it through this kind of structure means giving it meaning. That is why we usually feel better when we have told our story: we have given meaning to experience through the structure of narrative. That's why narratives don't simply "represent" experience, they shape it through meaning, and this has a looping effect, in the sense that it gets reincorporated back into our experience (see Gallagher and Hutto 2018).

The idea that narrativity is a cognitive skill by which we shape experience was originally developed by Jerome Bruner (1986, 1991), who used to think that there are two modes of cognitive functioning, "each providing distinctive ways of ordering experience": logical thought (paradigmatic) and narrative thought. The first deals with truth, the second "with the broader question of how we come to endow experience with meaning" (Bruner 1986: 13). Before and after Bruner, semiotic tradition (Eco 1979; Greimas 1983; Paolucci 2012, 2018) has shown that narrative thought has a stable pattern which is also at play in pre-linguistic and non-linguistic experiences and is a key aspect in social cognition.

For the aims of this paper, we claim that we make sense out of the action of others through a narrative mind. We will show: (i) how a narrative mind does not depend on the acquisition of language, but develops from more basic perceptions, emotions and embodied interactions with others, especially the ones between babies and caregivers; (ii) how narrativity – the deep cognitive structure that shapes narratives – permeates the interactive competencies of pre-linguistic children and social non-human animals; (iii) how mindreading skills in human and primates come from a *narrative logic* of inter-action.

In order to understand this narrative logic of inter-action, I will first refer to the semiotic tradition. Later, I will keep together the semiotic idea of a narrative mind together with other enactivist claims on social cognition. With "narrativity", the semiotic tradition means a prelinguistic skill able to shape experience through meaning (Paolucci 2012; Lorusso et al. 2012), which is prototypically expressed in narrative texts and practices, but is at work even in non-narrative ones (Eco 1979). Greimas (1970, 1983, see also Bertrand 2000; Fontanille 2008) has shown that any story whatsoever shows always a prototypical structure developing in four steps. These four steps have been identified by studying narratives (tales, myths etc.), but it has been shown that they can be found in any discourse or practice involving acting for reasons (see Paolucci 2018). This is why we claim that semiotic narrativity is a key component in order to develop a Folk Psychology competence, since Folk Psychology competence refers to our everyday practice of making sense of intentional actions in terms of reasons (beliefs, desires etc.).

The first step of this narrative logic of inter-action is called *contract* and is supposed to establish the system of values which will frame further actions. This step is characterized by "manipulation" and we can have very different kind of manipulations that structure the story: from *authority*, which Greimas (1983) describes as the transfer of a "having to do" (for example a king asking a hero to rescue a princess in order to save the village), to *persuasion* (described as the transfer of a "willing to do"), to *permission* (which is a transfer of a "can do"). In all these variable cases, what really matters is the establishment of something worth acting for: *values* that need actions in order to be preserved or transformed.

The second step is often called *competence*: in order to act, a subject must have the necessary abilities, the "knowing how to do", as Greimas calls them. A number of important transformations enacted in narratives address this issue, grounding further different relations between characters: helpers and opponents, for instance, help or create obstacles for the subject looking for "knowing how to do".

The third step is *performance*, a transformation where the subject transforms the undesired state by obtaining his object(s) of value (which, of course, can also be a non-physical object, a state of mind or whatever else he aims for). This third step represents the core transformation in any narrative, the transformation for which the subject was previously prepared by being manipulated and made competent.

The fourth step of the semiotic narrative schema is *sanction*. At this stage, the subject receives an acknowledgment of his success or failure by virtue of a given system of values (usually the one established in step 1).

Obviously, this kind of pattern, that can be found in every story, can also be found in the majority of animal cultures (Dautenhahn 2001; Ferretti 2016): the immature animal has to gain competence about getting food, has to make its own performances and get sanctioned on its own behaviour. This is why semiotics claims that this pattern unfolds the nature of those non-logical (narrative) relations between events which, according to Bruner (1986, 1991), constitute narrative thought (see also Danto 1985).

"Infant research" (Stern 1992, 1995) and semiotic studies (Violi 2012; Paolucci 2018) have shown that this kind of pattern is at play both in what Colwyn Trevarthen (1979; Trevarthen and Hubley 1978) used to call "primary intersubjectivity" (1–9 month old infants) and secondary intersubjectivity (9–18 month old infants). This aspect should be carefully considered in order to understand the role played by narrativity in early mindreading and folk psychology competence. Human children and many other social animals exhibit a special responsiveness to the intentional attitudes of others early on (3 months), discriminating human actors from mechanical agents and goal-related actions from mechanical movements. Indeed, during primary intersubjectivity, human infants and some other social animals (Myowa-Yamakowshi et al. 2004) are already able to see bodily movements as goal-directed, meaningful intentional movements and to perceive other persons as agents, discriminating a biological movement from other kinds of movements (Simion et al. 2011). Embodied interactions during primary intersubjectivity constitute our primary access for understanding the others and the skills we exhibit during this crucial period ground our more sophisticated social cognition abilities, developed later on in ontogenesis. These skills include proto-mimesis, emotional interchange, imitation and the parsing of perceived intentions (Gallagher 2005, 2006, 2009). During primary intersubjectivity, children are already able to interpret the actions and the expressive movements of the others through meaning (Zlatev 2008).

In all these embodied interactions during primary intersubjectivity, a narrative competence (in the semiotic sense) is already at play. When a 6 months-old infant starts perceiving various bodily movements as meaningful, understanding that he can answer them in interactive response, having back her mother's smile as a reward, keeping on doing this because the reward is intrinsically motivating, for a semiotician there is an evident narrative competence already operating, able to transform the values involved and shape experience through meaning (Violi 2012). The presence of values which are worth the acting (contract and sanction) is extremely important, since our radical forms of enactivism do not only include the idea of sensorimotor contingencies, but also emphasize other fundamental aspects of embodiment such as affectivity, reward, interest, motivation and embodied social interaction (see Dominey et al. 2016).

However, for mindreading skills to emerge, secondary intersubjectivity is crucial. Around the age of 1 year, but also earlier (9 months), together with the development of a semiotic competence (Vygotskij 1986; Eco 1975), the infant goes beyond person-to-person immediacy and enters contexts of shared attention, where he begins to tie actions to pragmatic contexts (Reddy 2008). The capacity for joint attention is a major addition to the repertoire of social skills exhibited during primary intersubjectivity. Not only children are now able to re-enact to completion the goal-directed behavior that someone else fails to complete, but, in those shared situations, an object or an event can become a focus between people: an object of value that can be communicated about (Hobson 2002). “The child, on seeing an adult who tries to manipulate a toy and who appears frustrated about being unable to do so, quite readily picks up the toy and shows the adult how to do it” (Gallagher and Hutto 2008: 24).

This emergence of a “third” beyond the caregiver/child interaction – that can be a value for both – is crucial for developing a narrative framework in which the infant starts to learn what things mean and what they are for, together with the idea that these values can be transformed and manipulated. Infants not only cooperate with the others, but, more deeply, begin to build their own stories in order to cheat them, like in the false cry to get an object and not only their mother’s attention. This is crucial for developing mindreading and all the cognitive skills required in order to handle and understand false belief situations properly. At around 9 months of age, children start to build worlds which are alternatives to the ones they are living in. Through imagination and strategic behavior, they start to build situations decoupled from the actual ones. They start to imagine fictional worlds and – more importantly – they start working in order to make these fictional imagined situations become the real actual ones (see Paolucci 2018). For instance, let’s say that they want an object, a third that is a value for them. In order to get it, they begin to obtain the competence they need and they actually perform something in order to own it, false crying in order to manipulate the mother and make her bring the object they want. They learn that they can manipulate, and be manipulated, that the others can believe in things that are not actually true, that the caregiver can really believe they are actually crying and that all this can change their world in a way they want it to be. That’s how human abilities to represent another’s false belief are connected to narratives and to all those semiotic skills which allow someone to construct signs that stand for other things and can be used to lie. After all, this was exactly the most beautiful definition by Umberto Eco (1975: 13): “semiotics is the discipline that studies everything that can be used in order to lie”.

This can tell us something important about the Theory of Mind and mindreading skills. Infants have at least implicit mindreading skills. Animals also have social cognition skills: they read others’ actions, desires, intentions and, according to very recent experiments by Buttelmann et al. 2017 and Krupenye et al. 2016, they also read and handle false beliefs. They have to do that in order to survive in the wild (see Andrews 2015). But animals do not have language or a theory of mind connected to propositional attitudes like we are supposed to have. However, they also interact with their caregivers during their development and, as said, during these embodied practices they also shape experience through semiotic narrative patterns. The same thing goes with social cooperation and joint activities inside the animals’ social network. During these interactions, the puppy attunes its skills and behaviours to its environment and to its social group. That’s why we firmly believe that mindreading is connected with narrative patterns inside embodied interactions and that the difference between great apes and human social cognition does not lie in their basic capacity to read other minds. Indeed, if deception is the key element in order to move from embodied social interactions to mindreading skills, primates and many other social animals always show astonishing deceptive skills.

The focus on deception is crucial for a radical enactivist account of mindreading and social cognition like the one we are defending. When deception is at play, the animal or the human are set in an unfamiliar context that requires to draw some kind of inference in order to predict a new behaviour. This holds true both for the deceiver – who has to construct a strategy that takes into account the image of the possible reactions of the others – and the deceived, who has to react in an unfamiliar situation, one he hasn't any behavioural abstractions for (see Gallagher and Povinelli 2012).

It is not by chance that Lurz (2011; Lurz and Krachun 2011) connects the adaptive function of mindreading to camouflage. "Lurz suggests that the reason why we mindread is that our ancestors found it useful to predict the behaviour of conspecifics who were looking at ambiguous stimuli, such as camouflaged predators or preys" (Andrews 2015: 167, see also Lurz 2011; Krachun et al. 2016).

If the adaptive function of mindreading is to predict others' behaviour in opaque environmental contexts, another important scenario that needs to be introduced in our semiotic enactivist account of social cognition is opaque cooperative social behaviour. This underlines another strong evolutionary claim: sociality doesn't only mean to be competitive and gain advantage through deception or strategic behaviour, but also to collaborate, share knowledge, build communities and engage in joint activities that may hugely benefit from mindreading skills. This is why in shared activities inside a social cooperative world, a strange behaviour is not immediately sanctioned negatively. Since primates and humans can handle meaning during interactions, they often bet that behind a strange behaviour in a collaborative task, there may be some sort of opaque reasons to engage in that particular behaviour by an individual inside a cooperative community. In situations of cooperation of that sort, that animal social behaviour does not always move to the sanction step, but goes back to the contract one, engaging in some sort of recognition that a particular behaviour can be valuable and worth being performed, even if it is not immediately clear.

Our everyday practice of making sense of intentional actions in terms of reasons (beliefs, desires etc.) is a skill that comes from social narrative practices in which we manipulate others, we try to make others do things inside a shared system of values, we gain the competences needed to do these kind of things, we act and we get judged on our actions This kind of activity grounds the relationship between caregiver and baby before verbal language shows up and is a pattern of action that can be found not only in primates, but probably in a variety of other social animals. A radical enactivist theory of social cognition grounded on semiotics and narrative practices claims that social cognition skills come from this mechanism, without involving any kind of inferences about beliefs or desires understood as mental states or representations. Semiotic narrativity is the key bridge that leads us to mind and beliefs starting from basic perceptions, emotions and embodied enactive interactions and the kind of social cognition that operates in implicit false belief task competency is developed out of this narrative logic of inter-action.

4.5 From Deception to Pretend Play to Language Acquisition

According to our Narrative Practice Semiotic Hypothesis (see Paolucci 2018), a radical enactivist account of social cognition claims that our mindreading skills are grounded first and foremost in the embodied interactions between infants and caregivers during primary intersubjectivity (1–9 months), but they fully develop during secondary intersubjectivity connected to the semiotic capacity of deception and lie (9–18 months). Only in its full blown form developed during secondary intersubjectivity narrativity can lead to mindreading skills. This drives to pretend play, which is also connected to semiotic skills and narrative thought (Hutto 2006, 2008, 2009), that typically begins in a child's second year, at around 18 months. As Leslie (1987, 2005) already noted, pretense signals the beginnings of the so-called second-order mental processes that underwrite the development of Theory of Mind. The conjunction of deficits in both pretense and Theory of Mind in autism is consistent with this idea.

Pretend play is a key moment for developing a Folk Psychology competence and not only because it highlights and fosters children's abilities to understand and coordinate multiple mental perspectives. If Folk Psychology competence refers to our everyday practice of making sense of intentional actions (our own and those of others) in terms of reasons (beliefs, desires etc.), it implies both a "first-person/second person" and a "first-person/third-person" matching. "I am spiderman", "I am mommy and you are daddy" exactly represent this kind of matching during pretend play activities.

When children are playing pretend they are playing 'as if' something or someone is real. This is why pretend play is actually connected not only with the beginning of the second-order mental processes that lead to mindreading, but also with a narrative logic that shape their experience, since this "as if" – as we have shown before – is acquired through semiotic narratives during secondary intersubjectivity, without being immediately related to language acquisition or to a representational content. Children simply start putting themselves in the position of the others: they become actors occupying other characters' positions.

Pretend play is a merging between fiction and reality, between the actual world of reality and the possible world of imagination. For example, a child might be placing a doll in a bed and, to the child, the doll is alive and really sleeping and so the child will have to wait until the doll wakes up. Pretend play is a fully developed narrative practice, involving skills that do not depend upon language acquisition. Language extends them beyond embodied interactions, fine tuning an already developed narrative competence connected to mindreading and to Folk Psychology skills. The same thing goes with shared attention skills developed during secondary intersubjectivity. Basic forms of co-referential shared interactive activity like pointing or gaze following are already at play by 9 months, but full-blown pre-linguistic joint attention skills are normally well established by 18 months, when pretend play also shows up. At this point, a full-blown mindreading competence, already at play in a more rudimentary way starting from 9 months, is usually already established. This is consistent with data coming from early mindreading experiments (see Paolucci 2018; Baillargeon et al. 2010).

During the course of the second year of life, language shows up, extending in important ways all these capacities. The Narrative Practice Hypothesys by Daniel Hutto, linked to verbal language and propositional attitudes, explains perfectly well why three-year-old children consistently fail standard verbal-based false belief and related meta-representational tests, showing us what happens when language enters the scene of mindreading life of children from 2 to 5 years. However, this does not necessarily mean that early mindreading is not a real form of mindreading and does not involve folk psychology states at all, like Gallagher and Hutto seem to claim (see Gallagher and Povinelli 2012). Data from very recent experiments by Buttelmann et al. (2009, 2017) in infants and primates are not fully interpretable in terms of an enactivist theory of embodied interactions without introducing a narrative competence, which has to be at play long before language acquisition (Paolucci 2018). Of course, Hutto believes in non-propositional forms of believing and non-discursive narratives, but those forms and those narratives do not enter in the Narrative Practice Hypothesys for Folk Psychology, that deals only with linguistically mediated propositional attitudes. But, as said, both experiments by Buttelmann et al. (2009, 2017) about early mindreading in prelinguist infants and primates seem not to be fully interpretable without introducing folk psychology competence and mindreading skills.

4.6 Some Final Remarks and Some Possible New Directions of Research

As far as mindreading and folk psychology competence are concerned, starting from the subpersonal action/perception/imagination matching mechanism implemented in mirror neurons and from the reward network – encouraging us to prefer the stimuli and the experiences that lead to a positive sanction – it is action with its narrative logic that turns a very general embodied matching system into a mindreading module, tuned to the meaning of the actions of the others during inter-action. And all this without the need of representational and linguistic content in the explanation of cognition in basic minds (see Hutto and Myin 2017).

Infants begin life with general mechanisms dedicated to processing intentions, goals as well as other social stimuli, that subsequently become “tuned” to mindreading as a direct consequence of the extensive experience with social interaction provided by the species-typical environment within the first months of life. As we have shown, joint attention, semiotic competence, deception skills and pretend play all play a key role in this process. Infants spend their entire first two years interacting with others. This is of course a critical moment, because social skills impairments, like Autism Spectrum Disorders (ASD), are the proof that this cognitive attunement can fail. We know that ASD boys and girls keep on failing on false belief tasks (Baron-Cohen 1995; Wellman et al. 2001) and clear signs of disattunements of this kind are actually visible during embodied interactions in primary and secondary intersubjectivity, focusing on the sanction and contract phases of the narrative development of the embodied interaction. This is crucial for our radical enactivist account of social cognition grounded on semiotics, because it claims that future social skills impairments may be already read during primary/secondary intersubjectivity, studying interactions between caregivers and infants with particular attention to the "contract" and the "sanction" levels. Our research team is working on this topic and this looks like an intriguing future for a radical enactivist theory of social cognition, grounded on semiotics and narrative practices.

References

Andrews, K. (2015). *Animal cognition*. London: Routledge.

Baillargeon, R., Scott, R.M., & He, Z. (2010). False-belief understanding in infants. *Trends in Cognitive Sciences, 14*(3), 110–118.

Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. Cambridge: MIT Press.

Bertrand, D. (2000). *Précis de sémiotique littéraire*. Paris: Nathan.

Bruner, J. (1986). *Actual minds, possible worlds*. Cambridge: Harvard University Press.

Bruner, J. (1991). The narrative construction of reality. *Critical Inquiry, 18*, 1–21.

Buttelmann, D., Carpenter, M., & Tomasello, M. (2009). Eighteen-month-old infants show false belief understanding in an active helping paradigm. *Cognition, 112*(2), 337–342.

Buttelmann, D., Buttelmann, F., Carpenter, M., Call, J., & Tomasello, M. (2017). Great apes distinguish true from false beliefs in an interactive helping task. *PLoS One, 12*(4), e0173793. https://doi.org/10.1371/journal.pone.0173793.

Butterfill, S.A., & Apperly, I.A. (2009). Do humans have two systems to track beliefs and belief-like states? *Psychological Review, 116*, 953–970.

Butterfill, S.A., & Apperly, I.A. (2013). How to construct a minimal theory of mind. *Mind & Language, 28*(5), 606–637.

Currie, G., & Sterelny, K. (2000). How to think about the modularity of mind-reading. *The Philosophical Quarterly, 50*(199), 145–160.

Danto, A. (1985). *Narration and knowledge*. New York: Columbia University Press.

Dautenhahn, K. (2001). The narrative intelligence hypothesis: In search of the transactional formats of narratives in humans and other animals In: M. Beynon, C.L. Nehaniv, & K. Dautenhahn (Eds.), *Proceeding fourth international cognitive technology. Conference CT 2001: Instruments of mind* (pp. 248–266).

Dominey, P., Prescott, T., Bohg, J., Engel, A., Gallagher, S., Heed, T., Hoffmann, M., Knoblich, G., Prinz, W., & Schwartz, A. (2016). Implications of action-oriented paradigm shifts in cognitive science. In A. K. Engel, K. J. Friston, & D. Kragic (Eds.), *The pragmatic turn: Toward action-oriented views in cognitive science*. Cambridge, MA: MIT Press.

Eco, U. (1975). *Trattato di semiotica generale*. Milano: Bompiani (English translate in on, *A theory of semiotics*. Bloomington: Indiana University Press).

Eco, U. (1979). *Lector in fabula*. Milano: Bompiani (English translation, *The role of the reader*. Bloomington: Indiana University Press).

Ferretti, F. (2016). The social brain is not enough: On the importance of the ecological brain for the origin of language. *Frontiers in Psychology, 7*, 1138. https://doi.org/10.3389/fpsyg.2016.01138.

Fontanille, J. (2008). *Pratiques Sémiotiques*. Paris: PUF.

Frith, U., & Happe, F. (1999). Theory of mind and self-consciousness: What is it like to be autistic. *Mind and Language, 14*(1), 1–22.
Gallagher, S. (2005). *How the body shapes the mind*. Oxford: Oxford University Press.
Gallagher, S. (2006). The narrative alternative to theory of mind. In R. Menary (Ed.), *Radical enactivism. Focus on the philosophy of Daniel D. Hutto* (pp. 223–229). Amsterdam/Philadelphia: John Benjamins.
Gallagher, S. (2007). Logical and phenomenological arguments against simulation theory. In D. Hutto & M. Ratcliffe (Eds.), *Folk psychology re-assessed* (pp. 63–78). Dordrecht: Springer.
Gallagher, S. (2009). Two problems of Intersubjectivity. *Journal of Consciousness Studies, 16*(6–7), 1–20.
Gallagher, S. (2017). *Enactivist interventions: Rethinking the mind*. Oxford: Oxford University Press.
Gallagher, S., & Hutto, D. (2008). Understanding others through primary interaction and narrative practice. In J. Zlatev, T. Racine, C. Sinha, & E. Itkonen (Eds.), *The shared mind: Perspectives on Intersubjectivity* (pp. 17–38). Amsterdam: John Benjamins.
Gallagher, S., & Hutto, D. (2018). *Narratives in embodied therapeutic practice: Getting the story straight*. (in press).
Gallagher, S., & Povinelli, D. (2012). Enactive and behavioral abstractions accounts of social understanding in chimpanzees, infants and adults. *Review of Philosophy and Psychology, 3*, 145–169.
Gallagher, S., & Zahavi, D. (2008). *The phenomenological mind*. London: Routledge.
Gallese, V. (2001). The 'shared manifold' hypothesys: From mirror neurons to empathy. *Journal of Consciousness Study, 8*, 33–50.
Gallese, V. (2005). Embodied simulation: From neurons to phenomenal experience. *Phenomenology and the Cognitive Science, 4*, 23–48. https://doi.org/10.1007/s11097-005-4737-z.
Gallese, V. (2007). Before and below 'theory of mind': Embodied simulation and the neural correlates of social cognition. *Philosophical Transactions of the Royal Society B—Biological Sciences, 362*(1480), 659–669.
Gallese, V., & Goldman, A. (1998). Mirror neurons and the simulation theory of mind-reading. *Trends in Cognitive Science, 12*, 493–501. https://doi.org/10.1016/S1364-6613(98)01262-5.
Gallese, V., & Lakoff, G. (2005). The Brain's concepts: The role of the sensory-motor system in conceptual knowledge. *Cognitive Neuropsychology, 22*, 455–479.
Gallese, V., Keysers, C., & Rizzolatti, G. (2004). A unifying view of the basis of social cognition. *Trends in Cognitive Science 8*(9), 396–403.
Gallese, V., Rochat, M., & Berchio, C. (2012). The mirror mechanism and its potential role in autism spectrum disorder. *Developmental Medicine and Child Neurology, 55*(1), 15–22. https://doi.org/10.1111/j.1469-8749.2012.04398.x. Epub 2012 Aug 28.
Goldman, A.I. (2006). *Simulating minds. The philosophy, psychology and neuroscience of mindreading*. Oxford: Oxford University Press.
Greimas, A.J. (1970). *Du sens*. Paris: Seuil.
Greimas, A.J. (1983). *Du sens 2*. Paris: Seuil.
Herman, D. (Ed.). (2003). *Narrative theory and the cognitive science*. Stanford: CSLI Publications.
Hobson, P. (2002). *The cradle of thought*. London: McMillan.
Hutto, D. (2004). The limits of Spectatorial folk psychology. *Mind & Language*. https://doi.org/10.1111/j.0268-1064.2004.00272.x.
Hutto, D. (2006). Narrative practice and understanding reasons. In R. Menary (Ed.), *Radical Enactivism. Focus on the philosophy of Daniel D. Hutto* (pp. 231–247). Amsterdam/Philadelphia: John Benjamins.
Hutto, D. (2007). The narrative practice hypothesis: Origins and applications of folk psychology. *Philosophy Royal Institute of Philosophy Supplement, 82*, 60. (Also in Hutto, D. (Ed.), *Narrative and understanding persons*, Cambridge: Cambridge University Press, pp. 43–68).
Hutto, D. (2008, September). The narrative practise hypothesis: Clarifications and implications. *Philosophical Explorations, 11*(3), 175–192.

Hutto, D. (2009). Folk psychology as narrative practise. *Journal of Consciousness Studies, 16*(6–8), 9–39.

Hutto, D., & Myin, E. (2017), Evolving Enactivism, Boston, MIT Press.

Jacob, P. (2011). The direct-perception model of empathy: A critique. *Review of Philosophy and Psychology, 2011*(2), 519–540.

Johnson, M.H. (2000). Functional brain development in infants: Elements of an interactive specialization framework. *Child Development, 71*, 75–81.

Krachun, C., Lurz, R., Russell, J.L., & Hopkins, W.D. (2016). Smoke and mirrors: Testing the scope of chimpanzees' appearance-reality understanding. *Cognition, 150*(2016), 53–67.

Krupenye, C., Kano, F., Hirata, S., Call, J., & Tomasello, M. (2016). Great apes anticipate that other individuals will act according to false beliefs. *Science, 354*(6308), 110–114.

Leslie, A.M. (1987). Pretense and representation: The origins of "theory of mind.". *Psychological Review, 94*(4), 412–426. https://doi.org/10.1037/0033-295X.94.4.412.

Leslie, A.M. (2005). Developmental parallels in understanding minds and bodies. *Trends in Cognitive Sciences, 9*(10), 459–462.

Lorusso, A.M., Paolucci, C., & Violi, P. (Eds.). (2012). *Narratività. Temi, Problemi, prospettive*. Bologna: Bononia University Press.

Lurz, R. (2011). *Mindreading animals*. Cambridge: MIT Press.

Lurz, R., & Krachun, C. (2011). How could we know whether nonhuman primates understand others' internal goals and intentions? Solving Povinelli's problem. *Review of Philosophy and Psychology, 2*(3), 449–481.

Malle, B.F. (2002). The relation between language and theory of mind in development and evolution. In T. Givón & B. F. Malle (Eds.), *The evolution of language out of pre-language* (pp. 265–284). Amsterdam: John Benjamins.

Myowa-Yamakowshi, M., Tomonaga, M., & Tanaka Tetsuro Matsuzawa, M. (2004). Imitation in neonatal chimpanzees (*Pan troglodytes*). *Developmental Science*. https://doi.org/10.1111/j.1467-7687.2004.00364.x.

Menary, R. (Ed.). (2006). *Radical enactivism. Focus on the philosophy of Daniel D. Hutto*. Amsterdam/Philadelphia: John Benjamins.

Noë, A. (2006). *Action in perception*. Cambridge: MIT Press.

Paolucci, C. (2012). Social cognition between theories, simulations and narratives: The narrative practice semiotic hypothesis. *Intellectica, 58*(2012), 173–196.

Paolucci, C. (2018). Social cognition, mindreading and narratives. A cognitive semiotics perspective on narrative practices from early mindreading to autism Spectrum disorders. In *Phenomenology and the cognitive science*. Dordrecht: Springer.

Povinelli, D.J., & Vonk, J. (2004). We don't need a microscope to explore the chimpanzee's mind. *Mind and Language, 19*, 1–28.

Reddy, V. (2008). *How infants know minds*. Cambridge: Harvard University Press.

Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience, 27*, 169–192.

Rizzolatti, G., & Sinigaglia, C. (2006). *So quel che fai, Il cervello che agisce e i neuroni specchio*. Milano: Raffaello Cortina Editore.

Rizzolatti, G., & Vozza, L. (2011). *Nella mente degli altri. Neuroni specchio e comportamento sociale*. Bologna: Zanichelli.

Ruffman, T., & Perner, J. (2005). Do infants really understand false belief? *Trends in Cognitive Sciences, 9*(10), 462–463.

Scott, L.S., Pascalis, O., & Nelson, C.A. (2007). A domain general theory of perceptual development. *Current Directions in Psychological Science, 16*, 197–201.

Simion, F., Turati, C., Valenza, E., & Leo, I. (2006). The emergence of cognitive specialization in infancy: The case of face preference. In M. Johnson & M. Munakata (Eds.), *Attention and performance XXI, processes of change in brain and cognitive development* (pp. 189–208). Oxford: Oxford University Press.

Simion, F., Di Giorgio, E., Leo, I., & Bardi, L. (2011). The processing of social stimuli in early infancy: From faces to biological motion perception. *Progress in Brain Research, 189*, 173–193. https://doi.org/10.1016/B978-0-444-53884-0.00024-5.

Stern, D. (1992). *Diary of a baby. What your child sees, feels and experience*. New York: Basic Books.

Stern, D. (1995). *The motherhood constellation*. New York: Btasic Books.

Sugita, Y. (2008). Face perception in monkeys reared with no exposure to faces. *Proceedings of the National Academy of Sciences of the United States of America, 105*, 394–398.

Talmy, L. (2000). A cognitive framework for narrative structure. In *Toward a cognitive semantics* (Vol. 2, pp. 417–482). Cambridge: MIT Press.

Trevarthen, C. (1979). Communication and cooperation in early infancy: A description of primary intersubjectivity. In M. Bullowa (Ed.), *Before speech* (pp. 321–348). Cambridge: Cambridge University Press.

Trevarthen, C., & Hubley, P. (1978). Secondary intersubjectivity: Confidence, confiding and acts of meaning in the first year. In A. Lock (Ed.), *Action, gesture and symbol: The emergence of language* (pp. 183–229). London: Academic.

Violi, P. (2012). Nuove forme della narratività. In A. M. Lorusso, C. Paolucci, & P. Violi (Eds.), *Narratività. Temi, Problemi, prospettive* (pp. 105–132). Bologna: Bononia University Press.

Vygotskij, L.S. (1986). *Thought and language*. Cambridge: MIT Press.

Wellman, H., Cross, D., & Watson, J. (2001). Meta-analysis of theory of mind development: The truth about false belief. *Child Development, 72*, 655–684.

Zlatev, J. (2008). The co-evolution of intersubjectivity and bodily mimesis. In J. Zlatev, T. Racine, C. Sinha, & E. Itkonen (Eds.), *The shared mind: Perspectives on Intersubjectivity* (pp. 215–244). Amsterdam: John Benjamins.

Chapter 5
On the Nature of Bodies. With the Help of Aristotle

Franco Lo Piparo

Abbreviations of the Aristotelian Works Mentioned

Cat.	Categoriae
DA	De anima
DGC	De generatione et corruptione
DIA	De incessu animalium
DI	De insomniis
DMA	De motu animalium
DMR	De memoria et reminiscentia
DSV	De somno et vigilia
DSS	De sensu et sensibilibus
EN	Ethica nicomachea
Met.	Metaphysica
Pol.	Politica
Rhet.	Ars rhetorica

0 I will deal with a cognitivist scientist of the fourth century BC, Aristotle, and his theory of the natural cognitive nature of bodies. I believe this can make a good contribution to the contemporary debate. Cognitivists do not usually have first-hand knowledge of him. Instead, above all thanks to Damasio, they know Spinoza, who however was indebted in turn to the Greek philosopher.

1 In contemporary cognitivist literature *embodied cognition* is a commonly used expression. It suggests, perhaps unintentionally, a different idea from what cog-

F. L. Piparo (✉)
University of Palermo, Palermo, Italy
e-mail: franco.lopiparo@unipa.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*,
Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_5

nitivism usually means by that expression. *Embody* and *embodiment* are terms that belong to theological lexicon and convey the idea that somewhere there is something that initially is not body and is subsequently embodied. In other words, the term *embodiment* is part of a dualistic paradigm that is exactly the opposite of what is usually meant by *embodied cognition* in the literature.

The misunderstanding of the expression arises perhaps from a theoretical lacuna. In cognitivist literature there is much insistence on the bodily rooting of cognition, whether artificial or animal or more specifically human. And yet it is rare to come across a satisfactory definition of body. It is taken for granted that the body is something material, that is to say something that can be touched or seen or at any rate perceived. I believe the implicit definition can be enunciated with the equivalence "body = matter." Is it sufficient?

A useful and theoretically telling definition of body is found in a text dating precisely from the fourth century BC. The text I am referring to is not much read by contemporary cognitivists for two reasons: (1) the translations are often not particularly alluring from the cognitivist point of view; (2) whoever in the first century after Christ gave titles to Aristotle's works entitled that text *De anima.* If one reads the text carefully one easily realizes that the appropriate title would be *De corpore.* The essay deals precisely with bodies.

2 I will begin with the definition of body that is given in the essay in question: *tò dè sóma tò dunámei on* (*DA*, 413a 2). The standard translation is as follows: "The body is what it is potentially." Literal translations, clearer in relation to our problem, are the following: "The body is what it is able to do" or, even better, "The body is a set of specific capacities." Some examples can help us to understand. The saw and the screwdriver or the car and the aeroplane are four material bodies. However, if we go beyond generic bodily materiality and we want to distinguish the saw from the screwdriver or the car from the aeroplane we have to say that saw and screwdriver or car and aeroplane are bodies with spheres of specific actions: the saw cuts, the screwdriver screws; the car moves on the road, the aeroplane flies. Or, if I have to put a nail in a wall, I do not use either a screwdriver or a saw, and even less an aeroplane.

We can re-phrase the Aristotelian definition in this way: *A body is constitutively tied to specific actions and deeds,* or, an equivalent formulation, *A body is defined by a set, infinite and closed, of operational capacities.*

Aristotle calls the set of operational capacities the *psuché*, 'soul', of that body. On the subject he gives didactically very effective examples. I will quote just one of them.

> Thus, if any of the tools, for instance the axe, were a natural body, its substance would be a function of the uses of the axe and this would be the soul; if it were separated from it, the axe would only exist by homonymy (412b 10–15).

Let us move on to the definition of *psuché*-soul*:*

> A definition common to every kind of soul is: *entelécheia he próte sómatos phusikoû organikoû* (DA, 412b 4–6).

I have deliberately left the definition in Greek. It is easy to find translations like the following:

The soul is:

the first actuality of a natural body possessed of organs (D. W. Hamlyn, Loeb Classical Library);
la réalisation première d'un corps naturel pourvu d'organes (Bodéüs, Flammarion);
l'entélechie d'un corps (Barbotin, Les Belles Lettres);
entelechia prima di un corpo naturale munito di organi (R. Laurenti, Laterza);
l'atto primo di un corpo naturale dotato di organi (G. Movia, Rusconi).

I do not believe that the problems of cognitivists can derive advantages or suggestions from them. Let us dwell on the word *entelécheia*, which for us is a technical term but was not one for a Greek speaker in the fourth century BC.

Entelécheia is a contraction of the expression *en télos échein*, which literally means "having one's own reality in the goal to reach." *Entelécheia* of a body is precisely the activity of the body directed toward the goal inscribed in the body's natural equipment. The literal translation of the Aristotelian definition is:

> The soul is the *principal activity inscribed in the constitutive equipment of a natural body endowed with organs* (DA, 412b 4–6).

For further clarification I will quote a very effective example of *psuché*-soul given in this original treatise of cognitive science from the fourth century BC:

> *If the eye were an animal, its soul would be sight: this is the substance [ousía] of the eye in relation to its definition.* The eye is the matter of sight: when it is lost the eye does not exist anymore except by homonymy as in the case of the stone or drawn eye. (. . .) The soul is activity directed to a goal [*entelécheia*] as sight is the ability of the organ-tool [*he dúnamis tou orgánou*]: *the body is what it is able to do [ò dè sóma tò dunámei on]. As the eye is pupil and sight so the animal is soul and body* (*DA*, 412b 18 – 413a 3).

The action of bodies, called *psuché*, is the defining trait of bodies. I will also highlight this other passage:

> Since every organ-tool exists in relation to a goal, every part of the body also exists in relation to a goal and *the goal is determined action*, it is clear that the body as a whole [*ò súnolon sóma*] exists in relation to composite action [*práxeos tinos éneka polumeroûs*]. In effect it is not the sawing that exists in relation to the saw, but it is the saw that exists in relation to sawing: sawing is a determined use <of the saw>. *Thus the body exists in a certain way in relation to the soul and each of its parts in relation to the tasks that it has to perform by its nature* (DPA, 645b 14–20).

We can draw the following conclusion: (1) where there is a soul, that is to say action tending toward a purpose, there cannot not be a body; (2) where there is a body there is also a soul, that is to say possible action tending toward a purpose. No body without a soul, no soul without a body.

3 All bodies, in that they are connected to possible actions, have a soul (*psuché*). The cognitive scientist of the fourth century BC does not stop here. He formulates the logical rule that governs the relationship between the body and its soul, that is to say its set of possible actions. For the time being I will give the name of the rule in Greek because the translation decides its correct meaning: *anágke ex hupothéseos.*

I will give its operational definition with Aristotle's words: "if this is to be the goal, these other things will necessarily have to come true" (DPA, 642a 33–34).

Hence "it seems that all the modes of the soul [*tà tês psuchês páthe*] go together with an <adequate> body [*metà sómatos*]" (DA 403a 16–17). Examples: if the task to be carried out (the goal) is to put in a screw, the suitable body cannot be a hammer or a saw; if the action to be performed is flying, the suitable body cannot be that of a snake or a giraffe. Aristotle's example:

> If it is required to break something with an axe, then it necessarily has to be hard and, if it is hard, it has to be made of either bronze or iron. Likewise, if the body is a tool (that is to say, every part of it and their totality are related to a goal) it is necessary, at least if it has to be that determined tool, that it be made that way and formed by those parts (DPA, 642a 9–13).

The translation of the Greek formula *anágke ex hupothéseos* with *conditional necessity* and, even worse, *hypothetical necessity* or *necessity by hypothesis*, does not correctly render Aristotle's thought. The translation most faithful to Aristotle's thought and also most useful for contemporary cognitivism is "necessity conditioned by the natural goal inscribed in the material conformation of the body." The rule sets up a strong correlation between *psuché*-soul and body: bodies are not freely exchangeable and souls (uses) do not freely transmigrate from one body to another.

> The correct opinion is that of those who believe that the soul does not exist without the body nor is a body. In reality it is not identified with the body but it is something that belongs to the body [*sómatos dé ti*]. It exists in a body, and indeed in a body of a determined kind and not as our predecessors believed, who had it enter the body without determining its nature and quality, although it never happens that anything welcomes anything. *And it is reasonable to suppose that this happens because the natural activity [entelécheia] of each thing comes about through its nature in that in which this possibility exists and in the appropriate matter [en te oikéia húle]* (DA, 414a 20–27).

4 If we apply the rule of "necessity conditioned by the goal" (*anágke ex hupothéseos*) to the human animal we find ourselves within a scientific paradigm that is neither dualistic nor monistic. It is simply Aristotelian:

> If man is this then these other things are required; and if these, also this other [*ei ánthropos todí, tadí; ei tadí, tadí*] (*Phys.* 200b 3–4).

> If thinking is a type of representation [*phantasía tis*] and at any rate does not exist without a representation, then thinking too is not possible without an <adequate> body (*DA* 403a 8–10).

Logos, that is to say the capacity to speak and to think with words, is the activity that distinguishes humans from other animals. *Logos* is therefore the *psuché*-soul that belongs to human animals. It necessarily requires an adequate body. Whole pages of *De anima* and *De partibus animalium* are devoted to minute description of the somatic features that are essential for a body to speak and think with words: lungs, movable tongue, fleshy and damp lips, and nose are the necessary conditions for an articulated voice to be produced in *grámmata* without which *logos* could not exist.[1]

[1] For further details see Lo Piparo, *Aristotele e il linguaggio*, Laterza 2011 (1st ed. 2003).

Historia animalium and *De partibus animaliums* are works that would now be defined zoo-cognitive. In them the relationship between bodies of animals and actions that the respective bodies can perform is studied with the rule of necessity conditioned by the goal (*anágke ex hupothéseos*).

5 Our cognitivist scientist of the fourth century BC faces two central issues for a cognitive science: (1) when a body is an animal; (2) in what the human body is distinguished from the bodies of other animals. Let us see.

According to Aristotle, an animal is distinguished from other bodies, living (like plants) and not living (like stones or machines), by the simultaneous presence of three types of activity that are different from one another but inseparable: (1) *aísthesis* ("sensation"); (2) *órexis* ("desire") or *epithumía* ("appetite", "wish", "lust", "instinct"); (3) *phantasía* ("imagination" or "mental representation": I will use these two terms as synonyms).

Aísthesis is the basic activity without which animality would not exist. "It is necessary for *aísthesis* to belong to animals, insofar as each one is an animal, since on this basis we define what the animal is distinguishing it from what is not an animal" (*DSS* 436b 10–12). Hence "animality and sensation are simultaneously formed" (*Cat.* 8a 7–8) and "plants do not have any sensation" (*DA* 435b 1).

It is necessary to give the correct meaning to the term *aísthesis.* Sensation, in Aristotelian philosophy, is not only a cognitive device for recognition of stimuli coming from the external world. If it were so, we would also have to attribute the ability to feel to the thermostat and, all the more, to any robot. "Sensation" for Aristotle means feeling first of all pleasure and pain: "where there is *aísthesis* there is also pleasure and pain" (*DA* 414b 4). Animals relate to the world through the filter of pleasure and pain. If this point is neglected one cannot appreciate the fineness and the innovativeness, in relation to post-Aristotelian intellectualism erroneously attributed to Aristotle, of the Aristotelian theory of perception and animal conscience.

I will give an example. For an animal to have the sensation of water does not only involve having the ability to recognize, among so many different elements, water and therefore to know how to distinguish it, for instance, from land or oil. Animal *aísthesis* of water is indissolubly associated with the feeling of pleasure that drinking water gives when that animal has been thirsty and the feeling of pain when it is thirsty and none is available.

Pleasure and pain are therefore the matrix of animality and *aísthesis* is simultaneously cognitive and affective activity. This is the starting point of a theoretical edifice that awaits reconstruction in its complexity and in its post-modern fascination. I will briefly mention a few aspects of it.

From the fact that animality relates to the world through the filter of pleasure and pain Aristotle draws a consequence that takes us a long way: the sensory apparatus of all animals, human and nonhuman, is indissolubly interwoven with desire. "If the animal is endowed with *aísthesis* it is also an animal that desires (*orektikón*) (. . .); where there is *aísthesis* there is also pleasure and pain and where there is pleasure and pain there is also an appetite [*epithumía*] since desire [*órexis*] is desire for the pleasant" (*DA* 414b 1–6).

This is another crucial passage. Let us stay with the example of sensation and/or perception (we will see that it is better not to treat the two terms as synonyms) of water. There is a difference between recognizing water as a natural kind that possesses particular physical-chemical characteristics (this is able to make it an automaton constructed by man) and desiring water as something that can assuage or suppress the pain of thirst. Water as a chemical substance and water that, as a source of pleasure, is also an object of desire are not ontologically coincident objects. Water's *aísthesis*, in the Aristotelian perspective, is first of the sensation of something that satisfies the desire to drink.

This is a first fundamental difference between the cognition of animals and that of intelligent machines: the former has a desire for and sensation of pleasure and pain as its bio-chemical basis; the latter only has intellectual intercourse with the world. The surprises do not end here.

The sensation of pleasure and pain cannot exhaustively explain the way in which desire is produced and acts. The initial somato-affective-cognitive cell of animality has to include another element which is equally fundamental. For desire to exist it is necessary for the animal that desires to be able to represent the goal that it desires to reach and by which it expects its desire to be satisfied: "an animal cannot desire without imagination or mental representation [*áneu phantasías*]" (*DA*, 433b 28–29). The natural grammar of desire therefore involves transformation of sensation into imagination: the *aísthesis* of pleasure and pain is simultaneously representation (*phantasía*) of something that is desired (as a source of pleasure) or which it runs away from (as a source of pain). This sets sensation and imagination in a continuous line: "the imagined objects [*phantásmata*] are as like those that are perceived and felt [*aisthémata*], except for the fact that they are matterless" (*DA* 432a 9–10).

Imagination [*phantasía*], having the same matrix as sensation and desire, is a sensation of what is absent and that is either desired as a source of pleasure or feared as a source of pain. With it the confines of the world are extended beyond the world immediately perceived. Complex psychic activity like remembering, hallucinating (perceiving as real what is only imagined) and dreaming find their affective-cognitive root here.

Memory. "It is evident that memory (*mnéme*) is proper to that part of the soul to which *phantasia* also belongs" (*DMR* 450a 22–23) and, therefore, "<all> animals different <from man> live with mental images and memories" (*Met.* 980b 25–26). And again: "Since feeling pleasure is a modality of sensation and *phantasia* is a weak sensation [*aísthesis tis asthenés*], remembering and hoping are always accompanied by the *phantasia* of what is remembered and what is hoped for" (*Rhet.*, 1370a 27–30). The primitive cell of animality is therefore endowed by its natural constitution with memory. Where there is an animal body there is also memory.

Hallucinations. The bio-cognitive continuity of perceptive contents (*aisthémata*) and of imagined ones (*phantásmata*) is the source of the driving force of hallucinations. "Because of the fact that *mental images* persist and are similar to sensations, animals perform many actions in relation to mental images: some because they do not have *noûs* [mind endowed with logos] and this is the case of nonhuman animals; others because their *noûs* is obscured at times by illness or sleep, and this is the case of men" (*DA* 429a 4–8).

Dreams. Since "the dream is a particular type of sense-impression (*aísthema trópon tinà*)" (*DSV* 456a 26), all animals, in that they are endowed with sensoriality, have dreams. Dreaming is affective-cognitive activity produced during sleep by the dynamics of sensitive faculty: "the dream is the mental image produced by the movement of sense-impressions (*apò tes kinéseos ton aistemáton*) when a person sleeps, because he or she sleeps" (*DI* 462a 29–31). "Since the part of the soul that imagines (*phantastikón*) is the same as the sensitive faculty (*aisthetikón*), although the imaginative and sensitive are different in essence, and since imagination is movement produced by the activity of the sensitive faculty and the dream appears to be a particular type of image (*phántasma*) (indeed we call 'dream' the mental image (*phántasma*) <produced> during sleep, whether it is produced in an absolute sense or in a determined way), it is clear that *dreaming is a modality of the sensitive faculty as able to imagine* (*DI*, 459a 16–22).

6 Sensation of pleasure and pain (*aíshesis*), desire (*órexis*), and imagination (*phantasía*) form the minimal architecture of the animal bodies. A body so structured cannot not be self-aware. This is another discovery of our cognitivist from the fourth century BC.

Let us reflect on the psychic laws governing the sensation of pleasure or pain focusing on the following propositions:

I feel great pleasure but I do not know it
I have a bad toothache but I do not know it.

These are propositions that clearly describe impossible situations since feeling pleasure and pain is nothing but awareness of one's pleasure and pain. Unwitting pleasure and pain are contradictory realities and therefore impossible. There are no pleasures and pains to which awareness *is added*: pleasures and pains are themselves forms of awareness. The *aísthesis* of pleasure and pain is therefore the embryonic modality of consciousness: "they [the living] because of the fact that they feel or can feel <pleasure and pain> know they live and are" (*DGC*, 318b 24–25).

This is the reason why it is preferable not to translate *aísthesis* as "perception". This is the case of the thermostat that *perceives* the temperature of an environment and operates a switch or the robot that knows how to distinguish water perceptively from other chemical substances. These are all perceptions not accompanied by awareness and without any affective involvement. Contemporary neurosciences have also identified the presence of unwitting and non-affective perception in humans. This happens in so-called *blindsight*. This is what happens: subjects with damage to the visual brain cortex, though saying they do not see a given phenomenon, if asked to try to guess the place in which the phenomenon takes place give the correct answer. I will further point out that humans are also able, in particular conditions, to have perceptions unwittingly. Some scholars[2] call *sensation* conscious perception loaded with affectivity and reserve the term *perception* for intellectual and non-affective exploration of the world.

7 Aristotle's *aísthesis* is the dawning emergence of self-awareness and affectivity. It is therefore not assimilable to intellectualistic perception. On this aspect Aristotelian analyses leave no room for doubt.

Not only pleasure and pain but all sensoriality, according to Aristotle, is constitutively self-aware. Sensations are by definition *sensations-that-feel-themselves-perceiving-objects*. "One who sees perceives-feels that he sees, one who hears perceives-feels that he hears, one who walks perceives-feels that he walks and likewise for other activities there is perception-feeling of the fact that we are in activity and therefore we feel we feel and think we think" (EN 1170a 29–32). *Aísthesis* could be defined as *perception-of-the-perception-of-an-object.* "A common faculty also exists that lives with all the sensations and by which the fact that we see and we hear is perceived" (DSV, 455a 15–17).

In *De anima* Aristotle wonders whether, to explain the phenomenon of "perceiving that we perceive", it is necessary to postulate different sense organs from those that perceive objects, or *perception of the object* and *perception of the perception of the object* are to be considered co-present aspects of a unitary complex phenomenon. The second solution is the one considered more satisfactory.

> Since we perceive that we see and hear, it is necessary for perceiving that we see takes place either by sight or by another sense. But <in the latter case> the same sense will perceive both sight and the colour that is the object of sight. Therefore either there will be two senses that perceive the same object[3] or the sight perceives itself. Further, if the sense that perceives sight were different from sight either an endless process is triggered or a sense must perceive itself: so we may as well attribute this ability to the former (*DA* 425b 12–17).

Perceiving-perceiving (or perhaps more correctly feeling-that-we-feel) is the embryonic form of self-awareness. All animals, not only human ones, are endowed with it. In *Aristotele e il linguaggio*,[4] on the model of the notion of epi-language worked out by the French linguist Antoine Culioli,[5] I suggest applying the term *epi-feeling* or *epi-perception* to perceiving-perceiving-something and *epi-cognitivity* to the implicit and unreflective meta-knowledge present in every form of operational knowledge. Epi-feeling is the first form with which there is manifested awareness of being-in-the-world of animal bodies.

[2]For instance, N. Humphrey, *Seeing Red. A Study in Consciousness*, 2006.

[3]The two different senses that would come to perceive the same object would be: (1) the sense that directly perceives the object; (2) the sense that, inasmuch as it perceives the sense-that-perceives-the-object, also indirectly perceives the object.

[4]*Op. cit*.

[5]"Le langage est une activité qui suppose, elle-même, une perpétuelle activité épilinguistique (définie comme 'activité métalinguistique non consciente')." A Culioli, *La formalisation en linguistique*, "Cahiers pour l'Analyse", 9, pp. 108–17.

8 Where can we place the specificity of the human animal body? We know the answer: in *logos*, that is to say in thinking and in being in the world with words.

> Are there perhaps functions and actions [*erga tinà kai práxeis*] proper to the carpenter and the cobbler, while there is no action proper to man? Was man perhaps born without any specific natural function [*argòn péphuken*]? Or, just as there is, patently, a specific function of the eye, of the hand, of the foot and generally of every part of the body, so have we also to admit that a specific function [*érgon ti*] exists of man in addition to all these? So what could this function ever be? Indeed, it is apparent that living is also common to plants, while here we are looking for what is species-specific [*ídion*] to man. So we have to exclude life reduced to feeding and growth. There would follow the life of the senses, but it is, manifestly, also common to the horse, the ox and every other animal. *There remains life seen as that determined and specific action proper <to the animal> that has language: both in the sense that it allows itself to be persuaded with language and in the sense that it has language and reasons. (...). The species-specificity [érgon] of the human soul is activity in relation to language and at any rate not without language. (...) Let us set as the species-specific function [érgon] of man a determined life, that is to say the activity of the soul and the actions that are performed with the contribution of language [metà lógou]* (*EN* 1097b 28 – 1098a 14).[6]

Logos, though it only belongs to the human animal ("nature does nothing without a purpose and man is the only animal that has *logos*" – *Pol.* 1253a), is rooted in the initial cell of animality formed by the interlacement of *aísthesis*, *órexis* and *phantasia.* The fundamental traits of the continuity and discontinuity between human and nonhuman animality are expounded in a very often quoted, and not always well translated, page of Book One of *Politics.* I propose to reread it leaving in Greek all occurrences of the word *aísthesis:*

> The reason is clear why man is a political animal [*politikón*] more than any bee or any animal that has a group life. The fact is nature does nothing without a purpose and man is the only animal that has language [*logos*]. The <inarticulate> voice is a sign of pain and pleasure and this is the reason why it is found in other animals. Indeed, their nature attains this point: having *aísthesis* of pain and pleasure and reciprocally signalling it to one another. Instead, language [*logos*] has as its end expressing what is useful and what is harmful and accordingly what is just and what is unjust. This happens because, in comparison to the other animals, it is a specific characteristic of man to have, he alone, *aísthesis* of good and evil, of the just and the unjust, and of yet other <qualities>: the mutual commonalty-communication [*koinonía*] of these qualities forms the family and the city. (1253a 9–18).

The human animal accesses "good and evil, the just and the unjust and yet other qualities" through *aísthesis*, that is to say through a modality that also involves affective involvement. Between the *aísthesis* of pleasure and pain, shared by the whole animal world, and the purely human *aísthesis* of good and evil, of the just and the unjust, there is an evident difference but also a continuity: both are ways, simultaneously affective and cognitive, of being-in-the-world. "Those people who at once feel (*sunaisthanómenoi*) what is well for themselves derive pleasure from it (*édontai*)" (*EN* 1170b 4–5). The common term used in the two cases, *aísthesis,*

[6]The translation is mine. It does not always correspond to other available translations. In *Aristotele e il linguaggio* I explain the reasons for this.

obscured by many translations,[7] is the sign of the theoretical paradigm within which Aristotle develops his reflections on the manifold articulations of the animal conscience.

The common aesthetic matrix of feeling-perceiving and thinking in and with *logos* is highlighted in various places in the natural history works. In some passages in *De anima*, the reasoning activity of the human animal is described, for instance, as a specific and complex form of *aísthesis:* "It seems that thinking (*noeîn*) and understanding (*phroneîn*) is a kind of feeling-perceiving (*aisthánesthai*); in both, indeed, the soul discriminates (*krínei*) and knows (*gnorízei*) some of the things that are; besides, the ancients affirm that understanding and feeling-perceiving are the same thing" (*DA*, 427a 19–26). "Thinking (*noeîn*) is like feeling-perceiving (*aisthánesthai*)" (429a 13–14).

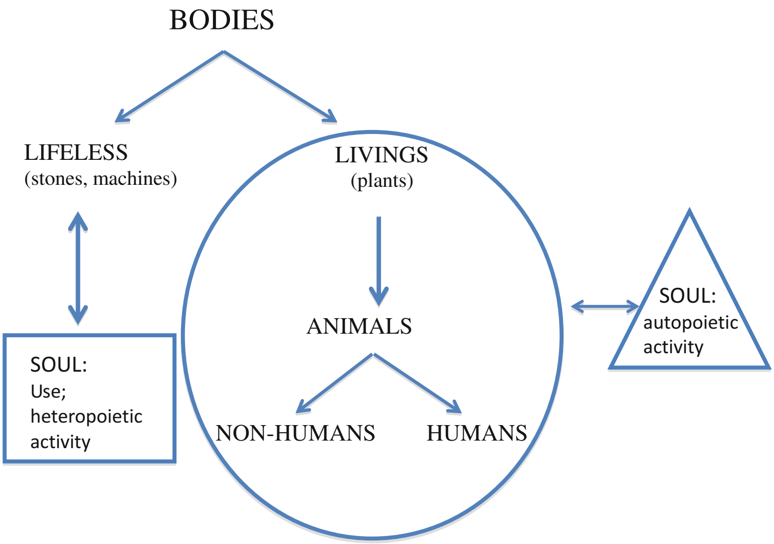
With the appearance of *logos*, *aísthesis* in some way becomes linguistic: "<In men> feeling (*aisthánesthai*) is similar to simple saying (*phánai*) and thinking (*noeín*). When <sensation> pursues what is pleasant and flees what is painful it is as if it said yes (*kataphása*) or no (*apophása*): indeed, feeling pleasure or pain is equivalent to acting through sensoriality with reference to good and evil as such" (*DA* 431a 8–12). "What in reasoning (*en dianoía*) saying yes (*katáphasis*) and saying no (*apóphasis)* are, in desire pursuing and running away from <something> are" (*EN* 1139a 21–22). "The drive (*epithumía*) says (*légei*): 'I must drink; feeling (*aísthesis*) or thought (*noûs*) say (*eípen*): 'this is a drink; then it is immediately drunk" (*DMA*, 701a 32–33).

With *logos* we pass from epi-awareness to *meta-awareness*, from operational and unreflective self-awareness to awareness that knows how to make itself an object of reflection. The animal universe becomes much more complex. The greater complexity does not sever all ties with what I have called the somato-affective-cognitive cell without which animality does not exist: the interlacement of *aísthesis*, *órexis* and *phantasía.*

In *Nicomachean Ethics* we find a definition of the human animal that by itself does justice to intellectualistic and ratiocinating interpretations of Aristotelian philosophy: man is simultaneously *desiring mind* (*orektikòs noûs*) and *reasoning desire* (*órexis dianoetiké*). Desire [*órexis, epithumía*] and verbal reasoning [*noûs, diánoia, logos*] are like the concave and convex parts of a curved figure: different in definition but inseparable in kind (1139b 4–5).

9 I will conclude with a graphic representation of my own of the typology of bodies according to Aristotle.

[7] Almost all translations render "*aísthesis* of good and evil, of the just and the unjust" with "*sense or sentiment* of good and evil, of the just and the unjust."


BODIES
LIFELESS
(stones, machines)
LIVINGS
(plants)
ANIMALS
NON-HUMANS
HUMANS
SOUL:
Use;
heteropoietic
activity
SOUL:
autopoietic
activity

Part III
Extended Theory Approaches

Chapter 6
Collective Action in the Wild

Mathew D. McCubbins and Mark Turner

Abstract Twentieth-century dispositions to model human cognition as logical systems have been undermined by evidence from the wild. Formal models of cognition as symbolic, algorithmic, internally consistent, disembodied, and sequentially marching through linear inference are not ecologically valid and are being replaced by pragmatic, usage-based theories, most notably in linguistics. In this article, we argue that game-theoretic models of human collective action must find new foundations, given the evidence that human behavior in experimental settings and in the wild does not conform to theoretical predictions. We propose an alternative, pragmatic theory of decision-making, founded on different conceptions of selves and decisions, conceptions that are consistent with new cognitive neuroscience.

Keywords Decision-making · Game theory · Predictability · Performativity

6.1 Introduction: Generating Predictability

As Engel (2005) argues, human beings are by nature highly flexible and variable, so much so that cultures must invent institutions to generate some predictability in human performance if we are ever going to be able to interact beneficially. Cultures invent institutions for the purpose of creating sufficient regularity and predictability to make collective action possible. In the last 50,000 years or so—an eye-blink in evolutionary time—cultures have invented contracts, classrooms, courts, constitutions, retail counters, certified public accountants, conjugal arrangements, . . . among many others. It is impossible to model collective action unconstrained by cultural institutions.

M. D. McCubbins
Department of Political Science and School of Law, Duke University, Durham, NC, USA

M. Turner (✉)
Case Western Reserve University, Cleveland, OH, USA
e-mail: mark.turner@case.edu

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_6

When we consider actual pragmatic situations of choosing in the wild, outside of the lab, we see design principles that offer clues to the how human beings make ecologically valid decisions. The *restaurant*, for example, as an Engelian cultural institution, is a showcase of strategies for generating predictability.

1. **The type of restaurant is a constraint.** Most restaurants are unable to produce smooth collective action between the owners and the customers by saying, “Tell us what you want, and we will tell you whether we will make it for you.” Indeed, the restaurant may be capable of making almost anything you can imagine; but instead it imposes a severe constraint on customer choices by its name, style, design, and many other markers.
2. **The menu is a constraint.** In addition, the menu strongly constrains customer choices further. If human beings were not so amazingly flexible in the moment, there would be no need for this heavy structure of constraints.
3. **The menu creates a pragmatic situation for the momentary choosing of a self.** The menu constrains the customer by proposing a limited number of possible selves. For example, the customer may not have thought about having something “light.” But the menu will say, “For those who want something light.” The customer now asks, “Am I someone who wants something light?” and constructs a self and a choice in response.
4. **The dessert cart creates a situation of presenting a self.** The restaurant has designed many presentations so as to obviate the need by either managers or customers to know or think about the customers’ preferences or the ranking of those preferences. The purpose of rolling out the dessert cart is to put people into an immediate moment of being somebody: you are here now, and you can point at any of these, or dismiss the cart.
5. **Corkage provides just the right amount of flexibility and is part of the menu.** The menu will prompt for selves, but sometimes the customer must have even more flexibility. Accordingly, you can often bring your own beverage to the table. The restaurant here gives up on an equilibrium of choosing from the menu and allows the flexible person to add idiosyncratically to the menu for a fee. This flexibility for the customer does not increase the burden on the restaurant. It is an easy addition: the only thing the customer can bring is a standard-size bottle, and the only thing the restaurant must do is uncork it for a standard price.
6. **Proposing possible selves in the restaurant.** When you come to the bar table, there might be a little standup card with a couple drinking cold beer, or a caipirinha. You are finding your way to action, and to do so must precipitate a concept of self in some kind of standard cultural story. You are not the people on the card, and not a photograph, either, but can imagine such people, who are probably fictional, and you can blend those with yourself, and review the possibility thereby activated. Perhaps you say, “I’ll have that,” or, “well, not a beer, but how about a cold Bombay Sapphire gin with Thomas Henry tonic and a slice of lime? Plenty of ice.” Restaurants, among other places, often specialize in trying to put people finding their way into moments where a self in a story will precipitate.

7. **Delegates in the restaurant.** There is a kind of agent in such situations to whom one delegates without even being specific about the delegation. For example, a bartender or a mother can be such an agent. The bar itself is a kind of dessert cart: you see what is on offer. The bartender can remember the armagnac you had 3 weeks ago and present that bottle to you again. The bartender is an institutional agent for making collective action possible in an environment where there are many possible selves available to the customer. Delegation does not require either the restaurant or the customer to consider the customer's complete and ranked list of preferences before the moment of choice.
8. **The vegetable dish case.** Consider a restaurant that has a case presenting the day's cooked vegetable dishes. Patrons do not need to walk up to the case, but they may. If they do, perhaps the dining room manager gives a quick description of each, watching for responses, and modifies the conversation accordingly. Suppose the diners do not respond, and keep looking at this and that. Then the dining room manager might propose a sampler for two, which is not on the menu, of everything, as a starter. Perhaps the customer proposes a sampler for two of everything except one of the particular dishes in the case. People looking at the vegetable dish case are inventing possible choice moments, and negotiating. The result can be a quick consensus on collective action.
9. **The food court.** The food court puts customers into immediate situations of choosing what self to be. The customer walks past all the foods. Traditionally, restaurants in Greece operated on a similar design. The customer inspected the foods being cooked in the kitchen. The various competing establishments in the food court use all the techniques listed above to conduce the customer in finding a way through the situation.

6.2 The Opposite Approach: Game Theory

Game-theoretic models are used to explain human interactions across a wide range of activities, such as allocation of security forces, allocation of health care services, and the design of political, legal, social, and market institutions (Roth 1990; Kagel and Roth 2016; Fudenberg and Tirole 1991). Despite the widespread use of game-theoretic models to explain human behavior, we often observe behavior—from voting to the divergence of political parties' platforms to market bubbles and crashes—that does not easily accord with game-theoretic predictions (Camerer 2003). Further, it is a common finding that experimental subjects, in tightly controlled settings, do not make choices that comport with Nash equilibrium strategies, or indeed, von Neumann-Morgenstern utility maximization (Plott 1982; Smith 2000).

To begin discussing game theory, we need to define our terms and identify game theory's flaws. A game is defined by identifying the items in PAISPOE:

- **players**;
- **actions** available to players;

- **information** they have about the game; the timing of access to such information; including the knowledge the players have about what other players know or will know and when those other players will know it;
- **strategies** define the action rules that specify what actions to take under every circumstance;
- **payoffs** associated with each outcome;
- **outcomes** which define the consequences of the game;
- and, finally, **equilibria**. A Nash Equilibrium (NE) results when, given players' strategies, no player can do better by changing their strategy while all others remain unchanged. An equilibrium concept defines which strategies are allowed and which are precluded.

Noncooperative games, at least in their classical format, assume that subjects share common knowledge. Classical game theory requires players to have correct and consistent beliefs. To have "correct beliefs" is to regard other players as following NE strategies and to predict that they follow classical equilibrium strategies. Indeed, it is also required that players know that other players know that all players, including themselves, are following NE strategies, and so on, ad infinitum. As Lupia et al. (2010: 106) notes, a Nash Equilibrium (NE) "requires shared conjectures. … Common Nash refinements … continue to require that actors share identical conjectures of other players' strategies." This is part of what economists assume when they accept that the players in a game share "common knowledge." As Smith (2000: 9) writes, "The common knowledge assumption underlies all of game theory and much of economic theory. … Without such common knowledge people would fail to reason their way to the solution arrived at cognitively by the theorist."

Thus, the common knowledge assumption of game theory, of rational human interaction, is unsurprisingly akin to the core belief of many religions. Take, for example, Chinese Buddhism. In Chinese Buddhism, there is a metaphor, central to their philosophy, that is used to describe the interconnectedness of all things, and it is referred to as Indra's Net. Indra's Net belongs to the Vedic deva Indra and it hangs over his palace on Mount Meru. Indra's net has a jewel at each vertex, and each jewel is reflected in all of the other jewels. Cook (1977: p) describes Indra's net thus:

> Far away in the heavenly abode of the great god Indra, there is a wonderful net which has been hung by some cunning artificer in such a manner that it stretches out infinitely in all directions. In accordance with the extravagant tastes of deities, the artificer has hung a single glittering jewel in each "eye" of the net, and since the net itself is infinite in dimension, the jewels are infinite in number. There hang the jewels, glittering "like" stars in the first magnitude, a wonderful sight to behold. If we now arbitrarily select one of these jewels for inspection and look closely at it, we will discover that in its polished surface there are reflected all the other jewels in the net, infinite in number. Not only that, but each of the jewels reflected in this one jewel is also reflecting all the other jewels, so that there is an infinite reflecting process occurring.

Unfortunately, the natural, biological, or cognitive means by which players acquire common knowledge is never specified in game theory. Implicitly, game theory often assumes that, given enough time and effort, all players can learn what behaviors to adopt and when to adopt them. The "New Institutionalism" of Cox (1987), Engel (2005), North (1990), North and Thomas (1973), North et al. (2009), among others, argues that societies will adopt rules, laws, or norms to restrict and channel behavior to more efficient forms. Prior work on subjects' beliefs in experimental settings suggests that subjects possess non-equilibrium beliefs (Croson 2007), and that, in at least some settings, their behavior can be reasonable, given their beliefs, although this is not always true (McCubbins and Turner 2012), to restrict and channel behavior to more efficient forms.

Because game theory mispredicts decision-making in both laboratories and the markets, behavioral game theory has been established to provide modifications to the theory. The main approach of behavioral game theory has been to propose systematic deviations from the predictions of rationality made by classical game theory, deviations that purportedly arise from, for example, character type, cognitive overloads or other reasoning, constraints and conditions of memory, or informational limitations. The fundamental idea of behavioral game theory is that, if we know the deviations, then we can correct our predictions accordingly, and so get it right. Indeed, if we know these deviations, we can anticipate them and we can nudge people to act more in accord with the equilibrium predictions of classical game theory, as modified by behavioral game theory (Thaler and Sunstein 2008).

There are two problems with this approach, however, and each is fatal. (1) For the chooser to contemplate the range of possible deviations actually makes it exponentially harder for the chooser to figure out a path to an equilibrium, since there are many dozens of possible deviations. This array of possible deviations makes the theoretical models useless for modeling human thought or human behavior in general. (2) Modeling deviations is helpful only if the deviations are *consistent*, so that scientists (and indeed decision-makers) can make predictions about future choices on the basis of past choices. They must be able to generalize from the particular deviation. But as we have shown, the deviations are not consistent (Lucas et al. 2015). In general, deviations from classical models are not consistent for any individual from one task to the next or between individuals for the same task (McCubbins et al. 2012). In addition, people's beliefs are in general not consistent with their choices (McCubbins and Turner 2014). Accordingly, there is no way forward to creating a general behavioral game theory.

6.3 Building a New Rationality from the New Cognitive Neuroscience

To address the discrepancy between predicted and actual behavior, we must build a better theory of human behavior. To do this we must start with an appreciation for how we actually reason. As cognitive science has shown, intuitive notions of how the mind works (vision, language, memory, etc.) may be very useful for humans to hold as scaffolding for consciousness, but they are comprehensively wrong and simplistic. Intuitive notions of how we reason are not a basis for cognitive science. How we reason must be discovered, not assumed, and certainly not borrowed from intuition.

The first step in designing a new model of human choice is to determine why game theory failed. The failure of game theory derives from its mistaken theory of mind. In this theory of mind,

- People have unitary selves and fixed preferences about outcomes
- People think about hypothetical paths that lead to outcomes
- People have cognitive models about other people, including that
  - those other people have unitary selves and consistent preferences about outcomes
  - those other people think about hypothetical paths that lead to outcomes
  - those other people have cognitive models about other people
- an actor considers everyone's fixed preferences (to the extent that they are known), the choices available to each actor at each moment in the rest of the decision tree, the information known to each actor at each moment, and the ultimate payoffs to the actors of ending up at each of the specific possible final outcomes.
- an actor chooses, at a moment of decision, the available choice that can lead rationally to the expected best outcome available for the actor. "Rationally" in this picture means not only that the actor will choose in this way but also that the actor understands that the other actors will choose in this way.
- Accordingly, actors make choices by backward induction, looking ahead to the final outcomes, and making choices at each node along the way so as to create a path to the expected best outcome for the actor at the end. In this picture, an actor's self is fixed throughout the course of complicated action, however many moments of choice are required, and indeed fixed across all games.

6.3.1 Flexibility and Blending

In contrast, the world's cultures have unhesitatingly recognized human flexibility. Even conditioned and trained humans in utterly confining conditions do not conform reliably to expectations of fixity. To succeed at all, game theory must control the activity of actors by imposing extreme, artificial constraints—as in chess, tic-tac-toe, or common-value auctions. A thorough theory of human decision-making will subsume game theory as a limiting case. The reverse subsumption is impossible, because modeling the vast majority of human choosing requires eliminating the constraints on flexibility imposed by game theory.

If the self is not fixed, how do we model choice by a self? Turner (2014, chapter 4), proposes that momentary selves at times of action are assembled via *conceptual blending*. Conceptual blending occurs when various input ideas, often starkly conflicted, are selectively combined to an idea not identical to any of the inputs, often with emergent structure. Such conceptual blending networks arise across all conceptual domains. The blend is a “mental space” in a conceptual network of many such mental spaces, and helps to manage that conceptual network. For example, consider Bill and Peter, brothers-in-law, each happy. Bill is a mathematically-talented professor in the Eastern time zone who likes investing and San Francisco. Peter is a stockbroker in San Francisco. Bill wonders, analogically, should he move to San Francisco and be a stockbroker and get a huge raise? No: Bill is a night owl but Peter must arise at 5:30 am Pacific Time to deal with the stock market’s opening at 9:30 am Eastern Time. Mentally, Bill has created a new, blended person—Bill-as-Peter, who is miserable, even though misery is not in any of the inputs. This kind of blending, depending on what is active in the mind as an input, what is selectively projected to the blend, and what new structure arises in the blend, is standard for human beings despite its utter incompatibility with the conception of selves in game theory.

Possible inputs to a conceptual blend are very many, including memories of previous selves, ideas of other people’s selves, ideas of selves which we encountered through reports, news, books, fiction, songs, movies, fairytales, or generic conceptions of character. Activation of ideas is highly variable in the brain; the potential inputs vary moment-to-moment. Projection to the blend is highly selective. Quite variable ranges of emergent meaning can develop in the blend.

There are analogies and disanalogies across all the different selves one has been, in reality or imagination. In constructing a self by blending, one may select some inputs and compress the analogies connecting them to an *identity* in the blend, and compress the disanalogies into *change* for that identity. For example, there are astonishing disanalogies between a person before marrying and the “identical” person after marrying. The analogies are compressed to an *identity*—the person—and the disanalogies are compressed to change for that identity: Mary *became* a wife. This common compression pattern—analogies to identity, disanalogies to change—is extremely common in mental blending. It is the same pattern we use for “dinosaurs turned into birds,” “the fences get taller as you drive West across the United States,” and “His girlfriend gets younger every year.” The resulting blend of a stable self is a useful illusion. Fauconnier and Turner (2002) explore constraints on blending and argue that nearly all attempts at blending take place outside of consciousness and fail almost immediately. Very few survive to be embraced by a community.

Adam Smith masterfully analyzed the creation of variable selves through blending (Turner 2014). Yet classical economics now pays no attention to the role of the dynamic and highly variable construction of a self over time. This failing is at the root of game theory’s mistaken view of mind.

6.3.2 Selves and Choices in Wayfinding

A person in a moment needs a self that serves to make choices, but not the straight-jacket internal consistency assumed by game theory. For example, take two people, Persons A and B, who encounter each other. Each needs to adopt a self in the moment of encounter, but there might be many serviceable selves to draw upon, and the brain may be imagining and simulating many of those, possibly incompatible, alternatives simultaneously. For action to precipitate, however, one self will have to take precedence in the moment of action, but that does not indicate that the brain was bent exclusively on that approach. It means only that one self precipitates to serve the moment of action. A different precipitation might occur in the same circumstances next time. A human being about to act needs a sense of a stable self, one that will make a choice leading to the next choice point, where the self will be different but not randomly so. Stability is important; uniqueness, stasis, and rigidity are not.

Suppose that a small group of colleagues at a conference, ignorant of the town, meet and decide to go out. Each participant needs to know how to choose at any given choice point. The chooser needs a wayfinding marker: "You Are Here Now." Or perhaps several such markers, only one to precipitate at each moment of choice. The chooser needs to be a wayfinder in this scene. The chooser does not need to try to model this as a game.

Choosers are wayfinders. At each choice point, the self may differ, in a different story. The possibility space of these alternative selves in stories is large. All that is needed is for one self to precipitate for each choice.

6.3.3 Selves and Choices in Cognitive Neuroscience

The view of people as wayfinders, imaginative manufacturers of multiple selves in multiple stories, seems to be compatible with the view of human mental operation that is emerging from recent advances in cognitive neuroscience. The field of cognitive neuroscience is in its infancy, and the current view is speculative, but it presents a number of new perspectives that support a shift to a different framework for studying human decision-making.

6.3.3.1 The Brain's Dark Energy

What is the brain doing? It turns out that the old view of the brain as driven by tasks prompted by external stimuli seems to have been a major overstatement. Most of the brain's work is intrinsic. When human beings are engaged in no tasks at all, the brain is nonetheless highly active. Many brain networks are now recognized as being highly active in such conditions, and what might be involved in such activity is quite unclear and debated within cognitive neuroscience. Cognitive neuroscience now routinely searches for discoveries about the purpose of this brain activity. One of the main proposals is that the brain is largely engaged in composing matrices of stories and selves. As Michael Anderson (2014) writes:

> Over the past few years there has been growing interest in something called "resting state functional MRI," a technique for seeing what your brain is doing when you aren't doing much of anything at all. It turns out that brains at rest are pretty restless, consuming far more energy than they do when doing. More interesting, "resting" activity is not random but highly coherent, consistent, and predictable. The discovery of the brain's characteristic resting behavior led some years ago to the postulation of a "default network" for the brain—a set of regions that consistently cooperate to do ... well, what, exactly, we don't know. But surely it must be something interesting. Your brain would hardly waste all of that energy dancing to the beat of its inner drummer if it didn't serve some function, right?
>
> Our ignorance regarding the function of all that fluctuation isn't for lack of trying. The discovery of the brain's default network has led to hundreds of studies relating the default network to the brain's anatomical structure as well as to mood disorders such as depression, developmental problems such as autism, and degenerative diseases such as Alzheimer's. It has even been suggested that resting-state activity holds the key (cue deep voice and echo effect) to understanding consciousness itself (e.g., Raichle 2010). Now, when neuroscientists start brandishing the "c" word, there are two predictable reactions: increased public interest and attention and increased scientific scrutiny and criticism. Both have happened here, generating a cadre of enthusiastic adherents and an equally committed group of critics who question whether we should continue wasting our energy figuring out why the brain appears to be wasting its energy. Or, as one prominent neuroscientist put it to me recently, "It's just such a fad. I kind of hate it."
>
> Hyperbolic allusions to cracking the mystery of consciousness excepted, I don't think anybody should hate it. But to see why we should if not love then at least care about the brain's intrinsic activity requires us to think about brain function in a new and unfamiliar way. (113)

In earlier notions of the computational brain, it was easy to view brains as having programming that remained fixed and that responded to external stimuli by taking inputs and computing an action. The fit between the theory of the computational brain and theory of games was pat: the chooser has preferences and rationality and, given knowledge of external circumstances, computes a choice and enacts it. But today's view of embodied neurobiology is much more compatible with the proposal that action is driven largely by intrinsic and imaginative construction of selves and stories in a process of wayfinding through life.

6.3.3.2 The Brain as an Imagination Engine for Selves and Stories

The Neuron Doctrine was compatible with a computational view of the brain as producing 1s and 0s in response to input, much the way a theoretical Turing machine operates by receiving input—one symbol on a tape at a time—and changing the static state of the machine according to algorithms for responding to the symbol. But recent work paints a picture of a brain engaged in largely intrinsic work, often connected to constructing selves and narratives. As (Kaplan et al. 2016) write,

> In attempting to characterize the kind of psychological operations that appear to engage this [i.e. the default] network, researchers have described them as related to social cognition (Mars et al. 2012), internally directed processing (Immordino-Yang et al. 2012), mental time travel (Ostby et al. 2012), or self-related processing (Qin and Northoff 2011). Interestingly, all of these operations are either involved in the processing of narratives or rely on a narrative organization of information. For example, the majority of studies that have shown cortical midline activations for self-related processing have focused on aspects of the autobiographical self such as personality trait judgment, rather than transient present-moment aspects of the self (Northoff et al. 2006). The autobiographical self is, in essence, a process of generating fragmentary narratives of our personal lives built from a multitude of recorded experiences (Damasio 1998). These same midline structures are activated just as much or more when we think about the biographies of other people (Araujo et al. 2013, 2014), suggesting that the processing of narratives may be more important for activating these structures than self-relatedness. (page 5)

6.3.3.3 The Search for Neuroscientifically Relevant Human Psychological Factors (NRPs)

We are in a period in which cognitive neuroscience is reconsidering from scratch what might be the "neuroscientifically relevant human psychological factors." Common, back-of-the-envelope notions of the mind as a system of passive perception, active response, fear, greed, desire, executive function, inference, memory, etc., may have been an unfortunate place for psychology and economics to begin. (See Anderson 2014 for a review.) A view of higher-order human cognition as largely intrinsic and constantly blending even strongly incompatible inputs in imaginative ways to produce innovations—in selves, stories, and possibilities—was largely unavailable in these common notions of folk psychology. Even less available was an idea of mental activity as generating simultaneously very many of these blending networks, in parallel, often with strong conflicts between them, and of action—including enacted choice—as the momentary precipitation of just one of these parallel imaginative lines into an attractor basin in the behavioral landscape. But such ideas of mental activity are being actively explored in the new cognitive neuroscience.

6.3.3.4 Dynamical Cognition

Cognitive neuroscientists have proposed exactly that the human brain is constantly scanning over a range of often-conflicting alternatives and collapsing that range to an action only in the moment of decision (Spivey 2008). Consider someone who wants to pick up a coffee cup. There are many ways to do so successfully, even in the same situation, and very many ways to do so in the range of situations in which people actually pick up coffee cups. The brain may explore many of those approaches simultaneously. The neurobiological basis of action can be varied, with simultaneous but conflicting lines, each with some probability of being given, at the final instant, control over skeletal and motor programs. One of those possibilities will precipitate, very briefly, in the moment of action. The world constrains us to enact only one of them, although that one may be a coherent blend of a few. But enacting only one action suite does not mean that the brain was exclusively focused on that one action suite; it means only that, in the moment of action, one coherent action was executed, after others were forsaken, left on deck.

Actually, we often see imperfect unitary execution. “Mistakes” in movement and speaking, for example, are often cases where two or more conflicting possibilities both bled through to the final moment of performance. There is no reason to expect that the precipitation of one of the conflicting possibilities in a brief moment of action indicates that the same precipitate of action would happen the next moment, in the same circumstances. People are variable and flexible.

The analysis above for picking up the coffee cup applies to any moment of choice. What a human being needs—at least unconsciously—is a sense, at each point of action, of what the self is, and what choice can be made that will take the self to the next point. The self at the next point is not randomly different, but always a different self. Uniqueness, stasis, rigidity are not the same as stability. The human being, to be human and to be successful, requires great flexibility, and a consistent human being is highly flexible and varied. Consistency is not repetition or fixity but instead a coherent migration path, or, realistically, the hope of a coherent migration path, since much of life consists of attempts at a coherent migration path that hit speed bumps and must be quickly re-mapped, or that hit worse speed bumps and require a reboot and a recalculation of a new path. Perhaps the next moment of picking up the coffee cup will have a self who is inviting, or dismissive, or finalizing the communicative turn, or trying to elongate the moment, or oblivious to the coffee because she is paying attention to other things, or styled as uncaring, or attentive, or sensitive, or concerned with the warmth of the coffee, or turning from that sip of coffee to more important or less important things, or simply bored with the usual ways of picking up a coffee cup.

When we look at action, it seems unitary and specific: we must pick up the cup just one way, not some incoherent blend of lots of different ways, not lots of different ways with different probabilities. Misled by the cause-effect isomorphism fallacy, we think the cause must have the attributes of the effect. Given that performed actions in the world are unitary and specific and form a nice chain, it is easy to imagine that the mind works something like that. Instead, as Spivey (2008) explains, it is better to think of multiple pathways of thinking happening in parallel and of one of them precipitating into an attractor basin for the purpose of performing a specific action. But the neural activity could drop into a different attractor basin.

6.4 Conclusion

As Wittgenstein writes and Geertz quotes,

> We ... say of some people that they are transparent to us. It is, however, important as regards this observation that one human being can be a complete enigma to another. We learn this when we come into a strange country with entirely strange traditions; and, what is more, even given a mastery of the country's language. We do not understand the people. (And not because of not knowing what they are saying to themselves.) We cannot find our feet with them. —Ludgwig Wittgenstein, as quoted in Geertz, Clifford. 1973. *The interpretation of cultures*. Basic Books. Page 13. [The original is available at Wittgenstein, Ludwig. 1953. Philosophical Investigations. Translated by G. E. M. Anscombe. Macmillan.]

Geertz himself comments:

> [C]ulture is best seen not as complexes of concrete behavior patterns—customs, usages, traditions, habit clusters—as has, by and large, been the case up to now, but as a set of control mechanisms—plans, recipes, rules, instructions (what computer engineers call "programs")—for the governing of behavior. Geertz, Clifford. 1973. *The interpretation of cultures*. Basic Books. Page 44.

and

> One of the most significant facts about us may finally be that we all begin with the natural equipment to live a thousand kinds of life but end in the end having lived only one. Geertz, Clifford. 1973. *The interpretation of cultures*. Basic Books. Page 45.

Game theory represents an utter extreme of eliminating personal flexibility, by creating draconian governing conditions under which we might have expected to be able to predict both behavior and an understanding of that behavior. And yet, as we have tested, people retain impressive flexibility even under these conditions.

We have proposed that, in the wild, people use flexible but orderly mental processes, such as conceptual blending and narrative imagination, to operate as wayfinders, constructing selves as they go along to make choices. We propose that recent cognitive neuroscience is consistent with this proposal. Our prescription for finding our way forward in creating a new rationality from a new neuroscience is to explore a fruitful alliance between institutionalist views of collective action and cognitive neuroscientific views of multiple, variable selves in multiple, various stories and their precipitation in some moments into individual coherent actions.

References

Anderson, M.L. (2014). *After phrenology: Neural reuse and the interactive brain*. Cambridge, MA: MIT Press.

Araujo, H. F., Kaplan, J., & Damasio, A. (2013). Cortical midline structures and autobiographical-self processes: An activation-likelihood estimation meta-analysis. *Frontiers in Human Neuroscience, 7*, 548.

Araujo, H. F., Kaplan, J., Damasio, H., & Damasio, A. (2014). Involvement of cortical midline structures in the processing of autobiographical information. *PeerJ, 2*, e481.

Camerer, C. (2003). *Behavioral game theory*. New York/Princeton: Russell Sage Foundation/Princeton University Press.

Cook, F.H. (1977). *Hua-Yen Buddhism: The Jewel Net of Indra*. University Park, PA: Penn State Press.

Cox, G. (1987). *The efficient secret: The cabinet and the development of political parties in Victorian England*. New York: Cambridge University Press.

Croson, R.T. (2007). Theories of commitment, altruism and reciprocity: Evidence from linear public goods games. *Economic Inquiry, 45*(2), 199–216.

Damasio, A. (1998). Investigating the biology of consciousness. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences, 353*, 1879–1882.

Engel, C. (2005). *Generating predictability: Institutional analysis and design*. Cambridge: Cambridge University Press.

Fauconnier, G., & Turner, M. (2002). *The way we think: Conceptual blending and the mind's hidden complexities*. New York: Basic Books.

Fudenberg, D., & Tirole, J. (1991). *Game theory*. Cambridge, MA: MIT Press.

Geertz, C. (1973). *The interpretation of cultures*. New York: Basic Books.

Immordino-Yang, M. H., Christodoulou, J. A., & Singh, V. (2012). Rest is not idleness: Implications of the brain's default mode for human development and education. *Perspectives on Psychological Science, 7*, 352–364.

Kagel, J.H. & Roth, A.E, editors. (2016). *The handbook of experimental economics, volume 2: The handbook of experimental economics*. Princeton: Princeton University Press.

Kaplan, J.T., Gimbel, S.I., Dehghani, M., Immordino-Yang, M.H., Sagae, K., Wong, J.D., Tipper, C.M., Damasio, H., Gordon, A.S., & Damasio, A. (2016). Processing narratives concerning protected values: A cross-cultural investigation of neural correlates. *Cerebral Cortex, 27*(2), 1428–1438.

Lucas, G.M., McCubbins, M.D., & Turner, M. (2015). Against game theory. In *Emerging trends in the social and behavioral sciences: An interdisciplinary, searchable, and linkable resource*. (pp. 1–16). John Wiley & Sons.

Lupia, A., Levine, A.S., & Zharinova, N. (2010). When should political scientists use the self-confirming equilibrium concept? Benefits, costs, and an application to jury theorems. *Political Analysis, 18*(1), 103–123.

Mars, R. B., Neubert, F. X., Noonan, M. P., Sallet, J., Toni, I., & Rushworth, M. F. (2012). On the relationship between the "default mode network" and the "social brain". *Frontiers in Human Neuroscience, 6*, 189.

McCubbins, M.D., & Turner, M. (2014). Are Individuals Fickle-Minded? *Synthese library, Vol. 372. Rethinking the individualism-holism debate: Essays in the philosophy of social science, Part II* (pp. 237–252). Basel: Springer.

McCubbins, M. D., & Turner, M. (2012). Going cognitive: Tools for rebuilding the social sciences. In R. Sun (Ed.), *Grounding social sciences in cognitive sciences* (pp. 387–414). Cambridge MA: MIT Press. Chapter 14.

McCubbins, M.D., Turner, M., & Weller, N. (2012). The theory of minds within the theory of games. In H.R. Arabnia, D. de la Fuente, E.G. Kozerenko, P.M. LaMonica, R.A. Liuzzi, J.A. Olivas, A.M.G. Solo, & T. Waskiewica (Eds.), *Proceedings of the 2012 international conference on artificial intelligence, Vol. I* (pp. 515–521). CSREA Press.

North, D. C. (1990). *Institutions, institutional change, and economic performance*. New York: Cambridge University Press.

North, D. C., & Thomas, R. P. (1973). *The rise of the Western world: A new economic history*. New York: Cambridge University Press.

North, D. C., Wallis, J. J., & Weingast, B. R. (2009). *Violence and social orders: A conceptual framework for interpreting recorded human history*. New York: Cambridge University Press.

Northoff, G., Heinzel, A., de Greck, M., Bermpohl, F., Dobrowolny, H., & Panksepp, J. (2006). Self-referential processing in our brain—A meta-analysis of imaging studies on the self. *NeuroImage, 31*, 440–457.

Ostby, Y., Walhovd, K. B., Tamnes, C. K., Grydeland, H., Westlye, L. T., & Fjell, A. M. (2012). Mental time travel and default-mode network functional connectivity in the developing brain. *Proceedings of the National Academy of Sciences of the United States of America, 109*, 16800–16804.

Plott, C. R. (1982). Industrial organization theory and experimental economics. *Journal of Economic Literature, 20*(4), 1485–1527.

Qin, P., & Northoff, G. (2011). How is our self related to midline regions and the default-mode network? *NeuroImage, 57*, 1221–1233.

Raichle, M. (2010). The brain's dark energy. *Scientific American, 302*(3), 44–49.

Roth, A.E. (1990). New physicians: A natural experiment in market organization. *Science, 250*(4987), 1524–1528.

Smith, V. (2000). Rational choice: The contrast between economics and psychology. In *Bargaining and market behavior: Essays in experimental economics* (pp. 7–24). New York: Cambridge University Press.

Spivey, M. (2008). *The continuity of mind*. New York: Oxford University Press.

Thaler, R., & Sunstein, C. (2008). *Nudge: Improving decisions about health, wealth and happiness* (Revised ed.). New Haven: Yale University Press.

Turner, M. (2014). *The origin of ideas: Blending, creativity, and the human spark*. New York: Oxford University Press.

Chapter 7
Moderate Mindreading Priority

Pietro Perconti

7.1 The Priority Issue

According to the common sense view, self-consciousness is the climax of human cognition. This provides the ordinary feeling of being special thanks to the faculty of self-consciousness. But, we can doubt how much nature takes care of our satisfactory feeling of being self-conscious. What if self-consciousness has any top role in human cognition (whatever it does mean)? In particular, is self-consciousness really prior to mindreading?, or the contrary? Call the first thesis "self-consciousness priority account" (SCPA) and the other "mindreading priority account" (MRPA). While MRPA is also the view that mindreading evolved prior to self-consciousness, SCPA is the claim that self-consciousness evolved prior to mindreading.

In what follows I will argue for the mindreading priority account. It means to believe that, to quote Peter Carruthers' words, "self-knowledge evolved for purposes of metacognitive monitoring and control. On this account, organisms evolve a capacity for self-knowledge in order better to manage and control their own mental lives. By being aware of some of their mental states and processes, organisms can become more efficient and reliable cognizers, and can make better and more adaptive decisions as a result" (Carruthers et al. 2012).

In arguing for the mindreading priority account, all depends on what you mean by the expressions "mindreading", "self-consciousness", "prior", and "priority". What "is prior to" does mean? According to James Dow (2014), priority could be: conceptual, functional, developmental, neuroscientific, and evolutionary. Then, "mindreading priority could be: a conceptual priority—mindreading can be conceived independently of self-consciousness; a functional priority—

P. Perconti (✉)
Department of cognitive science, University of Messina, Messina, Italy
e-mail: perconti@unime.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*,
Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_7

mindreading can be posited as a cognitive mechanism independently of self-consciousness; a developmental priority—mindreading develops in infancy prior to self-consciousness; a neuroscientific priority—mindreading is a brain function that is distinct from and active temporally prior to self-consciousness; an evolutionary priority—mindreading evolved prior to self-consciousness and self-consciousness is a byproduct of mindreading" (Dow 2014).

In what follows, I will take into consideration mainly the empirical priorities, i.e., developmental, neuroscientific, and evolutionary priority.

7.2 Dual-Process Account and the Two Components of Self-consciousness

On what the words "mindreading" and "self-consciousness" mean, I use a dual-process account, based on the idea that there are two different modes of brain processing, i.e., System 1 and System 2. This terminology is borrowed by Jonathan Evans (2008): "What dual-process theories have in common is the idea that there are two different modes of processing, for which I use the most neutral terms available in the literature, System 1 and System 2 processes". While System 1 includes mental processes that are unconscious, rapid, and automatic, System 2 includes conscious, slow, and deliberative mental processes (Evans and Frankish 2009; Evans and Stanovich 2013). In the fields of mindreading and self-consciousness, this means that we should consider a System 1 Mindreading (S1MR), a System 2 Mindreading (S2MR), a System 1 Self-consciousness (S1SC), and a System 2 Self-consciousness (S2SC).

Following this line of reasoning, then, the notion of 'self-consciousness' should be articulated into two component parts. Usually we do not experience self-consciousness as something that comes in degrees or that has components. Having experience of being self aware is rather something immediate and non-articulated. It looks like an 'all or nothing' phenomenon: if one is aware of oneself, he is fully so; otherwise, the subject is not conscious at all. The personal effect of the self-consciousness is, in a sense, similar to that of turning the light on in a room at night. If the light is on, everything is clearly visible; if it is off, all there is in the room is plunged into darkness. Likewise, if we are aware of ourselves, all the remaining part of mental life — moral and legal responsibility, the ability to calculate, and much more — can take place. But, if our self-awareness vanishes, as a consequence of being asleep or dead, we are no longer responsible of anything nor can exercise any form of reasoning or thought. We are no more living and whatever happens around us is not more our concern.

However, cognitive neuroscience suggests that we should get rid of the idea that to be aware is equivalent to the working of some system of our mind (or, of the brain) which simply 'colours' with consciousness those very experiences we would have unconsciously, if we were 'inferior' animals or machines. This kind of scientific evidence should change accordingly the ordinary way to conceptualize what self-consciousness is. We, therefore, need to produce distinctions able to better analyze the ordinary notion of self-consciousness. In order to do so, we could consider, on the one hand, all those capacities that have something to do with *self-identification*, and, on the other, the different ways of the *stream of consciousness*. We can refer to the first group of phenomena by the expression ‘self-recognition’ (or, System 1 Self-consciousness, S1SC), and use the expression ‘reflexive reasoning’ for the second kind of phenomena (or, System 2 Self-consciousness, S2SC).

7.3 Bodily Self-recognition

Self-recognition is the simplest form of self-consciousness, and the oldest from an evolutionary point of view. It requires the subject being able to refer to himself by means of a reflexive representation, typically a schema of his own body. Recognizing one’s own image is the most typical form of self-recognition. Other forms are the recognition of one’s own voice, of the different parts of the body, of the smell or of the smoothness of one’s own skin. We are aware of the features of our body, and this is the reason why we are able to recognize ourselves. A practice like shaving would not be possible without such an elementary form of awareness.

Is self-recognition really self-consciousness? According to Peter Carruthers et al. (2012), “while interesting, bodily self-knowledge has little to do with awareness of oneself as a cognitive being. Rather, the mirror test measures an ability to notice cross-modal contingencies, becoming aware of the mapping between one’s own bodily movements (as experienced proprioceptively) and what one perceives in the mirror (Ritchie and Carlson 2010). Knowledge of one’s own current mental states, however, is arguably more fundamental than either knowledge of one’s traits or knowledge of oneself as a self with an ongoing mental life”.

On the contrary, bodily self-knowledge is a key component of self-consciousness. It is, indeed, the System 1 of self-consciousness and, so to speak, an half of the self-consciousness experience itself. Moreover, Carruthers understimates the significance of the mirror test. When they are about two, children become able to recognize their own image reflected in a mirror (Keenan 2003), and this takes place before they are able to articulate the forms of reasoning which has them as object. In fact, they lack the linguistic resources to articulate such form of reasoning: above all, a sufficient mastery of the indexical expressions. The use of the personal pronouns is not yet well developed and their use of the tenses of verbs makes it impossible for them to produce and understand counterfactual arguments, which play a crucial role in reflexive reasoning. Consequently, in 2 year old children the capacity to engage in reflexive reasoning is still in an embryonic form. Children before this age are unable to pass the mirror test, and exhibit a social behaviour analogous to that of other animal species: they hit the surface of the mirror, lick it or smile at their own reflection (Zazzo 1977). They exhibit some kind of “social game” in which the reflected image is treated as if it belonged to another child.

Since Gordon Gallup (1970) devised the 'mark test', or mirror test, many experiments have been carried out to observe the reactions of various species. Among the primates subjected to the test we find the lemurs and the bushbabies, the squirrel monkeys, several species of marmosets, tamarins, baboons and guenons, macaques and gibbons (Gallup et al. 2002). The best results have been obtained with great apes. There is evidence that orangutans and bonobo pass the mark test (Suarez and Gallup 1981; Hyatt and Hopkins 1994). On the contrary, gorillas often fail the test (Shillito et al. 1999). If we leave to one side the primates, and we concentrate our attention on other animals, dolphins have given some vague sign of recognition of their own image (Reiss and Marino 2001). But it seems that also magpies, a songbird from the crow family, is endowed with self-recognition ability (Prior et al. 2008).

On the whole, the recognition of one's own image reflected in a mirror is not very common within the animal kingdom, and it is, in any case, present in species that are not able to engage in forms of reasoning which have themselves as objects.

7.4 Reflexive Reasoning

Generally speaking, reasoning means being able to draw the right consequences that follow from a certain thought we entertain. It is not simply matter of having an idea, but of recognizing that holding it implies some kind of responsibility towards a number of other ideas. When the conversation is authentic, each of the interlocutors can appeal to the responsibility that the other has towards the beliefs she assumes to be true. Usually, this kind of appeal is public, because it takes place in the social practice of conversation. However, the responsibility we have towards the network of concepts in which we wrap ourselves exercises its influence also when we engage in the inner speech, i.e., a private surrogate of conversation.

Considering reasoning in terms of inferences between concepts is an idea emphasized by Robert Brandom (2000). According to him, if we want to understand what it means to have a certain mental content, we should give much less importance to the classical notion of "representation", giving, instead, a key role to the notion of "inference". The practice of asking for and of providing justifications for our ideas constantly prompts us to establish the patterns of conceptual inferences. It is just because this we are responsible for our ideas and, asked to provide reasons for what we believe, we articulate inferentially our thought. In fact, apart from other people and the events of the world, reasoning can also have ourselves as object (Davidson 2001). I can become the object of my reasoning, experiencing in this way my inner life. If we attribute to ourselves a given property, we discover that, in so doing, we become responsible towards other properties which are also relevant to us, but which we had not yet considered. It is the web of the language system what, with its rules and limitations, provides a framework for reflexive thought and contributes to extend the knowledge I have of myself. If I attribute a property to myself, for instance, if I realize that I have lately become irascible, I am also led to attribute to myself other properties as a consequence of what I understand by ‘being irascible’. For example, if I believe that being irascible implies, among other things, to be moody, and I cannot bear to be in this particular state of mind, I will start watching for sudden changes in my mood. Such a behavioural stance is caused by the peculiar way the language system is instantiated in my mind, which drives me along the above described reflexive path.

What is, therefore, the general form of our self-conscious thoughts? What happens in our heads while, immersed in our thoughts, we walk along city busy roads? A first answer to the questions above must proceed from the observation that these thoughts must often have a quasi-dialogical form. Consider the following example from Hector-Neri Castañeda (1989, 137):

> “At park Friedrich is fully absorbed watching the birds and the bees carryng on their usual affairs. He is then having an I-less experience, of the sort of thing Sartre made a big fuss as irreflexive consciousness. He even feels some pressure on his bent knees, and without jumping to an I-owned experience he simply stands up and then sits on the grass. Then he becomes aware of himself. A thought that the experience was pleasant made him think that he himSELF was enjoying it”.

The analysis of this type of thoughts shows how the form typically assumed by the stream of consciousness consists of a temporal sequence of representations in which the attribution of a certain property to a reflexive representation has some consequences on the development of the reasoning, both in terms of inferences drawn between thoughts and of the experience of a new emotive “tone”. In having these thoughts, what triggers the feeling of being self-conscious is the meta-representation that refers to a given reflexive representation. The sequence of such representations takes place within a story, usually produced following stereotypical blueprints.

7.5 Reflexive Reasoning Without Self-recognition, and *viceversa*

Reflexive reasoning and self-recognition can occur independently of one another and are processed in different regions of the brain. In fact, there are cases of reflexive reasoning without self-recognition, and other cases in which the self-recognition takes place in the absence of a capacity on the part of the subject to reason on himself. Therefore, as above noticed, someone can recognize himself without being able to reason about himself. Consider now a case of reflexive reasoning without self-recognition. Here is a conversation between Antonio Damasio and one of his patients (Damasio 1999, 162):

> “ ‘It must be me because I’m here!’ That is what Emily said cautiously as she contemplated the face in the mirror before her. It had to be her; she had placed herself in front of the mirror before her. It had to be her; she had placed herself in front of the mirror, of her own free will, so it had to be her: who else could be? And yet she could not recognize her face in the looking glass; it was a woman’s face, all right, but whose? She did not think it was

> hers and she could not confirm it was hers since she could not bring her face back into her mind's eye. The face she was looking at did not conjure up anything specific in her mind. She could believe it was hers because of the circumstances: She had beeen brought by me into thus room and asked to walk to the mirror and see who was there. The situation told her unequivocally that it could not be anyone else and she accepted my statement that, of course, it was her".

Emily was affected by a severe form of prosopagnosia, which not only impaired her ability to recognize some familiar faces, but, actually, made impossible for her to recognize her own face. She was, therefore, affected by a condition which we could call 'auto-prosopagnosia', i.e., the lack of ability to recognize one's own face. But, the amazing thing is that, although Emily lost the ability to recognize her own image, she had not lost with it the ability to reason about herself. On the contrary, she formulated a number of conjectures concerning herself. And, it is because of such conjectures that she could come to believe something that was not justified by her experience. She did not recognize her face, but knew that what she saw must have been just her face. She was unable to identify her image, but she could reason about herself. Emily preserved intact reflexive reasoning, although she was unable in self-recognition.

7.6 Into the Brain

During the last few decades the role of the right hemisphere of the brain with regard to self-awareness abilities has been emphasized more and more. But, already in the seventies, working with split-brain patients, Roger Sperry (Sperry et al. 1979) and Bruno Preilowski (1977) noticed the dominant role played by the right hemisphere in the recognition of one's own face. When Sperry stimulated in the right way the right hemisphere, the absence of language did not create an obstacle for the patient in manifesting his awareness. These data have been made sharper by Julian Keenan. Using functional magnetic resonance imaging (fMRI), Keenan and his colleagues discovered that the area of the brain which is mostly involved in processing the information necessary for recognizing one's own face is the frontal lobe of the right hemisphere (Platek et al. 2004). Keenan obtained the same results using the Wada technique, according to which it is possible to anesthetize, for a short time, only one brain hemisphere by injecting an anesthetic substance into the left (or right) inner carotidal artery. In order to examine the subjects anesthetized with the Wada procedure, Keenan used images modified with the technique of morphing. This consists of fading the face of one person into that of another by a gradual transformation of the characteristic traits of his face into those of the other.

Now, imagine a subject, with only one brain hemisphere anesthetized, who sees a face in which an half of the traits belongs to his own face, and the other half belongs to a celebrity face. When questioned about who is represented by that image, what will she say? If it is the left hemisphere that has been anesthetized, she will say that it is her own face that she is seeing; otherwise, she will say that she is seeing the famous person's face. The experimental results provide evidence in favour of the dominance of the right brain hemisphere in processing the information necessary for the recognition of one's own face (Keenan et al. 2005). These experimental data were confirmed also by the evoked potentials technique (Tanaka and Portefield 2002). Moreover, it is not only visual perception of one's own face that activates the brain region on which we are focussing. Also one's own voice activates the right hemisphere, mainly its frontal cortex (Nakamura et al. 2001).

The right hemisphere dominant role is supported also by failed recognition due to the inhibition of brain activity induced by the Transcranial Magnetic Stimulation (TMS). In some cases, failed recognition of oneself can produce a mirror related agnosia, i.e., the lack of understanding of the very reflecting mechanism of mirror surfaces. A patient studied by Nora Breen and her colleagues was able to identify the objects that an experimenter placed behind the patient was waving, and whose images the patient could see reflected in the mirror in front of him. But, when asked to take the objects, the patient would try to grab the images reflected in the mirror striking the surface of the mirror with his hands (Breen et al. 2001; Breen et al. 2000). Similar cases have been recorded also by Vilayanur Subramanian Ramachandran and his colleagues with regard to four patients with injuries in the right parietal lobe. Also these patients believe that the objects they had to take were 'inside the mirror' or 'behind the mirror' (Ramachandran et al. 1997).

On the other hand, the investigations which have been carried out so far on the localization of the inner speech, and of reflexive reasoning, focus on brain regions which differ from the above mentioned ones. As remarked by Alain Morin (2005), on this question there is a traditional amount of evidence:

> "It is a well known fact that the left hemisphere of the brain is specialized in language (e.g., Gazzaniga 1970; Gazzaniga et al. 1962), and thus it very likely sustains inner speech. Recent neuroimaging studies indeed confirm this assertion. One precise area of the left hemisphere, the inferior frontal gyrus, has been shown to be more active in participants who are asked to silently articulate sentences (McGuire et al. 1996) or single words (McGuire et al. 1996). Studies of brain damaged patients support these findings: destruction of Broca's area in the left hemisphere (Verstichel et al. 1997) or of the left posterior and anterior frontal regions (Levine et al. 1982) disrupt inner speech".

7.7 Two Levels of Mindreading

In the end, enough evidence seems to be available for the S1SC and S2SC difference. In a similar way, dual process account argues for the difference between two levels of mindreading, S1MR and S2MR. In this field, however, the difference is not a major controversial issue. This kind of distinction is drawn, among others, by Alvin Goldman (2006) and Giorgio Coricelli (2005). S1MR is represented by a low level simulation concerning the understanding of the aim of an action. The neurophysiological basis of low level of simulation mainly consists in the mirror system and in the cerebellum (Gallese et al. 1996; Rizzolatti and Sinigaglia 2007;

Ito 2012). S2MR consists of a high level simulation taking place in cognitive processes such as the taking of a different point of view from one's own, and the "counterfactual imagination". High-level simulation, on the other side, is an activity of projection which, to take place, must have a virtual inner space in which to work.

S1MR does not need any intentional attribution. Understanding the goal why an action is performed is not a conscious and intentional activity; rather, it relies on hard-wired mechanisms in the brain. This means that we can understand other people's actions, intentions, and emotions even without any conscious mental representation. Or, in epistemological terms, understanding an action goal and the other people emotions is possible without appealing to the folk psychology framework, with its typical vocabulary made up by "mental contents" and "propositional attitudes". Therefore, the role of language in S1MR can be neglected. On the contrary, S2MR implies the whole theoretical framework of propositional intentionality. This means, among other things, that it is impossible to attribute a mental state, without attributing also a propositional *content*.

7.8 Again to the Priority Issue. Reformulating MRPA

To sum up the argument, we can now reformulate MRPA taking into account what above highlighted. It seems that MRPA mean different things, according to the appeal to the System 1 or the System 2 of brain processing. In particular, MRPA could mean:

1) S1MR is prior to S1SC
2) S1MR is prior to S2SC
3) S2MR is prior to S1SC
4) S2MR is prior to S2SC
5) (S1MR+ S2MR) is prior to (S1SC+ S2SC)

On the basis of the neuroscientific evidence above considered, sentences which constitute MRPA are empirically true or false as follows.

1) S1MR is prior to S1SC: true, T
2) S1MR is prior to S2SC: true, T
3) S2MR is prior to S1SC: false, F
4) S2MR is prior to S2SC: true, T
5) (S1MR+ S2MR) is prior to (S1SC+ S2SC): false, F

1) S1MR is prior to S1SC: T

Consider, for instance, the mainstreaming Intersubjectivity Theory, "according to which the ability to ascribe mental states to selves and others develops from symmetrical forms of intersubjectivity, which include capacities for imitation, face recognition, gaze following, pointing, and joint engagement" (Dow 2014). The central theories in this field include Zahavi's (2005, 2011), Direct Perception

Theory, Gallagher's Interaction Theory (2005, 2008), Hutto's (2009) Narrative Practice Theory, and Zawidzki's thesis (2008, 2013). From these investigatons, it results that all the above capacities, that is, imitation, face recognition, gaze following, pointing, and joint engagement, develop prior a child become able to recognize her bodily features.

2) S1MR is prior to S2SC: T

A fortiori.

3) S2MR is prior to S1SC: F

Consider, for instance, the case of ape self-recognition in a mirror in absense of a (counterfactual) mentalization (above detailed).

4) S2MR is prior to S2SC: true, T

It seems that there are not cases of reflexive reasoning without the use of high level mindreading abilities, like counterfactual imagination and pretence.

5) Hence, (S1MR+ S2MR) is prior to (S1SC+ S2SC): F.

While S1MR is prior both to S1SC and S2SC, S2MR is prior to S2SC, but not to S1SC. In other words, non conceptual mindreading is prior to self-consciousness, but conceptual mindreading is not prior to non-conceptual self-consciousness. What does it mean for MRPA? Simply that not all mindreading is prior to self-consciousness. On the whole, reformulating MRPA leads us towards a *moderate* mindreading priority account. Non-conceptual self-consciousness evolved in a independent way. Findings in ape mirror self-recognition seem to confirm this hypothesis, *pace* Carruthers.

Self-consciousness is the inner space from which high level simulation proceeds in its behavioural predictions, and in understanding the reasons behind the actions of others as well as our own. High level simulation is an activity of projection which, to take place, must have an inner space in which to be based and from which to operate. Reflexive reasoning is the inner space from which high level simulation proceeds in its attribution of intentions, and in its behavioural predictions. To explain behavioural prediction in competitive situations, in playing games, and in erotic stimulation, the simulation approach must be able to distinguish between what I would do in counterfactual circumstances, and what, instead, I would expect that the individual I am simulating would do.

The idea that reflexive reasoning, i.e., the conceptual side of self-consciousness, could work as the basis for high level simulation, and as inner space for behavioural predictions, is also a way of making possible for simulationism to tackle one of its most difficult problems, i.e., the cases of simulation in competitive environments. And it is also a way of casting some light on the "mysterious" relationship between self-consciousness and mindreading.

References

Brandom, R. (2000). *Articulating reasons: An introduction to inferentialism*. Cambridge, MA: Harvard University Press.

Breen, N., Caine, D., Coltheart, M., Hendy, J., & Roberts, C. (2000). Towards an understanding of delusions of misidentification: Four case studies. *Mind & Language*, *15*, 75–110.

Breen, N., Caine, D., & Coltheart, M. (2001). Mirrored-self misidentifiation: Two cases of focal onset dementia. *Neurocase*, *7*, 239–54.

Carruthers, P., Fletcher, L., & Ritchie, J.B. (2012). The evolution of self-knowledge. *Philosophical Topics*, *40*(2),13–37.

Castañeda, H.-N. (1989). Self-consciousness, i-structures and physiology. In M. Spitzer, & B.A. Maher (Eds.), *Philosophy and psychopathology* (pp. 118–145). Berlin, Springer Verlag.

Coricelli, G. (2005). Two-levels of mental states attribution: From automaticity to voluntariness. *Neuropsychologia*, *43*, 294–300.

Damasio, A. (1999). *The feeling of what happens: Body, emotion and the making of consciousness*. London: Heinemann.

Davidson, D. (2001). *Subjective, intersubjective, objective*. Oxford: Oxford University Press.

Dow, J.M. 2014. Mindreading, mindsharing, and the origins of self-consciousness. *Philosophical Topics*, *40*(2), 39–70 (Backdated to 2012).

Evans, J.S.B.T. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. *Annual Review of Psychology*, *59*, 255–278.

Evans, J.S.B.T., & Frankish, K. (2009). *In two minds: Dual processes and beyond*, Oxford: Oxford University Press.

Evans, J.S.B.T., & Stanovich, K.E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science 8*, 223–241.

Gallagher, S. (2005). *How the body shapes the mind*. New York: Oxford University Press.

Gallagher, S. (2008). Philosophical antecedents to situated cognition. In P. Robbins, & M. Aydede (Eds.), *Cambridge handbook of situated cognition* (pp. 35–51), Cambridge: Cambridge University Press.

Gallese V, Fadiga L, Fogassi L, Rizzolatti G. (1996). Action recognition in the premotor cortex. *Brain*, *119*, 593–609.

Gallup, G.G. (1970). Chimpanzees: Self-recognition. *Science 167*, 86–87.

Gallup, G.G., Anderson, J.R., & Shillito, D.J. (2002). The mirror test. In M. Bekoff, C. Allen, & G.M. Burhgardt (Eds.), *The cognitive animal: empirical and theoretical perspectives on animal cognition*. Cambridge, MA: MIT Press.

Gazzaniga, M.S. (1970). *The bisected brain*. New York: Appleton-Century-Crofts.

Gazzaniga, M.S., Bogen, J.E., & Sperry, R.W. (1962). Some functional effects of sectioning the cerebral commissures in man. *Proceedings of the National Academy of Science*, *48*, 1765–1769.

Goldman A.I. (2006). *Simulating minds: The philosophy, psychology, and neuroscience of mindreading*. Oxford: Oxford University Press.

Hutto, D. (2009). Folk psychology as narrative practice. *Journal of Consciousness Studies*, *16*(6–8), 9–39.

Hyatt, C.W., & Hopkins, W.D. (1994). Self-awareness in bonobos and chimpanzees: A comparative approach. In S.T. Parker, R.W. Mitchell, & M.L. Boccia (Eds.), *Self-awareness in animals and humans: Developmental perspectives* (pp. 248–253). New York: Cambridge University Press.

Ito, M. (2012). *The cerebellum: Brain for an implicit self*. Upper Saddle River: Pearson Education.

Keenan, J.P. (2003). *The Face in the mirror: The search for the origins of consciousness*, New York: Harper Collins.

Keenan, J.P., Rubio, J., Racioppi, C., Johnson, A., & Barnacz, A. (2005). The right hemisphere and the dark side of consciousness. *Cortex*, *41*, 695–704.

Levine, D.N., Calvanio, R., & Popovics, A. (1982). Language in the absence of inner speech. *Neuropsychologia*, *20*(4), 391–409.

McGuire, P.K., Silbersweig, D.A., & Murray, R.M., et al. (1996). Functional anatomy of inner speech and auditory verbal imagery. *Psychological Medicine*, *26*, 29–38.
Morin, A. (2005). Possible links between self-awareness and inner speech: Theoretical background, underlying mechanisms, and empirical evidence. *Journal of Consciousness Studies*, *12*, 115–134.
Nakamura, K., Kawashima, R., Sugiura, M., Kato, T., Nakamura, A., Hatano, K., Nagumo, S., Kubota, K., Fukuda, H., Ito, K., & Kojima, S. (2001). Neural substrates for recognition of familiar voices: A pet study. *Neuropsychologia*, *39,* 1047–1054.
Platek, S.M., Keenan, J.P., Gallup, G.G. Jr., Feroze, B.M. (2004). Where am I? The neurological correlates of self and other. *Cognitive Brain Research 19*, 114–122.
Preilowski, B. (1977). Self-recognition as a test of consciousness in left and right hemisphere of “split-brain” patients. *Activitas Nervosa Superior*, *19*(Suppl 2), 343–44.
Prior, H., Schwarz, A., & Güntürkün, O. (2008). Mirror-induced behavior in the magpie (Pica pica): Evidence of self-recognition. *PLoS Biology*, *6*(8), e202. doi:https://doi.org/10.1371/journal.pbio.0060202
Ramachandran, V.S. Altschuler, E.L. & Hillyer, S. (1997, May 22). Mirror agnosia. In *Proceedings of the royal society* (Biological Sciences, Issue: Volume 264, Number 1382, pp. 645–647) London: Biological Sciences
Reiss D., & Marino, L. (2001, May 8). Mirror self-recognition in the bottlenose dolphin: A case of cognitive convergence. In *Proceedings of the national academy of sciences of the United States of America* (Vol. 98, No. 10, pp. 5937–5942).
Ritchie, J.B., & Carlson, T. (2010), Mirror, mirror, on the wall, is that even my hand at all? Changes in the afterimage of one’s reflection in a mirror in response to bodily movement. *Neuropsychologia*, *48*(2010), 1495–1500.
Rizzolatti, G., & Sinigaglia, C. (2007). Mirror neurons and motor intentionality. *Functional Neurology*, *22*(4), 205–210.
Shillito, D.J., Gallup, G.G., & Beck, B.B. (1999). Factors affecting mirror behavior in western lowland gorillas, Gorilla gorilla. *Animal Behavior*, *57*, 999–1004.
Sperry, R., Zaidel, E., & Zaidel, D. (1979). Self recognition and social awareness in the deconnected minor hemisphere. *Neuropsychologia*, 17:153–166.
Suarez, S., & Gallup, G.G., Jr. (1981). Self-recognition in chimpanzees and orangutans, but not gorillas. *Journal of Human Evolution*, *10*, 157–188.
Tanaka, J., & Portefield, A. (2002). The own-face effect as an electrophysiological marker of self. *Cognitive Neuroscience Society: Ninth Annual Meeting Abstracts*, *66*.
Verstichel, P., Bourak, C., Font, V., & Crochet, G. (1997). Inner speech and left brain damage: Study of the phonological analysis of words in aphasic and non-aphasic patients. *Revue de Neuropsychologie*, *7*(3), 281–311.
Zahavi, D. (2005). *Subjectivity and selfhood: Investigating the first-person perspective*. Cambridge, MA: The MIT Press.
Zahavi, D. (2011). The experiential self: Objections and clarifications. In Siderits, M., Thompson, E., & Zahavi, D. (Eds.), *Self, no self? Perspectives from analytical, phenomenological, & indian traditions* (pp. 56–78). Oxford: Oxford University Press.
Zawidzki, T.W. (2008). The function of folk psychology: Mind reading or mind shaping? *Philosophical Explorations*, *11*(3), 193–210. https://doi.org/10.1080/13869790802239235.
Zazzo, R. (1977). Image spéculaire et image anti-spéculaire. *Enfance*, *24*, 223–230.

Chapter 8
Performativity and the Ideological Construction of the Self. The Age of Narcissism and (Possibly) Beyond

Marco Mazzone

Abstract Since Austin and Searle, performatives are taken to be crucial for the construction of social reality. More recently, performatives have been proposed to be essential for the construction of personal identities, too. I intend to analyze the postmodern assumption according to which this identity construction is in the power of individuals, an assumption which presupposes a view of performatives as endowed with unconstrained power – that is, with a power that is not subject to objective constraints. I will consider some reasons to reject this view. The first is rooted in Judith Butler's idea that – since normative approaches to political correctness undesirably reduce freedom of speech in the name of equality – we should seriously consider how offensive performatives may fail, due to objective constraints on their felicity. A second reason to reject the postmodern view of performatives lies in the consideration of narcissism as an individual and political issue. Narcissism in the political sphere can be described as a transformation of the "passion for equality" (for individual rights) in an individualistic appetite, deaf to everything else, and especially to social constraints and responsibilities. A different – less narcissistic and more social – model of the self is provided.

Keywords Ideology · The self · Performative · Narcissism · Equality · Freedom of speech · Judith Butler · Erik Erikson

8.1 Introduction

In the last decades, the notion of performative has played a crucial role in the debates about the self. The basic idea is clearly rooted in the work of John Langshaw Austin, according to whom there are utterances that do not merely *describe* facts, they *create* instead facts of a special kind – that is, institutional ones. In this perspective, it

M. Mazzone (✉)
Department of Humanistic Sciences, University of Catania, Catania, Italy
e-mail: mazzonem@unict.in

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_8

has been claimed that subjectivity, too, is the product of such a process of social construction.

By this theoretical move, the domain of linguistic phenomena is assigned a special responsibility as the one providing the foundations not only for institutionalized social roles, but even for personal identity in the fullest sense. Speech is accorded – so to speak – a creative power: the power to create an entire ontological domain made of social roles/institutions as well as persons. It is important to consider, however, whether there are specific conditions under which speech is able to produce that outcome.

I will consider the postmodernist view according to which speeches are endowed with a power that is not constrained by external forces – be it an objective world, or language intended as a socially established code.[1] For the latter aspect, this position is clearly a form of anti-structuralism. Structuralism had it that language is not "spoken by us", rather "we are spoken by" language: in other words, in that perspective subjectivity is shaped by language to such extent that there is no room left for individual freedom. At the other extreme, postmodernism argues for the unconditioned power of individual speeches with respect to language as a social institution. Although the use of Chomskyan categories in this context might be no more than a useful metaphor, we might say that the emphasis is entirely put on *performance* to the detriment of *competence*. The idea that performance is not merely a mechanical application of competence is stretched to the point that one can ask whether competence is left any role to play at all.

In this paper I first analyze Judith Butler's attempt to find a point of equilibrium between individual freedom and social constraints, as far as the performative construction of the self is concerned. She assesses the notion of performativity against a specific practical problem, that is, the opportunity of "politically correct" (PC) policies. Those policies have shown serious drawbacks, and Butler suggests that a more robust approach is required. The basic idea is that we should not attempt to regulate every aspect of ideological conflicts or even verbal violence, since performatives are not always effective: one might have the intention to offend but not succeed in doing it, in which cases no legal prohibition is required (and advisable). In other words, the subject is not entirely free to offend at will, insofar as its ability to offend is dependent on social factors.

Then I directly discuss the issue of subjectivity, by focusing on the postmodernist claim that the notion of subject is intrinsically dynamic and plural. If Butler's considerations on performativity are right, there is a sense in which subjective intentions as conveyed by speech are not entirely free: they are instead constrained by external forces. This undermines the claim that speech is endowed with unconstrained power, in the construction of the self as well as in other domains. Individual freedom seems

[1] This is necessarily a simplification. "Postmodernism" is a somewhat vague label and, as Mauro Serra has pointed to me, there are postmodernists that are well aware of the role of constraints and conflicts. However, I am not committed to the claim that a certain thesis – the unconstrained power of performatives – is essential to any postmodernist view. I only intend to analyze and discuss that thesis, which has had some circulation among postmodernists.

to have a limitation here. But, as I will argue, to acknowledge such a limitation is beneficial to democracy – and to the self as well. The notion of the subject as entirely dynamic and open to construction is somehow a manifestation of that overgrowth of the self – sometimes referred to as "narcissism" – which has been accused of being a crucial factor in the current crisis of democracy. Self-control and self-limitation are essential for the very possibility of finding a balance between individual interests/opinions, which is key to democratic societies.

Finally, I intend to explore the relation between the notion of ideology and the previous issues – the equilibrium between stability and change in the construction of the subject; the overgrowth of the self. Ideology can be defined in terms of verbal processes of social positioning based on our social/political attitudes and views. Now, this positioning is a crucial component of the self: it is key to our self-perception and the way in which we make sense of our lives, while on the other hand it importantly affects our choices and actions. In the light of that notion, how plausible is it that our self-image is dynamic and changeable in the way postmodernism suggests?

Such a claim follows, on the one hand, from an overestimation of the power of language, based on the idea that we can shape reality at will by simply using words. In the end, this is a form of pan-ideologism: the assumption is made that there is nothing outside language and independent from it, so that our ideologies alone determine what there is in the world. On the other hand, the postmodernist view of subjectivity as fluid and changeable implies an aspiration to *escape from ideologies* so as to reach a ground that lies beyond conflicting points of view. But that aspiration cannot succeed. There is no way to escape from social positioning, and the postmodernist view is no exception: as a matter of fact, dynamic conceptions of subjectivity as well as PC policies are perceived as forms of social positioning, which cause reactions and counter-positioning.

By this account, the postmodernist approach to subjectivity tends to combine, not without contradiction, the adolescent view of ideological positioning as an all-encompassing dimension (as it is described by Erikson) and a wishful-thinking attitude with regard to the possibility of entirely escaping from ideology. A different approach might consist in acknowledging the unavoidability of conflicts between individual (and even intra-individual) points of view, while embracing the aspiration to mediate them through dialogue, in the name of a principle of universalization which presupposes a common ground of shared principles and shared reality. According to Erikson, this equates to passing to a superior stage of identity development, that is, from the ideological to the moral stage: in the end, from adolescence to maturity. In this perspective, plurality and dynamicity are not – so to speak – static properties of the subject; they are instead meta-principles, by which individuals that are aware of their being positioned in a social field are willing to interact with differently positioned others.

8.2 Judith Butler on Performativity

8.2.1 Gender as Performative

One of Judith Butler's most famous ideas is that gender has a *performative* nature, with explicit reference to the notion of John Austin (1962, and its further development by John Searle 1969): "the substantive effect of gender is performatively produced [. . .] gender proves to be performative – that is, constituting the identity it is purported to be" (Butler 1990, 24–5).

What this means, in the first place, is that gender is not a metaphysic substance, not even one that emerges through social interactions:

> In this sense, gender is always a doing, though not a doing by a subject who might be said to preexist the deed. The challenge for rethinking gender categories outside of the metaphysics of substance will have to consider the relevance of Nietzsche's claim in *On the Genealogy of Morals* that "there is no 'being' behind doing, effecting, becoming; 'the doer' is merely a fiction added to the deed – the deed is everything". (Butler 1990, 25)

When those ideas are applied to gender, they amount to the following conclusion: "There is no gender identity behind the expressions of gender" (ibidem). Such a conclusion might be interpreted – and in fact it has often been interpreted – as if gender is entirely at the disposition of individual wills: your gender is what you want it to be, and more precisely whatever you make it to be. The way you choose to express your gender, whatever it is, *is* your gender. However, even at this stage of her reflection Butler provides clues that this is not exactly her view. In her words, gender is not "a set of free-floating attributes, [. . . since] the substantive effect of gender is performatively produced and *compelled by the regulatory practices of gender coherence*" (Butler 1990, 24; emphasis mine). This strongly suggests that there are social constraints at play ("regulatory practices"), and that some form of negotiation between the individual and his/her social environment is required. Thus, the claim that "There is no gender identity behind the expressions of gender" has to be understood as follows: gender expression on the part of the subject is necessary for gender identity, but in a way that is dependent on external factors as well.

Butler (1997) goes further in this direction by explicitly addressing the issue of whether there is anything like a "sovereign subject" – a subject who has complete performative power over herself. In her view, this notion of a sovereign subject brings with it an overstatement of the power of performatives: "Utterance itself is regarded in inflated and highly efficacious ways, no longer as a representation of power or its verbal epiphenomenon, but as the *modus vivendi* of power itself" (Butler 1997, 74). To put it otherwise, what is assumed here is a magical view of performatives, one that ascribes to words magical efficacy (idem, 21), thus provoking a "linguistification" of the political field (idem, 74): the exercise of power is equated to the ability to produce utterances, which are taken to be infallibly effective.

8.2.2 Political Correctness, Between the Equal Protection Clause and Freedom of Speech

Such an overstatement of the power of speech has been widely criticized with regard to PC policies. By prescribing what is judged to be the correct use of words, one may have the illusion to prevent conflicts, while in fact these seem to depend on deeper and more concrete factors which remain mostly unaffected by purely linguistic actions. PC policies and hate speech are indeed crucial in Butler's discussion of performatives, and she also echoes the other wide-spread criticism to PC policies: that is, the fact that they restrict the space for freedom of speech.

Specifically, Butler emphasizes that there is a balance to be struck between the protection of minorities form verbal abuse (a right that, in the US Constitution, is guaranteed by the Equal Protection Clause, which is part of the Fourteenth Amendment) and freedom of speech (guaranteed instead by the First Amendment): as a matter of fact, the more one extends the domain of application of the former principle, the more the domain of the latter is restricted. In other words, there is a risk of "linguistic overregulation", leading to a new form of rampant, though well-intentioned, censorship. Most of the times, considerations of this sort are appealed to from conservatives against (what is described as) the tyranny of organized and aggressive minorities. When protected by the law, those minorities may in fact use their privilege to silence what they feel as offensive, instead of accepting the challenge to defend their views against different ones through dialogue. Butler, however, puts emphasis on a different facet of the issue. Her point is that censorship is a sword that cuts in both directions – that is, the same principles that are invoked for the protection of minorities can be marshalled against them.

Butler provides a couple of examples. One is that of gangsta rap: "when conservative critics suggest that gangsta rap is responsible for urban crime and the degradation of women, they construe representation not merely as performative, but as causative" (Butler 1997, 22). In other words, conservatives adopt the same line of reasoning that underlies PC policies: speech is not "only speech", it has unconstrained performative (and therefore, causative) power. Verbal representation of violence *is* violence, and as such it must be censored. Or equivalently, conservatives suggest that the representation of sexual practices in AIDS education is incitement to certain deplorable kinds of sexuality.

In sum, in the interest of minorities, too, it is not desirable that magical efficacy is attributed to performatives. If in fact speeches are straightforwardly conceived as "conducts" (that is, as effective doing), then it is reasonable to invoke extensive censorship to stop their potentially offensive effects. And this leads to restrictions to freedom of speech – to the detriment of everyone, including minorities. Conversely, preserving freedom of speech requires that the power of performatives is conceived as somehow restricted by objective constraints.

As we will see in more detail below (in Sects. 8.3 and 8.4), the need to acknowledge such constraints on performatives has direct consequences for the construction of the self and gender. As a matter of fact, the self is intrinsically relational, and among its relational features there is the disposition to perceive the others' behaviors and speeches as offensive. In practice, everyone has to evaluate by which words or actions one has reasons to feel offended as a self. Now, if offensive speeches are only effective within the limits of certain objective constraints, then we should accordingly conceive of our self as not indefinitely open to be offended. This means two different things. On the one hand, the self is likely to be in principle less permeable to offenses than it may superficially appear. But on the other hand, this requires that individuals impose some sort of self-discipline on themselves, so as to prevent that hyper-sensitivity to offenses is used as a justification for censorship against unwelcome views.

For one example, Butler reports another case in which the magical view of performatives may be used against minorities

> "Pro-life" activists have argued with limited legislative success that terms such as "abortion" that appear on the Internet are themselves "obscenity" [. . .]. The utterance is understood not merely to offend a set of sensibilities, but to constitute an injury. (Butler 1997, 21)

The point is that pro-life activists should not be allowed to expand their self, so to speak, to the point that they can find offensive even the mere use of the word "abortion". In sum, Butler is suggesting that, in order to preserve freedom of speech, the argument based on the power of performatives requires a discipline – a resistance to its overuse – which, in the end, is a form of self-discipline: a discipline of the self.

We will come back to this below. Let us now turn to Butler's analysis of the objective constraints that apply to performatives.

8.2.3 The Citational Nature of Performatives

The important point here is that performatives have a "citational" character (as already noticed by Derrida): they are repetitive in structure and in fact, to some extent, conventional.

That performatives have to be conventional was already clear to Austin. The first of his "felicity conditions" for performatives prescribes that "there must exist an accepted conventional procedure having a certain conventional effect" (Austin 1962, 14). In other words, performatives do not exist as just punctual facts, they are instead embedded into a historical chain of repeated events, which is what makes them conventional in the first place. In Butler's words, performativity

> is not a discrete series of speech acts, but a ritual chain of resignification whose origin and end remains unfixed and unfixable. In this sense, an "act" is not a momentary happening, but a certain nexus of temporal horizons, the condensation of an iterability that exceeds the moment it occasions. (Butler 1997, 14)[2]

[2]See also the following quotation: "The illocutionary speech act performs its deed at the moment of the utterance, and yet to the extent that the moment is ritualized, it is never merely a single moment. The 'moment' in ritual is a condensed historicity: it exceeds itself in past and future directions, an

We are told that the origin and end of the chain are unfixed and unfixable, in that conventions do not come into being by means of explicit acts of regulation that precisely determine their domain of validity – when they start and end. On the contrary, conventions exist to the extent that they are *perceived as existent* by a community, as a consequence of their being repeated: repetition shows performatives' power but it also constitutes it, by creating individual and social habits. In a word, the authority of performatives as conventions essentially depends on habits: on the strength of precedents. But then, this authority is nuanced, underdetermined, and potentially subject to negotiation.

A first conclusion to be drawn from this is the following: in order for speech acts to be effective as performatives there must be an appropriate convention in place – either in a strict or loose sense of "convention". More precisely, words and sentences may be taken to count as offensive/oppressive conducts only insofar as i) there is a history of their use as offensive/oppressive, and ii) there are reasons to assume that the speakers intend to revive that history. In Butler's (1997, 52) words: "the speaker who utters the racial slur is thus citing that slur, making linguistic community with a history of speakers". This does not provide a very precise or univocal way to settle the issue. But there is no reason to expect that it should: human conventions may be very vague and sloppy, and therefore it may occasionally be unclear whether a convention (and, in case, which one) is instantiated. However, Butler's suggestion is that the more an offensive speech act satisfies the two previous conditions, the more it actually has the potential to offend.

Butler insists in many ways on the importance of such objective, history-based constraints on performativity. One way is her insistence on performatives' vulnerability to failure: the existence of conventional "felicity conditions" implies the very possibility of *in*felicity as well, as Austin recognized in the quotation used by Butler (1997, 1) as epigraph: "Infelicity is an ill to which all acts are heir which have the general character of ritual or ceremonial, all conventional acts". Another sign of the importance she attributes to the issue is the effort spent in aiming at a point of equilibrium between the respective positions of Derrida and Bourdieu.

In Butler's eyes, the merit of Bourdieu is his contribution to the understanding of how the social norms that govern speech "come to inhabit the body" (Butler 1997, 142). In practice, norms can be embodied in habits providing a "background understanding": that is, to act in accordance with them "is not necessarily following a rule in a conscious way" (idem, 134). As a matter of fact, "modalities of practices [...] are powerful and hard to resist precisely because they are silent and insidious, insistent and insinuating" (quoted by Butler 1997, 142). However, Bourdieu's emphasis on the normative and coercive side of social conventions tends to conceal the fact that

effect of prior and future invocations that constitute and escape the instance of utterance" (idem, 3).

> the force and meaning of an utterance are not exclusively determined by prior contexts or "positions"; an utterance may gain its force precisely by virtue of the break with context that it performs. (Butler 1997, 145)

This mention of the "break" is an implicit reference to Derrida. According to him, the key feature of language is its formal iterability, as is prototypically shown by writing. In writing, linguistic symbols are formally repeated and then subject to be interpreted in the absence of the original authors and contexts. Thus, there is a break with prior contexts of use and a capacity to assume new contexts, so that "the force of the performative is derived precisely from its decontextualization" (idem, 147). This is important to Butler because in this gap between the original context (and meaning) and the new ones – in this "break" – there is room for the possibility that a speech act is "an insurrectionary act" (idem, 160): that a resignification is imposed on linguistic symbols, so that the power of previous social norms is broken and transformed.

> The possibility of a resignification of [a] ritual is based on the prior possibility that a formula can break with its originary context, assuming meanings and functions for which it was never intended. In making social institutions static, Bourdieu fails to grasp the logic of iterability that governs the possibility of social transformation. (idem, 147)

This said, in Butler's opinion Derrida goes too far about the possibility to break with previous norms. It is therefore crucial to strike the right balance between the two approaches. On the one hand, she claims, Derrida is right that social norms are not endowed with unconstrained power over individuals. Their power depends on objective conditions that are more or less satisfied from one occasion to the other: in practice, social norms need to be acted and revived by individuals, who therefore have the opportunity to transform the context and cause the sort of insurrectionary "break" invoked by Derrida. But on the other hand, against Derrida, there is no sovereign subject endowed with unconstrained power, who is free to break with social norms at will. The insurrectionary break is no less uncertain and negotiable than the norms: any performative has to negotiate its power with existing norms.

In sum, a point of equilibrium must be found case by case. Neither social norms are endowed with invincible power, nor they can be violated or even transformed at will by individuals. Performatives are ruled by conventions acting as objective conditions of, and constraints on, their efficacy – which leaves to individuals some room for negotiation, though a variable and uncertain one. This is good news. The existence of (historical and conventional) constraints on the efficacy of performatives makes it possible to resist their offensive power without massively invoking legal remedy, and this is beneficial for freedom of speech. In this way, the issue of offensive speech is brought back – when possible – from the field of jurisdiction to the domain where it primarily belongs: the domain of ideological conflicts between subjects.

8.3 Theory of Subjectivity in the Postmodern Era

8.3.1 Unconstrained Subjectivity: The Age of Narcissism

Our previous considerations have consequences for the conception of the self.

Personal identity is clearly relational: it largely depends on a history of social interactions. If it is true, with regard to performatives, that individuals are neither entirely free nor completely bound by social regularities, then it might well be the case that the same holds for the construction of the self. I intend to argue that this is in fact the case, and that there are implications for the issue of postmodernism: its view of subjectivity as fluid and dynamic is one-sided, insofar as it fails to consider the constraints acting on identity construction.

As we already saw, Butler (1990, 25) makes the claim that "There is no gender identity behind the expressions of gender", which may suggest unconstrained freedom in gender construction – as if anyone can create gender at will by simply expressing it. More generally, Butler proposes to take very seriously Nietzsche's thesis that "the deed is everything" – while the "doer", the subject, is nothing but a fiction added to the deed. Now, if the self literally were such a fiction, then everyone could "stage" it in any way one desires. We also saw that Butler analyzes further the question, so as to impose on it much stricter constraints. But a literal, unbounded interpretation of her claims is far more popular among scholars and closer to a general feeling that identities are "fluid, temporary and negotiable social constructions" (Orsina 2018, 71; here and after, translations of this book are mine).

An example is how non-heterosexuals have defined their identity from the eighties on.

> In the beginning was the gay community. Later on, in order to include individuals that were thought not to be – or not to be adequately – represented from the word "gay", the acronym LGB started to be used. But then it has become impossible to put a stop to this: LGBT, LGBTQI, LGBTQQIAAP – and so on and on. Once one accepts the principle that collective identities can, and must, be deconstructed, the game of segmentation can go on indefinitely. (ibidem)

Are there reasons to oppose this indefinite proliferation of identities? Orsina (2018) answers this question in the affirmative, based on considerations that make an appeal to the concept of narcissism – which plays a crucial role in the debate on postmodernism. In short, his argument is that democracies tend to give free rein to individual appetites to the detriment of the common good, a fact that is turned against themselves. In practice, the balance between individual rights and duties is easily broken in favor of the former, leading to a society where everyone is focused on her/his own rights but is much less willing to pay the price for the rights of others. I want to focus first on this analysis, then I will come back to how it relates to the postmodern view of subjectivity.

The phenomenon described by Orsina has a long history: it was already noticed by Alexis de Tocqueville in his *Democracy in America*, published between 1835 and 1840. Let us consider the following quotation, concerning the "passion for equality" (and therefore, for individual rights) awakened by democracies:

> Democratic institutions awaken and flatter the passion for equality without ever being able to satisfy it entirely. Every day, at the moment when people believe they have grasped complete equality, it escapes from their hands and flees, as Pascal says, in an eternal flight. People become heated in search of this good, all the more precious since it is close enough to be known, but far enough away not to be savored. The chance to succeed rouses the people; the uncertainty of success irritates them. They get agitated, grow weary, become embittered. Then, everything that is in some way beyond them seems an obstacle to their desires [. . .]. (Tocqueville 2010, 136)

In this quotation, Tocqueville emphasizes the final result of the "passion for equality": that is, the way in which it easily turns into resentment. But there is another aspect to it, which precedes, and paves the way to, resentment. This is the unquenchable appetite for rights, which imposes on individuals a restless, nervous, even anxious movement. The general point is that as soon as democratic values are spread into the social body, they are subject to a major transformation: in fact, a vulgarization. They are no more perceived as "ideals", but rather as drives demanding immediate satisfaction – as already noticed by Ortega Y Gasset in the thirties with regard to the democratic idea of a sovereign subject:

> The sovereignty of the unqualified individual, of the human being as such, generically, has now passed from being a juridical idea or ideal to be a psychological state inherent in the average man. And note this, that when what was before an ideal becomes a component part of reality, it inevitably ceases to be an ideal. The prestige and the magic that are attributes of the ideal are volatilised. The levelling demands of a generous democratic inspiration have been changed from aspirations and ideals into appetites and unconscious assumptions. (Ortega Y Gasset 1993; quoted by Orsina 2018, 35)

For one example of this vulgarization, consider the "pursuit of happiness" mentioned in the US Declaration of Independence. By conceiving of it as an ideal, one acknowledges that there are obstacles to overcome, costs to pay, even human limitations to its pursuit, so that, presumably, complete happiness can never be achieved. Moreover, in the context of the Declaration the mention of happiness has a clear collective flavor: it is assumed to be a common good, such that every individual both has right to it and has responsibilities for it towards others.

In sum, democracy and its values should be thought of as goals of an endless – never entirely accomplished – collective construction: there is work to be done, there is a balance to be struck between personal desires, there are limitations both in human psychology and material resources. On the contrary, at the moment when the ideal is downgraded to an unconscious appetite, these constraints are entirely forgotten: then, individual rights appear as something that can be immediately cashed, with no costs to pay. But since this rarely occurs (most of the times desires must be instead mediated, delayed, and occasionally even suppressed), then a growing resentment – as observed by Tocqueville – is the natural outcome of the process.

The narcissistic view of the self as a sovereign, unconstrained subject can be thought to underlie the proliferation of gender identities described by Orsina, too. Subjects presume that they can shape their identity at will: nothing can interfere with the performatives through which they express their gender. But by this view, as Butler puts it, performatives are presumed to have a power that only pertains to God:

> power is understood on the model of the divine power of naming, where to utter is to create the effect uttered. Human speech rarely mimes that divine effect except in the cases where the speech is backed by state power. (Butler 1997, 32)

And, to be sure, even state power is subject to constraints of various sorts.

8.3.2 Premodern, Modern and Postmodern Subjects

In the previous section we have considered the postmodern view of the self as fluid and dynamic, from the perspective of its underlying tendency to narcissism. It is now time to analyze this view more systematically through a comparison with the alternative options.

In their review, Hermans and Hermans-Konopka (2010, 4) propose that "three models of self and identity, associated to different historical phases, should be distinguished". They respectively call them the "traditional", "modern" and "post-modern self". Their suggestion is that one is not obliged to choose between them. In particular, we should see as equally necessary "decentralizing movements that lead to an increasing multiplicity of the self" (as predicted by the postmodern model) and "centralizing movements that permit an integration of the different parts of the self" (as predicted by the modern model): both should be included in the more comprehensive notion of what the authors call "dialogical self" (idem: 5). I will come back to the necessity of centralizing movements which integrate different parts of the self. But before that, let us provide a general description of the three models (by quoting, with some liberality, Hermans and Hermans-Konopka 2010, 4).

The *traditional self* is characterized by the distinction between an imperfect existence on earth and a perfect existence in the after-world, and by faith in a strong social hierarchy, authority and dogmatic truth. The *modern self* is defined in terms of autonomy and individualism, the development of reason and the pretension to universal truth. The *postmodern self* is based on the importance of difference, otherness, local knowledge and fragmentation, in contrast to the universalistic pretensions of master-narratives; moreover, it "argues for the dependence of 'truth' on language communities with an important role of social power behind definitions of what is true and not true, right and not right".

In Sect. 8.4.3, we will say something more about the postmodern claim that truth is language-dependent. For the time being, suffice it to say that this is coherent with the assumption according to which there is no objective world that could place constraints on the self – on her/his performatives.

It is now time to assess the postmodern claim that the self is dynamic and plural, against the background of the modern self. As noticed by Rattansi and Phoenix (2005), the postmodern model is in fact grounded in a critique of the modern one, specifically of its notion of identity as “a principle of logical reasoning that states that something is what it is: A = A” (Berzonsky 2005, 129). This principle would underlie the theory of identity proposed by Erikson – and operationalized by Marcia’s (1966) identity status model. As a result, Erikson’s theory would prevent “understanding of the complex ways in which identities are formed and operate” (Rattansi & Phoenix 2005, 101). However, as argued by Berzonsky (2005), this line of reasoning can be disputed with regard to both its assumptions.

On the one hand, it is disputable that Erikson and Marcia were not aware of the plural and dynamic nature of identity. On the contrary, for instance, Marcia (1980) describes identity as “an internal, self-constructed, dynamic organization of drives, abilities, beliefs, and individual history”, and he writes:

> A well-developed identity structure [. . .] is flexible. It is open to changes in society and to changes in relationships. This openness assures numerous reorganizations of identity contents throughout the ‘identity achieved’ person’s life, although the essential identity process remains the same. (Marcia 1980, 160)

On the other hand, it is disputable that the self can entirely do without coherence and stability, provisional and open to revisions as they may be. Different arguments can be marshalled against this view. The first and most obvious is that action requires us to make decisions, and therefore prioritize inclinations and options:

> people still need to act, solve problems, and make decisions in a relativistic world. They need a frame of reference within which they can decide which options, possibilities, lifestyles, problem solutions, roles, moral principles, and so forth are better or more credible than others. (Berzonsky 2005, 134)

From this perspective, the point is not whether our selves are plural or not: of course, they are. But this does not mean that we can be – always and entirely – content with that plurality, without aiming to solve the potential or even actual conflicts between different parts of our selves. The construction of identity through adolescence and youth is essentially an effortful attempt to establish coherence within a multiplicity of options, urges and principles. When confronted with that plurality and the consequent conflicts,

> youth may engage in a mentally effortful process of seeking out, evaluating, and sorting through life options; [. . .] or they may opportunistically adopt and slough off roles, social poses, and public presentations as they move from situation to situation. (Berzonsky 2005, 132)

In the latter case, we have what is called “diffusion identity status”, that is, “youth with a pastiche sense of who they are” (ibidem) – a condition that may even lead to confusion and anxiety (Hermans and Hermans-Konopka 2010, 28).

While this first argument in favor of the (relative) coherence of the self is based on synchronic considerations, the second one focuses on coherence through time. As already noticed by Locke in the seventeenth century, the moral and legal notion of person is dependent on temporal continuity. In practice, there cannot be moral and legal accountability unless a person is now "the same" she/he was before:

> Personal identity implies that a specific person continues to be the same person across varying conditions and over time. Without a sense of identity, one could not be held accountable for her or his prior actions. [...] the stuff of social life—that is, legal obligations, moral responsibilities, promises, contracts, loans, and the like—would be meaningless if people did not own (or were not considered to own) their past. (Berzonsky 2005, 129)

In sum, the general point is that a coherent subject is not a "thing" in any trivial sense, but it is not a fiction either: it is something that we aim at, something that we actually construct in the course of time, in an endless, always revisable effort. As Hermans and Hermans-Konopka (2010, 8) suggest, a coherent subject is a *need*: "the mind does not simply coincide with itself, but rather needs itself in order to arrive at some clarity about itself and the world". This is why, beside the "decentralizing movements" leading to a plural and changing subject, there are also "centralizing movements": the subject is in search for a synthesis, that is, a (relatively) coherent and stable image of herself (or himself), which allows her to solve internal conflicts, guide action, and make the subject feel responsible for her actions.

In this search for a synthesis, the subject has to deal with a number of internal and external constraints. She cannot count on any divine power, on any performative magic delivering brand-new identities *ex nihilo*. Identities are instead negotiated – against our internal constraints, in the first place. This negotiation is often unconscious, but when it occurs under conscious control it may require a form of self-discipline: decisions must be made about which parts will be given priority. Without such a self-discipline, there is no mature self, just as there is no democracy. There is just narcissistic expansion of the self: an endless expression of its incoherent fragments.

8.4 Subjectivity and Ideology

8.4.1 Layered Selves

The previous considerations are not intended to show that the postmodern view of subjectivity is entirely wrong. On the contrary, we recognized that the subject is indeed plural and dynamic. But we argued that this is not the whole story: specifically, decentralizing movements (as Hermans and colleagues would call them) are counterbalanced by centralizing ones, that is, by a search for unity and coherence. Now I want to analyze in more detail this idea, by considering two aspects. The first is the fact that this search for coherence has a key role in the construction of ideological identities: by prioritizing urges and principles, or mediating between them, we cause social positioning of our self with respect to others. The second is the fact that we sometimes manage our social positioning –

and therefore our ideological identity – through metacognitive processes enabling genuine, transformative dialogue with others.

Within this framework, then, understanding of personal identity requires consideration of three different layers: first, the layer of the self as a set of incoherent parts (urges, appetites, interests, emotions and even ideal aspirations) that ask for expression, but also for unification in the service of action; second, the layer of the self as a provisionally stable unity across those different parts; third, the layer of the self as the attitude and capacity to metacognitively apprehend, and put into question, this provisional balance and the related ideological identity.

At the same time, this framework helps us to be more precise about why the postmodern model of subjectivity is unsatisfying. First of all, the insistence on fluidity and plurality of the self tends to conceal the importance of the second layer with its centralizing movements. But, most of all, that view fails to distinguish between the first and the third layer: what we might call, respectively, the pre-ideological and the post-ideological plurality of the self. This causes confusion in the management of ideological positioning.

It is one thing, in fact, the sort of "brute" multiplicity and changeability that we find at the beginning of the process, when the component parts of the self are not yet mediated in a relatively stable synthesis. It is quite another the fact that the self may eventually reach a metacognitive disposition to accept the existence of multiple ideological positions – between which a mediation may be required. This latter condition is in a sense normative: it is what a mature self should aim at. But if no distinction between the pre- and the post-ideological layer is drawn, then the brute plurality of our pre-ideological self is easily misinterpreted as a normative feature. In other words, one may conceive as an ideal – as a goal to be pursued – the fact that our not-yet-mediated parts are left free to express themselves.

This is misleading with regard to our self-perception and in fact leads to a narcissistic view of the self: the idea that any appetite can, *and should*, be expressed without consideration of internal and external constraints. But it is also misleading for the management of ideological positioning. Conceived as a normative feature, the primitive plurality of the self is erroneously thought as post-ideological: who adopts this model inclines to assume that it has to be universally accepted – as if it ensured that any ideological divergence is *ipso facto* accommodated. The proliferation of genders, for example, is taken as something that should raise no objection – insofar as it is motivated by a principle of pluralism. But this is clearly not the case. On the contrary, when one adopts the postmodern view of subjectivity, this tends to be perceived as a form of ideological positioning which causes counter-positioning. As a matter of fact, many rejects the postmodern model in favor of the modern, or even the traditional, one. Thus, postmodernism apparently dreams of an escape from ideology – from history and its conflicts – that is inconsistent with reality.

In contrast, adopting the three-layered model allows us to look beyond ideology without such utopian consequences. We may acknowledge that *any* coherent view of the self (and the world) implies ideological positioning within a plural arena, and at the same time make room to dialogue between divergent views just as a metacognitive attitude: that is, a disposition to recognize those views and try to mediate between them. Such a disposition is therefore something different from the coherent image of the self at the second layer. Even if the subject adopted the dialogical model of the self at this layer – as a form of personal identity and ideological positioning – the disposition might be present nevertheless as distinct from it: as nothing but a generic *willingness to go beyond any identity*.

This proposal is essentially consistent with Erikson's identity theory: it is interesting to briefly recall it.

8.4.2 Moral, Ideological, and Ethical Stage

In Erikson's view, "man's development does not begin or end with identity; and identity, too, must become relative for the mature person" (Erikson 1968, 42). More precisely, in a developmental perspective:

> beyond childhood, which provides the moral basis of our identity, and beyond the ideology of youth, only an adult ethics can guarantee to the next generation an equal chance to experience the full cycle of humanness. And this alone permits the individual to transcend his identity. (Ibidem)

Here we learn essentially two things. The most important is that identity is not the end of human development. But we also learn that, according to Erikson, there are three different stages to this development. One is the moral stage, rooted in childhood. Then there is the ideological stage, which characterizes youth. And finally, we have the ethical stage, which marks the entrance to the adult age.

In the moral stage, children acquire norms and values but they apply them in an all-or-none fashion, with little sensitivity to ambiguous circumstances and with a focus on punishment. In practice, there is little "awareness of a world in which various authorities [and moral principles] exist" (Cote and Levine 1987, 298). This awareness consistently grows in adolescence: individuals enter the ideological stage, which

> reflects an increasing but not complete toleration of others' experience as being potentially valid [. . .] while multiple perspectives are recognized from an ideological orientation they are not always accorded equal respect. Rather, a certain degree of egocentricity about one's own perspective remains. (Ibidem)

Finally, by entering the ethical stage, individuals gain a new, more equitable perspective on plurality:

> The individual's perspective at this stage is universal in the sense that other persons, groups, and ideas are not to be considered invalid simply because of a perceived "differentness." Instead, at the ethical stage there is an awareness that no one belief system, including one's own, is flawless or covers all contingencies. (Idem, 299)

This awareness of the limited validity of our own beliefs is key to this stage, which is why identity is not the final word and it "must become relative for the mature person". Identity is necessary as an intermediate step in order to give coherence to the self and the world:

> without an ideological simplification of the universe the adolescent ego cannot organize experience according to its specific capacities and expanding involvement. (Erikson 1968, 27)

But then, the subject should understand that her simplified model of the world is not the world – just one revisable model of it. A special model, indeed, thanks to which that subject finds her way in the world; a model embodied in habits and regularities which are home to that specific self, and that put constraints on her capacity to change. But nevertheless, just a model.

8.4.3 The Weight of Objectivity

To conclude, a few words on postmodernism and the issue of an objective, external world – or its loss.

The above considerations about metacognitive pluralism might seem very close to the postmodern view according to which there is no objective world, just different views of it. But this is not the case. Postmodernism assumes that there are no objective standards against which our models can be assessed, while here the assumption is just that models are always partial (they cannot cover all contingencies) and partially flawed. The existence of external constraints is not put into question: on the contrary, it is presupposed by assuming dialogue between models as a normative value.

In other words, postmodernism is a form of pan-ideologism: there is nothing beyond linguistic models and the social power that legitimates them. In contrast, according to Erikson, in order to reach maturity we need to leave the field of ideologies – but this requires the notion of something external and common, so as to complete the transition away from children's egocentrism.

This is consistent with the general view defended here. Just as there are objective constraints on the construction of identity – internal to the self, but also external to it as the historical chains laying the ground for performatives – there are, as well, objective constraints imposing common standards on dialogue between identities.

A final remark. We said a lot about the need to integrate the postmodern model with the modern one, but nothing about the contribution of the traditional model. Does it contribute anything to our understanding of the self? I submit the idea that the traditional model is important especially because, if compared to postmodernism, it lies at the other extreme of the continuum with regard to the weight of objectivity. The modern model, to be sure, defends the idea of objective, universal truth. But it is nevertheless committed to the ideal of a sovereign subject, who is able to mold reality as it ought to be. The traditional model is a reminder that this is only partially possible: the "distinction between an imperfect existence on earth and a perfect existence in the after-world", anachronistic as it may seem, is still strongly required not because we need to believe in the latter (a perfect existence in the after-world), but because we need to be reminded of the former (an imperfect existence on earth). Ideals, as Ortega Y Gasset had it, are aspirations, that only very imperfectly we may attempt to fulfil.

References

Austin, J.L. (1962). *How to do things with words*. Oxford: Clarendon.

Berzonsky, M.D. (2005). Ego identity: A personal standpoint in a postmodern world. *Identity, 5*(2), 125–136.

Butler, J. (1990). *Gender trouble. Feminism and the subversion of identity*. New York: Routledge.

Butler, J. (1997). *Excitable speech. A politics of the performative*. New York/London: Routledge.

Côté, J.A., & Levine, C. (1987). A Formulation of Erikson's Theory of Ego identity Formation. *Developmental Review*. 7, 273–325.

de Tocqueville, A. (2010). *Democracy in America: Historical-Critical Edition of De la démocratie en Amérique*. Indianapolis: Liberty Fund.

Erikson, E. (1968). *Identity. Youth and crisis*. New York/London: Norton & Co.

Hermans, H., & Hermans-Konopka, A. (2010). *Dialogical self theory: Positioning and counter-positioning in a globalizing society*. Cambridge: Cambridge University Press.

Marcia, J.E. (1966). Development and validation of ego identity status. *Journal of Personality and Social Psychology, 3*, 551–558.

Marcia, J.E. (1980). Identity in adolescence. In J. Adelson (Ed.), *Handbook of adolescent psychology* (pp. 159–187). New York: Wiley.

Orsina, G. (2018). *La democrazia del narcisismo*. Padova: Marsilio.

Ortega y Gasset, J.O. (1993). *The revolt of the masses*. New York/London: WW Norton & Company.

Rattansi, A., & Phoenix, A. (2005). Rethinking youth identities: Modernist and postmodernist frameworks. *Identity, 5*(2), 97–123.

Searle, J.R. (1969). *Speech acts: An essay in the philosophy of language*. Cambridge: Cambridge University Press.

Part IV
Aesthetics Approaches

Chapter 9
A Bodily Take on Aesthetics: Performativity and Embodied Simulation

Vittorio Gallese

Abstract The notion of performativity is addressed from a neuroscientific perspective, connecting it to its underlying neural mechanisms, and to the production and reception of human cultural artifacts. The connection between action, perception and cognition and its bearing on the creation of fictional worlds and their aesthetic experience is framed within a multidisciplinary approach, as the expression of the so-called bio-cultural paradigm.

Keywords Aesthetics · Body · Embodied simulation · Experience · Mirror mechanisms · Motor cognition · Performativity · Reuse

9.1 Introduction

> "The individual is not a being but an act, and being is an individual as the agent of this act of individuation by which it shows itself and exists. Individuality is an aspect of generation, is explained by the genesis of a being, and consists in the perpetuation of this genesis." (G. Simondon 1964, p. 189)

The notion of performativity, virtually absent from the debate in contemporary philosophy of mind, as aptly put by Antonino Pennisi "is not a property limited to certain specific human skills, or to certain specific acts of language, or to accidental enrichment of creative intelligence. On the contrary, the executive and motor component of cognitive behavior should be considered intrinsic to the physiological functioning of the mind and equipped with self-generative power. [. . .] Under this perspective, cognition would be a mediated form of action, and not a relationship between an inner thought and behavior taking place in the outside world." (Pennisi and Falzone 2016, p. 11; see also Pennisi 2019).

V. Gallese (✉)
Department of Medicine and Surgery, Unit of Neuroscience, University of Parma, Parma, Italy

Department of Art History and Archeology, Columbia University, New York, NY, USA
e-mail: vittorio.gallese@unipr.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_9

Cognitive neuroscience has provided strong and compelling empirical evidence of the tight relation between action, perception and cognition (see Gallese 2000, 2009, 2014, 2016; Gallese et al. 2009; Gallese and Cuccio 2015).

This perspective, which emphasizes the sensorimotor nature of human cognition, offers many advantages: (1) It allows to frame human cognition within an evolutionary scenario, which privileges exaptation over adaptation, continuity over discontinuity, challenging 'deus-ex-machina-like' solutions, like abrupt genetic mutations (i.e., the 'syntax gene'); (2) It enables a comparative perspective, connecting human cognitive skills to their evolutionary antecedents in non-human primates; (3) As it will become soon clearer, it enables a new take on aesthetic experience, linking the production of cultural artifacts to their reception.

In the present essay, I approach performativity from a neuroscientific perspective, connecting it, on the one hand, to its underlying neural mechanisms, and, on the other, to the production and reception of human cultural artifacts. Before addressing the connection between action, perception and cognition and its bearing on the creation of fictional worlds and their aesthetic experience, I start by arguing in favor of a multidisciplinary approach to performativity, as expression of the so-called bio-cultural paradigm.

9.2 Neuroscience and the Bio-cultural Paradigm

All human beings share the same impulse to create images and narrate stories– and to behold and listen to them. This impulse can be considered as the expression of the human propensity to create parallel fictional worlds, likely first imagining them, then turning those fantasies into images, signs and words. Cognitive literary theorist Michele Cometa (2018) recently argued that fiction help us to live because it helps us to compensate for our finitude and related inadequacy at coping with the world's challenges.

A full understanding of the intimate relationship between what we designate as nature and culture requires a series of preliminary steps. First of all, it is important to frame humans and their cognitive life within their *Umwelt*. The philosopher John Dewey used the notion of 'transaction' to emphasize the necessity not to separate organism from environment, stating that "we are willing under hypothesis to treat all of [human] behavings, including his most advanced knowings, as activities not of himself alone, but as processes of the full situation organism-environment" (Dewey 1949–1952, p. 97).

Second, we should resist the temptation to draw a sharp line separating material from non-material culture. The psychologist James Gibson can be considered as an anticipator of the bio-cultural turn. In his seminal book *The Senses Considered as Perceptual Systems* (1966, p. 26), he wrote: "The 'natural' environment is often distinguished from the 'cultural' environment. As described here, there is no sharp division between them. Culture evolved out of natural opportunities. The cultural environment, however, is often divided into two parts, 'material culture' and 'non-material culture'. This is a seriously misleading distinction, for it seems to imply that language, tradition, art, music, law and religion are immaterial, insubstantial, or intangible, whereas tools, shelters, clothing, vehicles, and books are not. Symbols are taken to be profoundly different from things. [. . .] No symbol exists except it is realized in sound, projected light, mechanical contact, or the like."

Nowadays more and more scholars are questioning the rigid dichotomy separating culture from nature (see Wojciehowski and Gallese 2011, 2018), on the basis of the assumption that culture can be considered as an extension or outgrowth of the natural, that is, as the evolved capacity of human beings to develop and use instrumental intelligence. To paraphrase Helmuth Plessner (1928/1981), as human beings we are artificially natural and naturally artificial.

In this vein, culture can be described as a naturally evolved type of human cognitive technology. The French philosopher Gilbert Simondon (2001) argued that technology exceeds any narrow utilitarian purpose: as technology expands, it produces new relations between people and things, or between people and people, or between things and things. Technology is a network of relations: far from marking our alienation from the natural world, technology is what mediates between humankind and nature. This point has been recently reinstated by the cognitive archeologist Ian Hodder (2012) with the notion of 'entanglement', that is, the different ways humans and things relate to one another: humans depend on things, things depend on other things, things depend on humans, humans depend on humans. The notion of entanglement implies that humans and things are relationally produced.

According to the evolutionary framework, human cultural evolution can be conceived as a perpetually dynamic process of cognitive technological development, where the first prehistoric lithic tools and the iPhone 7 used to shoot feature movies, like the recent *Unsane* (2018) by Steven Soderberg, represent two different and temporally distinct expressions of the same technological dimension. What we currently designate as 'cultural artifacts' or 'works of art' constitute no exception to this perspective. The bio-cultural paradigm posits that any human technology is at the same time the expression of the human mind and of humans' bodily nature, as the latter scaffolds the former.

To put it in more radical terms, when we speak of nature and culture we are always dealing with two sides of the same coin. Nevertheless, the human mind and humans' bodily nature should be kept separate at the operational level, as they are best approached and studied from multiple perspectives, according to multiple methodologies, leading to correspondingly different levels and languages of description. The real challenge for the bio-cultural approach is to define bridge concepts and/or empirically test how to deconstruct, revise or even dissolve many of the conceptual tools we currently employ to discuss art, literature, and their reception.

Many scholars in the humanities are now incorporating bio-cultural information and conceptual models from the sciences and social sciences into their research, and thereby reshaping their disciplines. Meanwhile scientists, in the last decades have started exploring topics and issues that have been for ages the exclusive domain of study of various disciplines in the humanities.

What is the bearing of neuroscience to the bio-cultural paradigm? I think that cognitive neuroscience can provide new concepts bridging nature and culture, as it is well equipped to address the conceptualization of human culture, art, film and literature by investigating the brain-body mechanisms underpinning both the creative process and the reception of its outcomes. By studying the brain-body in relation to artistic expressions and their reception we can better understand the constitutive elements of aesthetic experience and the genesis of aesthetic concepts.

Indeed, if one considers human culture and nature as mutually interacting domains, any biological description of human cognitive/cultural traits is neither forced to surrender to deterministic innatism, nor to neglect historical and ethnological cultural diversity (Wojciehowski and Gallese 2011).

If science can abandon its delusion of explanatory self-sufficiency, it can greatly benefit from a trans-disciplinary dialogue and collaboration, which could bring to scientists' attention an enormous corpus of knowledge testifying the great cultural diversity and at the same time some universal principle presiding over the way human beings relate to reality through the lens of art and fiction (Wojchehowski and Gallese 2018). In the next section, I show how neuroscience can shed new light on the performative character of cognition.

9.3 Cognition and Performativity: Motor Cognition

Solid empirical evidence shows that the cortical motor system plays an important role in cognition (see Gallese et al. 2009; Gallese 2000, 2009, 2014, 2018). This new perspective on cognition was triggered by the neurophysiological exploration of the ventral premotor cortex and the posterior parietal cortex of macaque monkeys, showing that the cortical motor system is functionally organized in terms of *motor goals*. Premotor neurons map in motor terms the relationship between the agent and the object target of the motor act. Premotor neurons indeed are activated only if a particular type of effector-object relation (e.g. hand-object) is executed until the relation leads to a different motor outcome (e.g. to take possession of a piece of food, to throw it away, to break it, to bring it to the mouth, etc.) regardless of the effector employed, (see Rizzolatti, Fogassi and Gallese 2000), or of the movements the effector employs to interact with the object (Umiltà et al. 2008).

A further element of novelty about the cognitive properties of the cortical motor system concerns its role in perception: many motor neurons are indeed endowed with sensory properties. Several studies demonstrated that premotor and parietal areas contain motor neurons that also perceptually respond to visual, auditory and somatosensory inputs (see Rizzolatti and Gallese 1997; Fogassi et al. 1996; Rizzolatti et al. 2000). Altogether, these findings led to the formulation of the "Motor Cognition" hypothesis as a leading element for the emergence of social cognition (see Gallese et al. 2009; Gallese 2000, 2009, 2018). According to this hypothesis, cognitive abilities like the mapping of space and its perception, the perception of objects occupying our visual landscape, the hierarchical representation of action with respect to a distal goal, the detection of motor goals and action anticipation are possible because of the peculiar functional architecture of the motor system, organized in terms of goal-directed motor acts. The proper development of such functional architecture likely scaffolds more cognitively sophisticated social cognitive abilities.

The functionality of the motor system literally carves out a pragmatic *Umwelt*, dynamically surrounding our body. The profile of peripersonal space is not arbitrary: it maps and delimits a perceptual space expressing – and being constituted by – the motor potentialities of the body parts it surrounds. Manipulable objects are not only 3D shapes, but the potential target of intentional action and they are mapped as such by the cortical motor system. An important component of the perceptual experience of manipulable objects is determined, constrained, and ultimately constituted by the limits posed by what the body can potentially do with it (Fogassi et al. 1996; Rizzolatti et al. 1997). Recent evidence corroborates the contribution of action not only to shaping the way we interact with the world in the vicinity of our body, but also to bodily self-awareness. A recent study by Ardizzi and Ferri (2018) shows that interoceptive accuracy, likely reflecting more attentional resources allocated to internal self-related inputs, affects the extension of peripersonal space, which, as we have seen, is mapped according to motor coordinates.

The same motor circuits that control individuals' behavior within their environment also map distances, locations and objects in that very same environment, thus defining and shaping in motor terms their representational content. The way the visual world is represented by the motor system incorporates agents' idiosyncratic way to interact with it. To put it simply, the producer and repository of representational content is not the brain per se, but the brain-body, by means of its interactions with the world of which it is part.

I take these discoveries to be highly relevant to the bio-cultural paradigm and its research agenda, for they provide empirical support to recent theories advocating the necessity to consider the brain and the body when addressing human culture: Material Engagement Theory (see Malafouris 2004, 2013) constitutes a good example. According to Malafouris, we need to "reclaim the study of mind and its evolution from the detrimental influences of 'cognitivism', evolutionary psychology, and neo-Darwinism", arguing for "a continuity of action between brain, body, and culture and the primacy of material engagement" (Malafouris 2015, p. 352). Moreover, continues Malafouris, "the relation between brains, bodies, and things (in the broad sense of the relevant material environment, natural or artificial) is not one of representation, not even one of mere interaction. Instead, it is a transactional process of mutual constitution. It is only by understanding the different forms and properties of this transactional co-constitution that we will ever be able to understand the remarkable plasticity of the human mind." (Malafouris 2015, p. 354).

The discovery of mirror neurons in the brain of macaques (Gallese et al. 1996; Rizzolatti et al. 1996), and the subsequent discovery of mirror mechanisms in the human brain (see Gallese et al. 2004; Gallese 2007, 2014) revealed that a *direct* access to the meaning of others' behavior is available, a modality that is different from the explicit attribution of propositional attitudes: the appreciation of purpose doesn't need to exclusively rely on explicit propositional inference, as motor outcomes and motor intentions are part of the 'vocabulary' spoken by the motor system. In several occasions, we do not explicitly ascribe intentions to others; we simply detect them.

Mirror neurons shed light on a new empirically founded notion of intersubjectivity connoted first and foremost as intercorporeality – the mutual resonance of intentionally meaningful sensorimotor behaviors: it is possible to directly understand others' basic actions by means of the motor equivalence between what others do and what the observer can do. Thus, intercorporeality becomes the primordial source of knowledge that we have of others.

Empirical research demonstrated that the human brain is also endowed with mirror mechanisms in the domain of emotions and sensations: the very same nervous structures involved in the subjective experience of emotions and sensations are also active when such emotions and sensations are recognized in others. For example, witnessing someone expressing a given emotion (e.g. disgust, pain, etc.) or undergoing a given sensation (e.g. touch) recruits some of the viscero-motor (e.g., anterior insula) and sensori-motor (e.g., SII, ventral premotor cortex) brain areas activated when one experiences the same emotion (Wicker et al. 2003; Botvinick et al. 2005; Jackson et al. 2005) or sensation (Keysers et al. 2004; Blakemore et al. 2005; Ebisch et al. 2008), respectively. Other cortical regions, though, are exclusively recruited for one's own and not for others' emotions (Jabbi et al. 2008), or are activated for one's own tactile sensation, but are actually deactivated when observing someone else's being touched (Ebisch et al. 2011).

This empirical evidence shows the intrinsic and tight relationship connecting action, perception and cognition. Is there a common functional mechanism underpinning such connection? My suggested answer is positive: such mechanism does exist, it is what I refer to as embodied simulation.

9.4 Embodied Simulation and the Performative Quality of Perception and Imagination

The discovery of mirror neurons and mirror mechanisms boosted new interest in simulation theories, suggesting an embodied approach to simulation, which led me to propose the theory of Embodied Simulation (see Gallese 2003, 2005, 2007, 2014, 2016, 2017b). Embodied simulation theory posits that the mirror mechanisms underpin mental simulation processes primarily because brain and cognitive resources typically used for one purpose are reused for another purpose. For instance, the activation of parieto-premotor cortical networks, which typically serve the purpose of mapping and guiding the accomplishment of motor outcomes, also serve the purpose of attributing the same motor goals or motor intentions to others. The same holds for emotions and sensations. The activation of embodied simulation is the recall of the background bodily knowledge.

We recruit this knowledge in several different situations, as when witnessing others' actions, emotions and sensory experiences, when remembering past experiences, when planning future actions, when engaging in fictional experiences, and when comprehending linguistic descriptions of facts, actions, and events. Embodied simulation, among other things, aims to account for basic social interactions by means of a neurobiologically plausible and theoretically unitary framework.

These examples of dual activation patterns of the same brain circuits can be interpreted as the instantiation of neural "reuse" (Gallese 2008, 2011, 2014, 2016). The main argument of the reuse view is that all simulation type mindreading requires any resemblance of the mental states or processes between the simulator and the target to arise from the reuse of the simulator's own mental states or processes. At bottom it is mental reuse, not resemblance between target and simulator, to drive mindreading.

By neural reuse different brain areas participate in different functions through their dynamical engagement with different brain circuits. Furthermore, a given cognitive function can be supported by a variety of brain circuits; the newer in evolutionary term a cognitive function is, the wider is the brain circuit underpinning it (Anderson 2010). Neural reuse not only enables the cortical motor system to process and integrate perceptual stimuli, hence instantiating novel cognitive functions, but also sheds new light on the phylogenesis and ontogenesis of the vicarious experiences characterizing human intersubjectivity. Sensorimotor systems, originally evolved to guide our interactions with the world, once decoupled from the common final motor pathway and dynamically reconnected with other cortical areas, can be put into the service of newly acquired cognitive skills.

What about imagination? Mirror mechanisms are just one instantiation of ES: in this case the simulation process is triggered by a perception, like when observing someone performing an action, expressing an emotion, or undergoing a somato-sensory stimulation. However, embodied simulation can also occur when we imagine doing something or imagine perceiving something. When we imagine a visual scene, we activate the same cortical visual areas of our brain normally active when we do perceive the same visual scene. Similarly, mental motor imagery and real action both activate a common network of cortical and subcortical motor centers such as the primary motor cortex, the premotor cortex, the supplementary motor area (SMA), the basal ganglia and the cerebellum (for review, see Wojciehowski and Gallese 2011). A recent high-density EEG study showed that the brain circuits that inhibit action execution are partly the same as those that allow us to imagine to act (Angelini et al. 2015).

Thus, visual and motor mental imagery are not exclusively symbolic and propositional. They both rely on and depend upon the activation of sensory-motor brain regions. Visual imagery is somehow equivalent to simulating an actual visual experience, and motor imagery is somehow equivalent to simulating an actual motor experience. In other words, motor and visual imagery do qualify as further forms of ES. When indulging in visual or mental motor imagery we re-use our visual or motor neural apparatus to imagine things and situations we are not actually perceiving or doing.

When viewed from a neuroscientific perspective, the border separating real and fictional worlds appears much less sharp and clear than what humans thought for centuries. This aspect is particularly interesting when referred to the production of cultural artifacts and their fruition. The artist through her imaginative creativity gives birth to a fictional world that not only shares many features with the real one, but also some of the underpinning neural processes.

Our experience of the world is the outcome of multimodal integration processes, in which the motor system is one of the key players. The multimodal integration of what we perceive is triggered by the potentiality for action we express corporeally. We build non-verbal maps of our surrounding space, and we have similar non-verbal relationships with objects, things and other human beings, both when factually perceived or only imagined, using the functional base mechanism of embodied simulation. The pivotal motor aspects of our bodily-self integrate and anchor to a bodily first-person perspective the multimodal sensory information about the body and about the world with which it interacts (Gallese 2009, 2014, 2016). We are open to the world because of the motor potentialities our bodily nature entails. The way the perceptual world is mapped by the motor system incorporates agents' idiosyncratic ways of interacting with it.

In conclusion, the reviewed evidence seems to suggest that several important aspects of human cognition share a performative character, that is, they qualify as mediated forms of action.

9.5 Embodied Simulation, Performativity and Aesthetics

What can neuroscience tell us about Aesthetics and its experience? At the time when brain imaging is pervasively used to study the human brain, I see rather problematic to look for a 1:1 mapping between the concepts employed to describe aesthetic concepts and their supposed location in the brain. The sub-personal level of description provided by neuroscience is necessary but not sufficient to understand human cognition and aesthetic experience. To make sense of cognition and aesthetic experience we need to study the brain, the body, their relationship with the world and with the brain-body of others (Gallese 2014, 2016, 2017b; Gallese and Cuccio 2015).

Cognitive neuroscience is currently empirically investigating art and aesthetics using different approaches to address a number of different issues and questions: (1) To use artistic expressions to understand how the brain works; (2) To localize in the brain –and/or reduce to its functioning– aesthetic concepts like beauty or the sublime; (3) To study the brain to explain art; (4) To study the brain-body in relation to artistic expressions, to understand the constitutive elements of aesthetic experience and the genesis of aesthetic concepts. I have proposed that neuroscience can be highly relevant to address the experience of film and art, particularly if spelled out as in the last point (Gallese 2017a; Gallese and Guerra 2015).

As we have seen in the previous section, the neurobiological mechanisms interfacing us with the 'real world,' largely overlap with those acting when we imagine fictional worlds both through images and words. Indeed, also when we read or listen to narratives we literally embody them by activating a substantial part of our sensory-motor system. The activation of motor representations in the brain of the reader or listener has been demonstrated at the phono-articulatory level, as well as during the processing of action-related linguistic expressions (words and sentences) and of morpho-syntactical aspects of language (for review, see Pulvermüller 2005; Gallese 2008; Glenberg and Gallese 2012). This evidence, although widely discussed, points to a causal role of embodied simulation in language processing and understanding.

Hence, embodied simulation theory can be used both to account for how we perceive the world and how we imagine it, or build a world of fiction and experience it. Basically, my hypothesis is that the world of cultural artifacts is 'felt' not too differently from how we feel the more prosaic world of our daily life. We feel for and empathize with fictional images and characters in ways that are similar to how we feel for our real social partners, although with qualifying differences.

A further element pointing to the crucial role played by performativity in cultural evolution is the connection between utilitarian behaviors and the 'invention' of cultural artifacts, through the process of 'ritualization'. Ritualization, if spelled out in zoological terms, refers to the evolutionary process by which an action or behavior pattern in an animal loses its original function but is retained for its role in display or other social interaction. I submit that the ritualization of utilitarian behaviors might have sparked the creation, development and evolution of what today we designate –broadly speaking– as cultural artifacts (see Turner, 1982). As pointed put by Catherine Bell, "Since ritual acknowledges powers beyond the invention of the community and implies correct and incorrect relations with these powers, it is often more likely to generate a social consensus about things. [. . .] Activities that are so physical, aesthetic, and established appear to play a particularly powerful role in shaping human sensibility and imagination." (2009, p. 137). The ritualization of shared social practices affects and colonizes the life style and the imaginary world of a given social community. Shortly, through the repetition, combination and memorization of particular shared behaviors and actions, the social group infuses new cultural meanings into reused bodily performances.

The emphasis on the constructive, performative character of aesthetic experience is by no means new. In the second half of the XIX century authors like Adolf von Hildebrand (1893) maintained that when beholding (artistic) images, the perception of the spatiality of the image is the result of a constructive sensory-motor process. In Hildebrand's view, space is a product and not *a priori* of experience as Kant suggests: the reality of the artistic image lies in its effectual nature, conceived as both the result of the causes that produced it and as the effect that it produces in the observer.

According to this constructivist logic, the value of a work of art also lies in the ability to establish a relationship between the artist's intention and the observer's reconstruction of it, thus establishing a direct relationship between the creation of the object and the artistic pleasure it produces. Hildebrand proposed that knowing the object is equivalent to knowing the process by which it has been created. Another of Hildebrand's ideas is even more in line with the theory being proposed here: our experience of observed images has fundamental connotations in motor terms (see Freedberg and Gallese 2007; Gallese 2011, 2012, 2017a; Gallese and Guerra 2015). This has indeed been confirmed by a series of experiments carried out in my lab: observing letters of the Roman alphabet, Chinese ideograms or a meaningless scribbles, all written by hand, activates the beholders' motor representation of their hand (Heimann et al. 2013). In two other studies we demonstrated that a similar motor simulation of hand gestures is evoked when looking at the cuts on canvas by Lucio Fontana (Umiltà et al. 2012), or at the dynamic brushstrokes on canvas by Franz Kline (Sbriscia-Fioretti et al. 2013).

The visible traces of the creative gestures activate in the observer the specific motor areas controlling the execution of the same gestures. Beholders' eyes catch not only information about the shape, direction and texture of the cuts or strokes; by means of embodied simulation they breach into the actual motor expression of the artist when creating the artwork. The sensory-motor component of image perception, together with the jointly-evoked sensory and emotional reactions, allow beholders to feel the artwork in an embodied manner (Gallese 2017a).

In a recent study (Ardizzi et al. 2018), we explored whether beholders' sensorimotor engagement with the emotional content of works of art contributes to the formation of their objective aesthetic judgment of beauty. To this purpose, participants' sensorimotor engagement was modulated by asking them to overtly contract the Corrugator Supercilii facial muscles or to refrain from any voluntary facial movement, while judging the aesthetic value of painful and neutral facial expressions in selected examples of Renaissance and Baroque paintings. Results demonstrated a specific increase in the explicit rating of aesthetic beauty of paintings showing painful facial expressions during the congruent activation of the Corrugator Supercilii muscles. Furthermore, participants' empathetic traits and expertise in art were found to correlate directly with the amplitude of the motor enactment effect on aesthetic judgments. These results suggest that performativity not only affects the empathic engagement with works of art, but also their explicit aesthetic judgment.

9.6 Embodied Simulation and Aesthetic Specificity

So far, I emphasized the similarity between our responses to real and fictional events. It should be added that this similarity transpires even at the level of single neurons. A recent study by Caggiano et al. (2011) showed that macaques' mirror neurons respond to both the observation of real actions performed by the experimenter physically present in front of them, and to their filmed footage displayed on a computer screen.

However, a strong argument against the hypothesized role of embodied simulation in aesthetic experience is the fact that humans can draw a clear difference between fiction and reality. We respond differently to imagined and real scenarios: no one rushes out of the movie theatre in panic after watching a house on fire on the movie screen. The same applies to the literary world of fiction: we weep for Anna Karenina, while being aware she doesn't exist.

All these examples are telling us that there is something distinctive of our response to fiction. What might that be? A possible solution to this conundrum is offered by the hypothesis of 'liberated embodied simulation.' According to this hypothesis, embodied simulation generates the specific attitude informing our aesthetic experience of fictional worlds, because of the potentiation of the mirroring mechanisms that they activate (Gallese 2011, 2012; Wojciehowski and Gallese 2011). Such potentiation likely boosts the bodily memories and imaginative associations that fictional content awakes in our minds, and thus provides the specific character of its reception. How is such potentiation achieved? One important context-dependent aspect characterizing our relationship to fictional worlds deals with our distancing from the unrelated external world, which remains at the periphery of our attentional focus. Such distancing, this temporary suspension of the active grip on our daily occupations, liberates new simulative energies.

When beholding a painting, reading a novel, or watching a film, we distance ourselves from the "everyday" context. By adopting such an attitude, our embodied simulation becomes "liberated"—that is, it is freed from the burden of modeling our actual psychophysical presence in daily life; hence, new simulative energies are liberated. The specific and particularly moving experience generated when relating to the world of fiction is enhanced by the sense of safe intimacy with a world we not only imagine, but also literally embody with augmented intensity. Furthermore, when engaged with fictional narratives, the contextual bodily framing—our being still—additionally boosts our embodied simulation. Being forced to inaction, we are more open to feelings and emotions. When relating to fictional worlds, our attitude toward their content can be characterized as a sort of "neotenic look" (Gallese 2017b). This is similar to the way we look at the world during the early period of our development, in which, because of our poor motor autonomy, our interactions with the world are mainly mediated by the embodied simulation of events, actions, and emotions animating our social landscape. We probably learn to calibrate gestures and expressions and to match them with experiences of pleasure/displeasure, while observing them in others, thanks to embodied simulation and its plasticity.

When we temporarily inhabit fictional worlds, our relative immobility is the outcome of a deliberate decision on our part. However, immobility, that is, a greater degree of motor inhibition, likely allows us to allocate more neural resources to the task at hand, intensifying the activation of embodied simulation and, in so doing, making us adhere more intensely to what we are simulating. This, in turn, helps strengthen our empathic engagement. Curiously enough, some of the most vivid fictional experiences we entertain, such as those occurring within dreams, are paralleled by the massive inhibition of the muscle tone in our body.

A final point is in order to answer another potential argument against embodied simulation in relation to aesthetics: its putative stereotyped, reflex-like quality, supposedly failing to capture the diversity of cultural expression and of its reception. The culturally diverse artistic styles and genres can be equated to different mindsets, each presupposing specific rules, mappings and their related bodily images and behaviors. However, each of this supposedly different mind sets share a great deal of underpinning neurobiological mechanisms. For example, according to René Girard (2002), comedy and tragedy show, at bottom, a common mimetic scheme: laughter and tears share the same propensity to put the body into play to expel from it, and cathartically remove the mimetic conflict pattern, which is at the center of both the comic theater and the tragic one. It is no coincidence, Girard says, that laughter is most evoked by tickling, a bodily practice that simulates an attack on the other's body. Comedy thus becomes an "intellectual tickle" that puts us in a position to witness the eternal conflictual reciprocity of our species, ritualized in the mimetic scheme intrinsic to the comic genre.

Finally, and most importantly, mirroring mechanisms and embodied simulation are not stereotyped and undifferentiated responses. They are both context-dependent and idiosyncratically linked to individuals' personal historical, social and biological identity. The political and ethical impact of all cultural artifacts clearly depend upon how these modulating factors affect the bodily responses they trigger. In our response to cultural artifacts there is always a projective quality, related to how our personal life history determined the development of our embodied cognition, as the latter is the outcome of our bodily habits and implicit memories (Gallese and Guerra 2015). Each of us, to a certain degree simulates a given fictional content in a very specific way. Indeed, the more we consider inter-individual diversity, the more we understand how differently people relate to the world of fiction.

The bio-cultural search for supposed universal mechanisms enabling the way we experience cultural artifacts does not imply, let alone posit, cultural homogeneity. I submit that the same neurobiological mechanisms be at stake in every culture. However, we speak of different cultures or of different responses within the same culture, precisely because these mechanisms are plastic (see Malafouris 2015) and bear the mark of each individual's personal identity, thus leading to personalized forms of embodiment.

Acknowledgments This work was supported by Maria Paola Chiesi and by the PRIN grant on Perception, Performativity and the Cognitive Sciences.

References

Anderson, M.L. (2010). Neural reuse: A fundamental reorganizing principle of the brain. *Behavioral Brain Sciences, 33*(4), 245–266.

Angelini, M., Calbi, M., Ferrari, A., Sbriscia-Fioretti, B., Franca, M., Gallese, V., & Umiltà, M.A. (2015). Motor inhibition during overt and covert actions: An electrical neuroimaging study. *PLoS One, 10*(5), e0126800.

Ardizzi, M., & Ferri, F. (2018). Interoceptive influence on peripersonal space boundary. *Cognition, 177*, 79–86.

Ardizzi, M., Ferroni, F., Siri, F., Umiltà, M.A., Cotti, A., Calbi, M., Fadda, E., Freedberg, D., & Gallese, V. (2018). Beholders' sensorimotor engagement enhances aesthetic rating of pictorial facial expressions of pain. *Psychological Research*, (Aug 3). [Epub ahead of print].

Bell, C. (2009). *Ritual: Perspectives and dimensions*. Oxford: Oxford University Press.

Blakemore, S.J., Bristow, D., Bird, G., Frith, C., & Ward, J. (2005). Somatosensory activations during the observation of touch and a case of vision–touch synaesthesia. *Brain, 128*, 1571–1583.

Botvinick, M., Jha, A.P., Bylsma, L. M., Fabian, S.A., Solomon, P.E., & Prkachin, K.M. (2005). Viewing facial expressions of pain engages cortical areas involved in the direct experience of pain. *NeuroImage, 25*, 315–319.

Caggiano, V., Fogassi, L., Rizzolatti, G., Pomper, J.K., Thier, P., Giese, M.A., & Casile, A. (2011). View-based encoding of actions in mirror neurons of area f5 in macaque premotor cortex. *Current Biology, 21*(2), 144–148.

Cometa, M. (2018). *Perchè le Storie ci Aiutano a Vivere. La letteratura Necessaria*. Milano: Raffaello Cortina Editore.

Dewey, J. (1989). Knowing and the known. In *The later works, 1925–1953, vol. 16, 1949–1952*. Carbondale: Southern Illinois University Press.

Ebisch, S.J.H., Perrucci, M.G., Ferretti, A., Del Gratta, C., Romani, G.L., & Gallese, V. (2008). The sense of touch: Embodied simulation in a visuo-tactile mirroring mechanism for the sight of any touch. *Journal of Cognitive Neuroscience, 20*, 1611–1623.

Ebisch, S.J.H., Ferri, F., Salone, A., d'Amico, L., Perrucci, M.G., Ferro, F.M., Romani, G.L., & Gallese, V. (2011). Differential involvement of somatosensory and interoceptive cortices during the observation of affective touch. *Journal of Cognitive Neuroscience, 23*(7), 1808–1822.

Fogassi, L., Gallese, V., Fadiga, L., Luppino, G., Matelli, M., & Rizzolatti, G. (1996). Coding of peripersonal space in inferior premotor cortex (area F4). *Journal of Neurophysiology, 76*(1), 141–157.

Freedberg, D., & Gallese, V. (2007). Motion, emotion and empathy in esthetic experience. *Trends in Cognitive Sciences, 11*, 197–203.

Gallese, V. (2000). The inner sense of action: Agency and motor representations. *Journal of Consciousness Studies, 7*, 23–40.

Gallese, V. (2003). The manifold nature of interpersonal relations: The quest for a common mechanism. *Philosophical Transactions of the Royal Society of London B, 358*, 517–528.

Gallese, V. (2005). Embodied simulation: From neurons to phenomenal experience. *Phenomenology and the Cognitive Sciences, 4*, 23–48.

Gallese, V. (2007). Before and below theory of mind: Embodied simulation and the neural correlates of social cognition. *Philosophical Transactions of the Royal Society of London B, 362*, 659–669.

Gallese, V. (2008). Mirror neurons and the social nature of language: The neural exploitation hypothesis. *Social Neuroscience, 3*, 317–333.

Gallese, V. (2009). Motor abstraction: A neuroscientific account of how action goals and intentions are mapped and understood. *Psychological Research, 73*(4), 486–498.

Gallese, V. (2011). Embodied simulation theory: Imagination and memory. *Neuropsychoanalysis, 13*(2), 196–200.

Gallese, V. (2012). Aby Warburg and the dialogue among aesthetics, biology and physiology. *Ph, 2*, 48–62.
Gallese, V. (2014). Bodily selves in relation: Embodied simulation as second-person perspective on intersubjectivity. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences, 369*, 20130177, published 28 April 2014.
Gallese, V. (2016). Finding the body in the brain. From simulation theory to embodied simulation. In H. Kornblith & B. McLaughlin (Eds.), *Alvin Goldman and his critics* (pp. 297–317). New York: Blackwell.
Gallese, V. (2017a). Visions of the body: Embodied simulation and aesthetic experience. *Aisthesis, 1*(1), 41–50.
Gallese, V. (2017b). Neoteny and social cognition: A Neuroscientific perspective on embodiment. In C. Durt, T. Fuchs, & C. Tewes (Eds.), *Embodiment, Enaction and culture. Investigating the constitution of the shared world* (pp. 309–332). Boston: MIT Press.
Gallese, V. (2018). *Embodied simulation and its role in cognition*. Reti, Saperi, Linguaggi, in press.
Gallese, V., & Cuccio, V. (2015). The paradigmatic body. Embodied simulation, intersubjectivity and the bodily self. In T. Metzinger & J.M. Windt (Eds.), *Open MIND* (pp. 1–23). Frankfurt: MIND Group.
Gallese, V., & Guerra, M. (2015). *Lo Schermo Empatico: Cinema e Neuroscienze*. Milan: Raffaello Cortina Editore.
Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain, 119*, 593–609.
Gallese, V., Keysers, C., & Rizzolatti, G. (2004). A unifying view of the basis of social cognition. *Trends in Cognitive Sciences, 8*, 396–403.
Gallese, V., Rochat, M., Cossu, G., & Sinigaglia, C. (2009). Motor cognition and its role in the phylogeny and ontogeny of action understanding. *Developmental Psychology, 45*, 103–113.
Gibson, J.J. (1966). *The senses considered as perceptual systems*. Boston: Houghton Mifflin.
Girard, R. (2002). *La Voix méconnue du reel*. Paris: Grasset.
Glenberg, A., & Gallese, V. (2012). Action-based language: A theory of language acquisition production and comprehension. *Cortex, 48*(7), 905–922.
Heimann, K., Umiltà, M.A., & Gallese, V. (2013). How the motor-cortex distinguishes among letters, unknown symbols and scribbles. A high density EEG study. *Neuropsychologia, 51*, 2833–2840.
Hildebrand, V.A. (1893). *Das Problem der Form in der Bildenden Kunst*. Strasbourg: Heitz.
Hodder, I. (2012). *Entangled: An archaeology of the relationships between humans and things*. Oxford: Wiley Blackwell.
Jabbi, M., Bastiaansen, J., & Keysers, C. (2008). A common anterior insula representation of disgust observation, experience and imagination shows divergent functional connectivity pathways. *PLoS One, 3*(8), e2939.
Jackson, P.L., Meltzoff, A.N., & Decety, J. (2005). How do we perceive the pain of others: A window into the neural processes involved in empathy. *NeuroImage, 24*, 771–779.
Keysers, C., Wicker, B., Gazzola, V., Anton, J.-L., Fogassi, L., & Gallese, V. (2004). A touching sight: SII/PV activation during the observation and experience of touch. *Neuron, 42*, 335–346.
Malafouris, L. (2004). The cognitive basis of material engagement: Where brain, body and culture conflate. In E. DeMarrais, C. Gosden, & C. Renfrew (Eds.), *Rethinking materiality: The engagement of mind with the material world* (pp. 53–62). Cambridge: McDonald Institute for Archaeological Research.
Malafouris, L. (2013). *How things shape the mind: A theory of material engagement*. Cambridge, MA: The MIT Press.
Malafouris, L. (2015). Metaplasticity and the primacy of material engagement. *Time and Mind, 8*(15), 351–371.
Pennisi, A. (2019). Dimensions of the bodily creativity. For an extended theory of performativity. In A. Pennisi, & A. Falzone (Eds.), *The Extended Theory of Cognitive Creativity* (Perspectives in Pragmatics, Philosophy & Psychology, Vol. 23). Cham: Springer.

Pennisi, A., & Falzone, A. (2016). *Darwinian biolinguistics. Theory and history of a naturalistic philosophy of language and pragmatics*. Cham: Springer International Publishing.

Plessner, H. (1928/1981) *Die Stufen des Organischen und der Mensch. Einleitung in die philosophische Anthropologie*, vol. 4 of his Gesammelte Schriften, Frankfurt am Main: Suhrkamp.

Pulvermüller, F. (2005). Brain mechanisms linking language and action. *Nature Reviews Neuroscience, 6*(7), 576–582.

Rizzolatti, G., & Gallese, V. (1997). From action to meaning. In J.-L. Petit (Ed.), *Les Neurosciences et la Philosophie de l'Action* (pp. 217–229). Paris: Librairie Philosophique J. Vrin.

Rizzolatti, G., Fadiga, L., Gallese, V., & Fogassi, L. (1996). Premotor cortex and the recognition of motor actions. *Cognitive Brain Research, 3*, 131–141.

Rizzolatti, G., Fadiga, L., Fogassi, L., & Gallese, V. (1997). The space around us. *Science, 277*(5323), 190–191.

Rizzolatti, G., Fogassi, L., & Gallese, V. (2000). Cortical mechanisms subserving object grasping and action recognition: A new view on the cortical motor functions. In in chief Gazzaniga, M.S. (Ed.), *The new cognitive neurosciences* (2nd ed., pp. 539–552). Cambridge, MA: A Bradford Book, MIT Press.

Sbriscia-Fioretti, B., Berchio, C., Freedberg, D., Gallese, V., & Umiltà, M.A. (2013). ERP modulation during observation of abstract paintings by Franz Kline. *PLoS One, 8*(10), e75241.

Simondon, G. (1964). *L'Individu et sa genèse physico-biologique: L'individuation à la lumière des notions de forme et d'information*. Paris: Presses Universitaires de France.

Simondon, G. (2001). *Du Mode d'Existence des Objets Techniques*. Paris: Aubier.

Turner, V. (1982). *From ritual to theatre. The seriousness of human play*. New York: PAJ Publications.

Umiltà, M.A., Escola, L., Intskirveli, I., Grammont, F., Rochat, M., Caruana, F., Jezzini, A., Gallese, V., & Rizzolatti, G. (2008). How pliers become fingers in the monkey motor system. *PNAS, 105*, 2209–2213.

Umiltà, M.A., Berchio, C., Sestito, M., Freedberg, D., & Gallese, V. (2012). Abstract art and cortical motor activation: An EEG study. *Frontiers in Human Neuroscience, 6*, 311.

Wicker, B., Keysers, C., Plailly, J., Royet, J.-P., Gallese, V., & Rizzolatti, G. (2003). Both of us disgusted in my insula: The common neural basis of seeing and feeling disgust. *Neuron, 40*, 655–664.

Wojciehowski, H.C., & Gallese, V. (2011). How stories make us feel. Toward an embodied narratology. *California Italian Studies, 2*(1).

Wojciehowski, H.C., & Gallese, V. (2018). Introduction. *Costellazioni: Rivista di lingue e letterature, 5*, 9–22.

Chapter 10
Imagination, Performativity, Technics. A (Post)Kantian Approach

Pietro Montani

Abstract In the present paper, I propose to rebuild and develop the concept of «Technical Schematism» presented by Kant (First introduction to the critique of the power of judgment. In: Guyer P, Wood A (eds) Critique of the pure reason. Cambridge University Press, Cambridge, 2000c) in the first *Introduction* to his *Critique of the Power of Judgment* [1790]. With this concept Kant designates a transcendental principle of a new type, endowed with a high epistemological interest. In fact, although it does not determine anything about nature, it sheds light on the analogical (or abductive) procedure by which the faculty of judgment organizes and extends the empirical experience. I will show, in particular, that the concept of «Technical Schematism» contains precious indications for: (i) consistently confront the issue of the performativity implied in the human praxis; (ii) profitably connect it with the issue of technics; (iii) open a promising perspective, in order to refer both performativity and technics to the cognitive (or denotative) function of language.

Keywords Imagination · Schematism · Perception · Analogy · Language

10.1 Schematism and the Synthetic Character of Experience

In the present paper, I aim at showing that the philosophical paradigm elaborated by Immanuel Kant in his Three Critiques, in particular the concept of Schematism, can still give precious indications for: (i) consistently confront the issue of the performativity implied in the human praxis; (ii) profitably connect it with the issue

P. Montani (✉)
Sapienza University of Rome, Rome, Italy

Vilnius University, Vilnius, Lithuania
e-mail: pietro.montani@uniroma1.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_10

of technics; (iii) open a promising perspective, in order to refer both performativity and technics to the cognitive (or denotative) function of language.[1]

Accordingly, I shall start by some considerations concerning the issue of the *Schematism*, as this is presented by Kant (2000a) in the *Critique of Pure Reason*. Then, I shall extend the discussion to the *Critique of the Power of Judgment* (Kant 2000b). Finally, I shall argue that Schematism – a fundamental performance carried on by imagination – can, and indeed should be referred to the field of technics, thanks to the significant definition of *«technique of nature»* Kant adopted in the *First Introduction* to the *Critique of the Power of Judgment* (Kant 2000c), but abandoned later on. Arguably, he neglected only the definition, not the related idea. This definition is meaningful, at least because of allowing us to recognize the insightful relation existing between two problems of primary importance. Firstly, we find the problem of aesthetics: its status as critical reflection, which concerns our sensitivity and imagination, appears as being of considerable import and accordingly, is to be rethought as a *techno-aesthetics*.[2] Secondly, we find the problem of the relation between imagination, performativity and perception on one side, and understanding and language on the other – perception and language will be considered here as active processes. In the latter case, however, it will be necessary to go beyond Kant.

In addition to what I just said, the Kantian Critical Philosophy furnishes us a highly seminal paradigm for adequately confronting the phenomenon of the increasing penetration of technological proxy into the organization of our experience and forms of life. I particularly think to those proxy I called elsewhere «technologies of sensitivity», and to their meaning for what Kant defined as «common sense»[3]: a sense shared by all human beings associated in communities.

I assume here that some of the premises to my argument are largely uncontroversial. Accordingly, I shall present them only sketchily, using formulations which could sound divergent from the literal sense of some of the key notions used by Kant. The first one of these premises outlines the fact that the issue concerning *Schematism* is the pivot of Kant's Critical Philosophy. As a matter of fact, the task of this way of thinking requires nothing less than the attempt of explaining the *synthetic* character of the human knowledge – I say "human" because the prima facie evidence is that it is a species-specific feature. In other words, I mean that while dealing with the objects of experience at a cognitive and performative level, we, the humans, add them something (rules and concepts) which cannot be empirically extracted from these very objects, although the former are objective properties of latter in all respects.

[1] In this philosophical statement, I am faithful to the teachings of Emilio Garroni (1977, 2005, 2010) who devoted several innovative and seminal studies to Kant. Among the most recent and notable interpretations which update Kant's Critical Philosophy, I must mention at least: Palmer (2008, 2018) and Malabou (2016).

[2] Notably, the formulation of «techno-aesthetics» was introduced by Simondon (2014), in a letter addressed but never sent to Jacques Derrida in 1982. I use this concept, in a theoretical acceptation largely independent from Simondon's philosophy of technics.

[3] As far as this issue is concerned see Montani (2007, 2014, 2017, 2018).

The second premise is concerned with the fact that Kant never stops reconsidering the issue of Schematism, in a quest for a (never ultimate) settlement of the instances so bound together: intuition, imagination and understanding. In particular, the most significant oscillation concerns the role arguably played by imagination. Notoriously,[4] this reconsideration has already taken place in the First Critique but is more decisively accomplished only within an aesthetics, that is, within a doctrine of intuition, sensitivity and the common sense, as that one developed in the Third Critique (Kant 2000b).

One point is never changing, however: a synthetic action is imputed to imagination, and this action is *pre-intellectual* – or at any rate, it is *different* from that one granted by understanding, its function consisting in *preparing*, so to say, the whole of the empirical data recorded by intuition to the cognitive unification exclusively granted by understanding, thanks to the interaction of these data with a conceptual rule which Kant significantly calls *Bedeutung*: this is an *objectual meaning*, which can be expressed by a corresponding linguistic meaning. However, it is still undetermined how this specific synthesis, which imagination is likely to realize autonomously, should be meant. As a matter of fact, Kant leaves undetermined the fact that this is really a synthesis, that is, the addition of some regularity (although not of conceptual kind) to the intuited manifold.[5]

In the First Critique, Kant offers many definitions of the synthesis supplied by the imagination. At least one of the most notable should be quoted in its integrity. We find it in § 10 of the *Transcendental Logic*:

> Transcendental logic, on the contrary, has a manifold of sensibility that lies before it *a priori*, which the transcendental aesthetics has offered to it, in order to provide the pure concepts of the understanding with a matter, without which they would be without any content, thus completely empty. (...) Only the spontaneity of our thought requires (*erfordert*) that this manifold *first* (*zuerst*) be gone through, taken up, and combined (*durchgegangen, aufgenommen und verbunden*) in a certain way in order for a cognition to be made out of it. I call this action (*diese Handlung*) synthesis. (Kant 2000a, 201)[6]

[4]I cannot discuss here the reasons which could lead Kant (2000a) to substantially change the Section devoted to the *Deduction of the pure concepts of understanding*, and completely rewrite it for the Second Edition of the *Critique of Pure Reason*. On this point, the interpretation Martin Heidegger gave in *Kant and the Problem of Metaphysics* (Heidegger 1997) is still fundamental.

[5]I limit to highlight the emergence of a decisive temporal issue inside the process imagination is engaged in, in the course of the activity of schematizing. By speaking of a «pre-intellectual» synthesis, one suggests indeed that we are in presence of a linear conception of time (imagination *before*, *then* understanding). However, although this conception is consistent with that one explicitly adopted by Kant, it does not correspond to his way of conceiving the original temporal condition of imagination. I shall come back to this question.

[6]In this passage, I have highlighted the adverb «first» (*zuerst*), in order to restate, in accordance with what I said above, that Kant argues here a sequential conception of time, apparently non problematic, as if in this phase, imagination could be considered as acting without making any reference to the instance of the understanding, which would appear only later on. In Kant (2000b) we shall see how far this way of exposing the question needs to be more adequately reformulated.

What does realize this synthesis? Imagination. What is the sense of the three imaginative operations – go through, take up, and combine – Kant outlines? I argue that a really synthetic operation is imputed here to imagination, although as a synthesis, it is *qualitatively different* from that one supplied by the understanding, or in which, as states Kant, at any rate, understanding is to produce some «effect»», rather than barely preliminary to it. My argument is that this imaginative synthesis can be understood *only* if we think to it as an activity of which the goal is the *recognition or production of a technical artifact*. Therefore, and ultimately, this synthesis is to be thought as a *performative* activity, in the sense that it corresponds to an ongoing praxis. More specifically, it is an *adaptive* praxis fundamental to the human being.

Here it is my third premise. One of the innovative aspects in Kant (2000b) consists in the fact that he uses now the concept of «aesthetics», according to a different acceptation than in the *Transcendental Aesthetics* of the First Critique. The principal difference lies in the fact that in this new formulation, sensitivity works in close contact with imagination. In turn, the latter is in a new relation to understanding. To define this relation, Kant coins the celebrated formulation of the «free play». In view of what is this formulation meant?

I believe that a good answer could be the following: Kant's formulation fulfills the need for a better definition of the synthetic activity of imagination which has been referred to the operations of going through, taking up, and combining. This answer puts an end to the idea that this synthesis is pre-intellectual, in every sense of the word, as I suggested above. Of this action, indeed, no one could argue that it is *pre*-intellectual because, although it does not determine anything at a conceptual level, it happens nevertheless *in the presence of understanding*. This is what Kant aims at arguing when he speaks of a «schematizing without concept». This formulation is particularly daring, and I am to come back on it. Kant refers this operation to the relation of imagination to understanding exemplarily exhibited in the pure judgments of taste: namely, the judgments by which we state that something is beautiful. In other words, the representation of the object has no other function here, than that of ratify and feed the «free play of imagination and understanding»:

> Since the freedom of imagination consists precisely in the fact that it schematizes without a concept, the judgment of taste must rest on a mere sensation of the reciprocally animating imagination in its freedom and the understanding with its lawfulness. (Kant 2000b, 167)

A question arises here: what leads this «schematizing without concept» in the work of exploration of the empirical data, in the perspective of possible syntheses? The answer to this question is the keystone of the entire third Critique. Kant defines, in facts, the principle which triggers the free play of imagination and understanding as the idea of «purposiveness of nature» (*Zweckmässigkeit der Natur*). He also clarifies that it consists in nothing of objective but only in an analogical prerequisite, that is, a *simulation* with a heuristic purpose that the reflecting faculty of judgment gives to itself.

We must still discuss the fact that in the «free play», it is the autonomy of imagination that leads the action: it explores the empirical data *as if* these could correspond to an indeterminate finalistic order – but in the earlier formulation, as we shall see in a few moments, Kant spoke of a *technical order*. However, imagination fulfills this function without recurring to determinate concepts, but only against the background of an indeterminate conformity to laws. Nonetheless, this solution to the problem does not answer yet the question whether in the free exploration of imagination, an event of synthetic character happens in the full sense of the word: namely, whether the addition of a rule is realized. Furthermore it does not answer the question concerning what kind of synthesis, and of «rule», is.

I come now, at last, to the point to be developed in the second part of this paper. It is extremely meaningful that in the original formulation presented in Kant (2000c), he defined the leading principle of the faculty of judging as the idea of a «technique of nature». And he added that on the basis of this idea, imagination schematizes in a technical way, that is, «artistic» or «artificial», (*künstlich*). The reference to the word *Kunst* is to be understood in a broad sense, i.e. exactly as a *technique*, and seems to strengthen and clarify what Kant had already said in the celebrated formulation of the *Critique of Pure Reason* where Schematism was defined as an art, and its action as a *Handgriff*, «handlings», «manipulations».[7]

Here it is the passage in question from the *First Introduction* to the Third Critique:

> The reflecting power of judgment thus proceeds with given appearances, in order to bring them under empirical concepts of determinate natural things, not schematically, but *technically*, not as if it were merely mechanically, like an instrument, but *artistically*, in accordance with the general but at the same time indeterminate principle of a purposive arrangement of nature in a system, as it were for the benefit of our power of judgment (. . .). Thus the [reflecting] power of judgment itself makes the *technique of nature* into the principle of its reflection *a priori*. (Kant 2000c, 17)

Before concluding this section devoted to the exposition of the premises, I must vindicate the slight terminological stretch by which I emphasized the presence of a *hand* (*Hand*) in the expressions *Handlung* and *Handgriff*. To do that, I only need to refer to a paleontological framework like the creation of an artifact by any member of the great family of the hominins. I am referring, then, to a certain phase of the evolution when language had not appeared yet.[8] It is evident that the formulation "schematizing without concept" must be understood here exactly as a way of «going throug, taking up, and combining» the perceptual data, exploring their virtualities. In other words, it is a *somatic and sensorimotor Schematism*, epitomized by the synthetic action done by a hand in its exploratory interaction with the world-environment. «Hand» metonymically stays for the whole body. Accordingly, the regularity to which this performative action conforms, is an *embodied* regularity, and its production is made of artifacts. Therefore, it is not a non-intellectual

[7] See Kant (2000a, 273). The Editors of the Cambridge Edition actually translated *Handgriffe* with «operations», The aim here is to emphasize the reference to the action of a hand.

[8] I refer here to the fact, to which I have already alluded above, that after the appearance of language, the specific work of understanding (abstraction, generalization, unification) found its most powerful organ of articulation and shared expression.

synthesis, in the narrow sense of the word; nevertheless, it is capable of producing *constructive rules*. I make a step further, leaving aside the literal sense of Kant's text, which I have already stretched as I chose an example from anthropology, by adding that these rules embodied in an artifact should be recognized as having the faculty of operating a feedback action on imagination itself: it is a path of "return" which empowers the schematizing function of imagination to reorganize in significant ways. In other words, what I am describing could be defined as a peculiar technical «*empowerment*», both *conditioned* by the performative praxis in which it is produced, and *condition* of new and more integrated performances.[9]

10.2 Technical Schematism, Analogy and the Techno-Aesthetics

As I said, Kant replaces the analogical and heuristic image of a «technique of nature» with that of a more general «purposiveness of nature». The issue of a technical or artificial Schematism disappears from the Third Critique; the question that it poses, however, is unchanged.

Quite clearly, Kant knows that in the «free play», imagination surveys understanding not only with «blind syntheses» – as he defined them in the First Critique – but also with the result of the work of an *active formativity*: real embodied schemata of hypotheses that the understanding can eventually synthetize in its own way, namely, by a conceptual rule.

And obviously, this conceptual rule can be made explicit by language into a real empirical law: we just need to remember updating our paleontological framework to an age where the most powerful of all technical empowerments available to *homo sapiens* has already made its appearance: namely, articulated language. But notoriously, this rule can also be embodied in an artifact: it is, then, a rule of art, in the sense that art is (also) *techne*. This artifact could be, for example, a tool like a bow used to shoot arrows. In the passages Kant devotes to this acceptation of art, the presence of the issue of a *technical schematizing* – a way of *embodying* and *externalizing* rules into an artifact – is well supported.[10]

They are rules, i.e. synthetic events; nevertheless, they are not determined intellectually, in a linguistic sense. This evidence is supported, first of all, by the fact that an embodied and externalized rule can be exported, just as a constructive principle, in order to create other artifacts. For instance, the synthetic schema of the bow, i.e. the *embodied* rule by which we can build bows of different size, with

[9] As a matter of fact, this development of the Kantian philosophy echoes several theoretical and epistemological models referred, also at an experimental level, to the «Extended Mind», the «Embodied Cognition» and the «Embodied Simulation».

[10] See Kant (2000b §§ 43–53). In Montani (2014, 32–8), I discussed the example of a bow to shoot arrows where the bow is the dynamic schema available in the creation of other artifacts.

several flexible materials, etc., can be transferred into the design of the arcade for a bridge or the vault for a building. In this «exportation», we can grasp the sense of the play between what is relevant to the sensorimotor element and what is relevant to the linguistic-intellectual element: I could teach somebody how to create a bow without using language at all. Actually, by using the same rules with regard to the creation of a totally different artifact, as in the case of a bridge with regard to a bow made for shooting arrows, what the creator preserves, is the capacity the bow has of being charged with a force, not that one of converting this force into a ballistic performance. Evidently, the mode of the sensorimotor teaching shows its limits in this exportation of an embodied rule from one kind of artifacts into another. Accordingly, the field for a decisive relation to language emerges here.

The last point allows me to make another step further which is, by the way, rather important: it seems, in fact, that an interesting epistemological framework emerges where the performance imagination embodies and externalizes behaves like a *Schematism which functions as the substratum* of a process, at the same time more free and more refined than other schematic articulations. As a matter of fact, this very articulation should be credited to the effect of «return» mentioned in the previous paragraph. It is more free because the action proceeds in an analogical way, and more refined because the action can be – or maybe must be – openly assumed by the specific sources of human language, thanks, in particular, to its typically extraordinary articulatory properties. Saussure put these properties in the category of the «arbitrariness».[11] In a nutshell, the relation between the significant form (the phonatory articulation, refined by *homo sapiens*) and the segment of semantic matter the former retails (the order of reference) is radically arbitrary, and nothing forbids that in the matter of experience (the perceptual manifold, to use Kant's words), more and more fine and differentiated partitions might be introduced, so making room to an increase in the lexicon (motivated by reasons of pragmatic kind). It is quite evident that the Saussure's theoretical apparatus is the pendant of the «objective» Schematism of the First Critique where it is exactly at stake the possibility that the concepts, both pure and empirical, have a *Bedeutung*, as states Kant, that is, a reference to the manifold of intuition «articulated» by the concepts. The step further made in the Third Critique consists, as we see now, in integrating a new fundamental *analogical* element into this apparatus, and in binding this element to the issue outlined above of a technical Schematism, both embodied and externalized, that is, connected to an action of «return». This bound is only partly discussed, however.

Nonetheless, this subject is exposed and formulated in a very important passage of the *Critique of the Power of Judgment.* I mean § 59, in which arguably, Kant brings the entire work of reconsidering the Schematism up to one of its most

[11] See de Saussure (1966). As far as the correct interpretation of the principle of arbitrariness is concerned, the commentary written by Tullio De Mauro, the Italian editor of the *Course* is unavoidable: see F. de Saussure, *Corso di linguistica generale*, ed. by T. De Mauro, Laterza, Roma-Bari 2009. On this question, Garroni's observations are still fundamental: see Garroni (1977, 2005). I developed this approach to the linguistic articulation as technical empowerment more widely in Montani (2018).

important accomplishments: the idea of a particular form – more specifically, a creative form – of Schematism that he defines «symbolic exhibition».

In the paragraph in question, Kant (2000b, 225–28) recognizes two modes of exhibition called «hypotyposis (*subjectio sub adspectum*)» – the presentation of something in a certain respect – in the work of imagination. The first one is schematic, in the sense clarified in Kant (2000a): an «objective» Schematism, a semantics of the *Bedeutung*; on the contrary, the second one enjoys the attitude of imagination to work not only in a direct (denotative, referential) way but also in an indirect and analogical way,[12] which is called «symbolic». The exhibition is called «symbolic», then, when, the exhibition is furnished to an idea, that is, a concept of reason to which no direct sensible intuition can be adequate. Therefore, the proceeding of the faculty of judgment is «merely analogous» to what happens in the objective Schematism: «i.e., writes Kant, it is merely the *rule of its procedure*, not of the intuition itself, and thus merely the form of the reflection, not the content». (Kant 2000b, 226. Emphasis in italics is mine). The definition, though rather obscurely expressed, is clarified below, thanks to a particularly fitting example:

> Thus a monarchical state is represented by a body with a soul if it is ruled in accordance with law internal to the people, but by a mere machine (like a handmill) if it is ruled by a single absolute will, but in both cases it is represented only *symbolically*. For between a despotic state and a handmill there is, of course, no similarity, but there is one between the *rule for reflecting on both and* their causality. (Kant 2000b, 226. Emphasis in italics is mine).

Kant adds that our *language* is full of these indirect exhibitions, in which «the expression does not contain the actual schema for the concept but only a symbol for reflection», and offers some extremely significant examples:

> Examples are the words *ground* (support, basis), *depend* (be held from above), from which *flow* (instead of follow), *substance* (as Locke expresses it: the bearer of accidents), and innumerable other nonschematic but symbolic hypotyposes. (Kant 2000b, 226).

Kant's examples are almost fortuitous but are extremely significant for the argument I am developing since they outline, in a more or less pronounced way, the *somatic source* of this indirect and analogical mode of the Schematism: as if imagination is inserted primarily into a typically bodily and motor experience. Foundation (*Grund*) is what is bound to the action of "touching ground" on a basis which is solid for our feet, and for the standing position. Depending (*abhängen*) is the action of staying and feeling hanging from something which could collapse and release us: it is almost the opposite of *Grund*, then. Deriving (*fliessen*) is the action of flowing but also feeling adrift, the streaming of a body in the flow. Substance

[12] Kant had already explored this indirect and analogical mode of the imaginative work in the Section of the Third Critique devoted to the sublime (§§ 23–29). It might be useful to observe that in this very context, he openly admits that every purely sequential conception of the temporality of imagination must be replaced by a different and somewhat controversial conception «it does violence to the inner sense» (Kant 2000b, 142). The Italian philosopher Luigi Scaravelli pointed out to these passages in a masterful essay (see Scaravelli 1968, 451–66).

(*Substanz*) is the substratum of the accidents but also, and above all, the physical action of sustaining something: we are still within the constellation of foundation and depending.

In this way, we are aware that the example of the monarchic state fulfills the same requirements since in this case too, imagination took the «form of the reflection» from a *body* – of which, to use one of Kant's celebrated formulation, it can be said that each organ is both means and purpose in it. Imagination could have taken this form also from a *bodily action* – make a handmill (*Handmühle*) turn.

The order of the intuitive reference is, therefore, a bodily experience, a *somatic attitude to the schematization*: this relation is systematic in Kant's examples. But this being the case: what kind of «rule» should be the one which empowers the analogical exportation Kant aims at enlightening? It seems exactly that we should look at the *technical Schematism* mentioned in *FI*. In other words, the understanding of the semantic performances language realizes by virtue of an analogical proceeding is likely to be oriented spontaneously toward the *performative relation* of the human body to the design of an artifact or to an artifact which works as a proxy of the human body and its *aisthesis*. Language take an evident advantage of this relation in its task of explanation. In other words, the fact that language enjoys a «rule of the reflection» depends on the fact that this rule appears primarily as the synthetic and performative result of a technical Schematism. As suggested above, the extension of a rule to other artifacts depends, in turn, on a validation that *only language is able to offer*. Or rather, language is likely to be made exactly to supply such validation, by the possibility of separating itself from a direct (in presence) intuitive exhibition, in order to relocate analogically on another intuition. More precisely, it is the *embodied* and externalized Schematism of imagination that produces these shifts. But it is language that eventually grants the real formalization and its following, and possible, refinement.

In all these examples, therefore, Kant allows us to suppose that, by an externalized and performative projection, imagination realizes a *technical Schematism* which extends spontaneously in the design and use of a tool or an artifact. Easily enough, after all, we can complete the *frame* of the examples Kant offers, and introduce the presence of an artifact freely meant as a proxy or a part of the body. Let us imagine, for *Grund*, a golf player who «touches the ground» with her feet, in order to give the right force and precision to the blow shot with her club; or a climber who recklessly confronts a dangerous passage by moving as one with the harness on which she literally «depends» (*abhängen*); or a kid sitting on an inflatable cushion who falls down from a water slide skedaddling (*fliessen*); or a worker committed with her whole body supporting a weight like, for instance, two loads of bricks hanging from a board which requires a continuous action of balancing (*Substanz*).

In conclusion, it is at stake here a *specifically techno-aesthetic mode of the Schematism* which is constituted as the background of a highly creative activity of the analogical apparatus at the basis of the symbolic exhibition. This mode establishes a particularly productive relation to articulated language since this relation is likely to grant an unlimited extension of what can be experienced, up to the (indirect) sensitization of the ideas of reason, as argues Kant in those parts of *CPJ* devoted to the sublime, recovered and improved here.

In other words, the «rule for reflecting» discussed here is exactly a *rule which is produced in the course of a schematic and synthetic operation, and by which a technical tool is designed, realized and used* – for instance, a handmill, as well as the whole class of artifacts which are based on the same operative schema. Therefore, it is one of those *embodied* and externalized rules of which I have spoken above: it is possible now to see better its connection with the action of «return» I have often referred to.[13] It is a *rule for the technical operation, not for the conceptualization*. Furthermore, it is a rule for which an aesthetics, in the acceptation of the First Critique, is unsatisfactory: we need a techno-aesthetics, namely, an attitude to feel the «lived body» as this is extended by a proxy. Or rather, it is a mode by which imagination operates, in order to project synthetic regularities of technical kind onto the being so encountered. This mode encounters – *unveils*, *phenomenalizes* – beings technically, to use a Heideggerian terminology fully consistent and insightful here.

In a nutshell, the *entire process Kant describes can be proposed anew in the respect of a specific analogical theory of the linguistic creativity, as this is anchored in a technical Schematism, thanks to the synthetic and performative work of an externalized imagination, and is so supported by a techno-aesthetics*. This conclusion is significant for several reasons. As a matter of fact, it envisages a meaningful reformulation of many classic problems in linguistics (I think to the crucial question of reference and its reorganization) and in the theory of the arts (the extension of the artistic creativity to the domain of technics narrowly construed). But I refer also to the cognitive neurosciences broadly construed: I think, for instance, to the very influential theory of the *embodied simulation*. The evident phenomenological traits of this theory have been already clarified: it could take now a huge advantage from the linguistic paradigm outlined here.[14] Finally, if it is true that we mostly live in environments with a high degree of technical mediation, that is, in «medial environments»[15] with which we interact more and more massively, thanks to *wearable* or directly embodied technologies, the epistemic field of a techno-aesthetics is credited of being of primary importance as the horizon and breeding ground of the schematic performances, both performative and analogical-linguistic, here discussed.

[13]The idea that the technologies we use carries out an action of reshaping on our brains, just as the one carried out by language on our thought at the moment of its (phylogenetic and ontogenetic) appearance is an extraordinarily productive hypothesis, elaborated by L.S. Vygotsky's pioneering studies: see in part. Vygotsky (1987). Notoriously, a likely hypothesis is developed by McLuhan (1962). See also Malafouris (2013).

[14]See Gallese (2009), Cuccio and Gallese (2018). See also S. Gallagher (2005, 2017) *How the Body Shapes the Mind*, Oxford University Press, Oxford 2005.

[15]See Cecchi et al. (2018).

References

Cecchi, D., Feyles, M., & Montani, P. (2018). *Ambienti mediali*. Milano: Meltemi.

Cuccio, V., & Gallese, V. (2018). A Peircean account of concepts: Grounding abstraction in phylogeny through a comparative neuroscientific perspective. *Philosophical Transactions of the Royal Society B: Biological Sciences, 373*, 20170128. https://doi.org/10.1098/rstb.2017.0128.

De Saussure, F. (1966). *Course in general linguistics* (ed. Baskin, W.). New York: McGraw-Hill.

Gallagher, S. (2005). *How the body shapes the mind*. Oxford: Oxford University Press.

Gallagher, S. (2017). *Enactivist interventions. Rethinking the mind*. Oxford: Oxford University Press.

Gallese, V. (2009). *Neuroscienze e fenomenologia*. http://www.treccani.it/enciclopedia/neuroscienze-e-fenomenologia_(XXI-Secolo)/

Garroni, E. (1977). *Ricognizione della semiotica*. Roma: Officina.

Garroni, E. (2005). *Immagine, Linguaggio, Figura*. Roma-Bari: Laterza.

Garroni, E. (2010). *Creatività*. Macerata: Quodlibet.

Heidegger, M. (1997). *Kant and the problem of metaphysics* (ed. Taft, R.). Bloomington/Indianapolis: Indiana University Press.

Kant, I. (2000a). *Critique of the pure reason* (eds. Guyer, P., & Wood, A.). Cambridge: Cambridge University Press.

Kant, I. (2000b). *Critique of the power of judgment* (ed. Guyer P., and trans. Guyer, P., & Matthews, E.). Cambridge: Cambridge University Press.

Kant, I. (2000c). *First introduction to the critique of the power of judgment*. In P. Guyer & A. Wood (Eds.), *Critique of the pure reason*. Cambridge: Cambridge University Press.

Malabou, C. (2016). *Before tomorrow. Epigenesis and rationality*. Cambridge: Polity.

Malafouris, L. (2013). *How things shape the mind. A material engagement theory*. Cambridge: MIT Press.

McLuhan, M. (1962). *The Gutenberg galaxy. The making of typographic man*. Toronto: Unversity of Toronto Press.

Montani, P. (2007). *Bioestetica. Senso comune, tecnica e arte nell'età della globalizzazione*. Roma: Carocci.

Montani, P. (2014). *Tecnologie della sensibilità*. Milano: Cortina.

Montani, P. (2017). *Tre forme di creatività. Tecnica, arte, politica*. Napoli: Cronopio.

Montani, P. (2018). Sensibilità, immaginazione e linguaggio. Processi di interiorizzazione e cultura digitale. *Bollettino della Società Filosofica Italiana*, Settembre–Dicembre, pp. 25–41.

Palmer, L. (2008). *Kant and the brain: A new empirical hypothesis*. Department of Philosophy, Carnegie Mellon University.

Palmer, L. (2018). "Schematizzare senza concetti" e senso comune. In Cecchi et al. (2018), *Ambienti mediali* (pp. 39–56). Milano: Meltemi.

Scaravelli, L. (1968). *Scritti kantiani*. La Nuova Italia, Firenze, pp. 451–66.

Simondon, G. (2014). Sur la techno-esthétique. In *Sur la technique (1953–1983)* (pp. 391–392). Paris: PUF.

Vygotsky, L.S. (1987). Thinking and speech. In R. Rieber & A. Carton (Eds.), *The collected works of lev Vygotsky* (Vol. 1). New York: Plenum.

Chapter 11
Implications of Creativity: A New Experiential Paradigm for an Aesthetics of the Extended Mind?

Giovanni Matteucci

Abstract This essay is divided into two parts. In the first one it aims at showing the relationship that exists between narrative mind, performativity and creativity. The core issues are: in what sense and how does the literary mind express its own creativity, that is, what does it mean for a literary mind to be creative? When is it possible to maintain that a literary mind is creative in a sense that is considered as positive? Usually, when attempting to answer these questions, only the isolated and finished product of the creative act is taken into consideration. Contrariwise, we will here maintain that a literary mind's creativity, or creativity more generally, should be evaluated by considering also the experiential fulfillment of the aesthetic production, and hence narration as bound not to the intentional transparency of cognitive acts but to their material components. From this standpoint, creativity results as a radically aesthetic competence in its performativity, if not even the very basis of that mind's extension that is typical at least of human beings.

What will hence be introduced in the second part of this essay is a particular paradigm of aesthetic experience. The basic reasons for this proposal will be explained through a paradox that we believe thrives in our present conception of the aesthetic. The general coordinates of the paradigm at issue will then be provided by attempting to highlight, at least in principle, its specific connection with the extended mind model.

Keywords Creative literary mind · Narration · Aesthetic competence · Experience-with paradigm

G. Matteucci (✉)
Department for Life Quality Studies, University of Bologna, Bologna, Italy
e-mail: giovanni.matteucci@unibo.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_11

11.1 Creativity as Aesthetic Performativity of the Extended Mind

11.1.1 A Cartesian Model

In order to outline the problem of creativity I will here start from a specific case, that is, the literary mind, by initially referring to Stendhal's novel *Lucien Leuwen*, which remained unfinished although it had been widely developed. This choice is not arbitrary. It is useful for engaging immediately the critical dialogue with the creativity model explained by Jon Elster in *Ulysses Unbound* (Elster 2000), which – not least for the way it addresses exactly Stendhal's unfinished novel – can be seen as emblematical as far as it concerns some approaches to the topic in question that are wide-spread also within the cognitive sciences.

Elster elaborates his own conception of creativity as a result of a more general analysis of *precommitment* or *self-binding* (Elster 2000, ix). According to this principle, at least sometimes and not only in the artistic creative act, but most prominently – in Elster's opinion – in political activity, it is more useful, for individuals, to subordinate their freedom of action to some pre-established rule so that their action would lead to an effectively fruitful result. In these circumstances, a reduction of freedom corresponds to an increase of efficacy and success. "Less is more", to quote the title of the chapter of the volume in which artistic creativity is analysed (Elster 2000, 175–269).

Elster's investigation is extremely detailed especially as far as it concerns the classification of the different kinds of constraints that affect and promote the creative act. Instead of discussing this classification (see Levinson 2003; Onarheim and Biskjær 2013; Matteucci 2015, 153–169), here I would rather evaluate the overall approach underlying it. This overall approach appears schematic insofar as it understands constraints exclusively as cognitive conditions that the creative mind identifies and determines, in order to then proceed with its own productive activity. From this standpoint, Elster does nothing else but simply proposing again a widely accepted model also in by now classic formulations of the creative paradigm, such as that provided by Margaret Boden (1990), with her "conceptual space" thesis, or as that at the centre of David Novitz's (1999) considerations that result in the "recombination" thesis.[1] According to this conception, the overall creative arc should be divided essentially into two phases. The first one is the generation of constraints in terms of premises similar to argumentative hypotheses; the second one is the exploration or analysis of inferential consequences that would define the range of possibilities that the actor would ideally ponder in order to make the most convenient choices, namely choices that he/she is inclined to consider the best ones. To generate (premises) and to explore (consequences) would hence be the two

[1] It is noteworthy that Elster quotes neither of them.

segments configuring as "gene-plore" (*gene*[rate] + [ex]*plore*) the act of creating as a syncretic whole.

Such an approach implies that the subject is able to at least potentially exercise an absolute control over its activity. He/she is a Cartesian subject who, as a matter of fact, acts separately from his/her own matter, observes it detachedly, and then decides what is best and what is not best doing within a transparent deliberative space. It will hence be a wrong constraint choice the cause of cases like that which, according to Elster, Stendhal has experienced with his unfinished novel. In other words, Stendhal would have stopped writing *Lucien Leuwen* simply because, by setting contradictory premises, he would have eventually no longer been able to develop the narration (Elster 2000, 177). Consequently, *Lucien Leuwen* should be considered a narrative artistic failure: "*Lucien Leuwen* remained unfinished because its separate parts converge to a nonexistent point" (Elster 2000, 240).

Contrariwise, I will here maintain that *Lucien Leuwen* is a great, even extreme, achievement of narrative creativity precisely by virtue of its interruption.

What first of all merits attention is the particular conception of narration that connotes Elster's perspective. As it emerges also in reference to jazz and to improvisation in the other parts of the same chapter, the expressive activity is reduced by Elster to the determination of its own contents on the basis of an increasing limitation of options. In the case of narration, this means making fully coincide, to the point that they can be equated, such activity with the production of what is narrated. Accordingly, the narration would exclusively consist of what is narrated: the content, the matter that is narrated, or simply "the narrated" (as I will refer to henceforth). This passage, though, does not allow the integration into the narration of what is determined starting from the narrated, that is, it does not allow to consider intrinsic to the narration that which the narration itself produces. To this end it would be necessary to investigate an arc of experience that includes elements, which go way beyond the production of the narrated and, by evaluating in relation to these elements the positivity or the negativity of the achieved result, to shift to a conception of narration (and, thus, of the narrative mind) as irreducible to a Cartesian-like, intracranial activity.

The first problem with the model at issue here is its being essentially abstract. The Cartesian nature of Elster's stance is attested to by its radical intentionalism. The creative act is explained in the first place as "intentional precommitment" (Elster 2000, 176), as the setting of rules that the author decides to adopt as constraints. Elster namely attempts to explain the creative act on the basis of a rational, or at least reducible to rationality, activity, by conjecturing a straightforwardly causal nexus between the cognitive content established by the self-imposed constraint and the outcome that is consequently determined. It is possible to see all this differently if we simply no longer analyse the process unilaterally from given intentional contents, but in relation to the "grammar" (in a Wittgensteinian sense) underlying a work in itself, which implies (also) non-intentional constraints since they are in the first place imposed by the mutual relationship that is established between the agent and the material with which the latter works or is at work. In this case, creativity appears as an indeed constrained act, but these constraints are not self-imposed rules in the first instance. They rather emerge from the interaction with the content of experience, with the matter and the material that are dealt with. As a consequence, the structure of the problem of creativity radically changes. Its focal point is no longer a subject versus an object, but the relationship between factors from which the creative dynamics results.

It is reassuring to notice that the latter direction is followed by such studies as those addressing the so-called "radical mediation" (Grusin 2015) as a form of relation from which subjectivity and objectivity result, without hence implying the autonomous existence of a subject and of an object, as it is on the other hand Elster's case. By adopting this point of view – that can already be observed in analyses of the dialectical thought developed in the XX century, such as Adorno's – we will have to maintain that subject and object are outcomes, and not premises, of a mediation. This also means that creativity constraints are not imposed to reality, but are attainable because they are precisely implemented in it. Hence, from the creative process also emerges a mediated whole or complex that extensively connects the field's vectors and that does not only concern the subject's productive activity. If we carefully observe from this standpoint *Lucien Leuwen* it is hard to peremptorily maintain that it is a failure originated by the intentional self-imposition of mutually contradictory constraints established by the author. In order to say whether it is a success or not, we should analyse it as the possible configuration of an overall narrative field due to the wide-spread constraints active within it, that is, as the concretization of that overall activity that is carried out in terms of a creative extended mind, since it is inextricable from the content elements with which the narrator interacts.[2]

11.1.2 The Performative Function of Narrative Creation

In order to definitively abandon the Cartesian abstractness of the model at issue here, a second question needs to be raised. It concerns what may be defined as the performative function of narration. The latter emerges if we ask ourselves, for instance, when Stendhal's narration stops in *Lucien Leuwen*. His narrated actually ends where the novel ends, and hence in the moment in which the narrated love is reaching happiness. And this is an indeed contradictory ending, considering the disastrous and tragic love stories that Stendhal usually deals with. Elster's

[2] In this context it is not possible to adequately discuss the intentionally technical meaning given to the extension of the narrative mind by means of the reconsideration of narration that has been explained here. We will hence limit ourselves to dogmatically state that: narration follows the "coupling argument" since the interaction between narrative act, narrated matter and narrative material is to say the least intrinsic; the processes which are external to the narrative act integrate non-accidentally narration as such, in a tight complementarity relationship; the narrative external support can work as (a component of) the internal narrative act as regards both the reader and the author him/herself.

conclusion is that *Lucien Leuwen* would prove to be an ungovernable exception for the fact that it was originally meant to have a happy ending, making it incompatible with crucial elements of the Stendhalian narrative poetics. *Lucien Leuwen* would have hence generated such an *impasse* as to prevent Stendhal from proceeding since this would be the negation of its peculiar way of seeing the narration. The creative mind would have here gotten caught in an irremediably aporetic situation due to intentions which have eventually proved themselves to be conflicting ones. And once the narrated ceased, the narration would have ceased too.

The situation appears different if we connect the question concerning how to develop the narration to a more complicated question, which makes precisely the case at issue pregnant. In fact, in the development of this novel and with his whole production, Stendhal carries out a conception of narration that is not limited to the narrated insofar as it tends to “make do something”, by fulfilling itself as experience.

This is evident first of all in a dialogue – which also Elster (2000, 236–238) takes into consideration – between Lucien and Madame de Chasteller, from which it is clear how they cannot confess their love since both, deeply in love with each other, are afraid that by using mere declarations they would appear calculating people, vulgar seducers (Stendhal 1952, 959–960). This dialogue emblematically reveals Stendhal’s seeming *impasse*. The point is that it does so not because, as Elster thinks, it shows conflicting intentional instances (declaring one’s love and at the same time avoiding being equivocally seen as a manipulator). Rather, in love language it is possible to experience a paradigmatic situation because its thematic dimension (i.e. the dimension made explicit by what is actually uttered or narrated) strenuously requires being the vehicle for elements which are *per se* not thematic at all, since they have to act more powerfully in order to allow love to really fulfil itself. These are elements which hence belong to the operative dimension of the love dialogue, and of love as such. And the experiential fulfilment of language is Stendhal’s authentic narrative problem: how to keep together the two elements of the thematic and the operative, of the explicit and the implicit, or, we may also say, of the representational (of the represented) and the performative, yet by means of a narrative work. This is a problem that thus underlies not only the quoted dialogue, but also the whole novel. *Lucien Leuwen*, in fact, ceases as narrated when love is no longer to tell, but to live. Yet, if the reader gets this thanks to the narrated, then *Lucien Leuwen* as a whole, precisely in the exterior form of an unfinished narrated, becomes the perfect narration. When the story, the narrated ends, a different moment starts, that of the narration, a time to live, to experience. And it is entrusted not only to the characters the novel is about, but to the reader him/herself. It fulfils itself without ever being fulfilled through a cognitive-intentional determination that the author would own. As it is well-known, beauty, according to Stendhal, is a *performative* act as “*promesse de bonheur*”, which is not a task of the narrated to keep, since otherwise it would no longer be a promise but a declaration.

It is almost like Stendhal showed an acute awareness of the illocutionary power of the expressive-narrative gesture, which greatly exceeds the ascertainment of a represented reality. The problem, then, becomes not the representation of the world, but the relationship within the world, by soliciting to make a radical leap. Rather than the experience of something that presents itself in front of a subject and allows its own thematization, narration embodies the experience with something thanks to which who gets “il-luded” in it, taken into its game, can broaden his/her horizon. It is a radical change of paradigm concerning creativity and/or narration in terms of, generally speaking, a competence that is integrated into the aesthetic and that through it becomes a factor in the extension of the mind. And by shifting from considering the experience *of* something to considering the experience *with* something, we cross the border of Modern thought, transgressing a series of limitations that otherwise would suffocate, theoretically, this kind of practices that are actually characteristic, profoundly characteristic, of human beings.

From the point of view of *experience-with* – that will be further developed in the second section of this essay – what interrupts the narrated in Stendhal is not so much, as Elster maintains, the impossibility of combining innocence and wit, or naivety and cynicism, meant as opposed intentional instances. The narrated actually ceases where such an antinomy, rather being solely thematised through narrated dialogues and circumstances, starts to work as experience, to make itself an operative narration, to fulfil itself as a promise to keep. Stendhal’s impossibility is only a seeming one, since it concerns not the subsistence of conflicting conditions or instances, but their being effective as a couple, their acting while being interwoven, thus requiring a time that goes beyond the narrated, an experiential supplement of it.

11.1.3 Aesthetic Creativity as Perceptualization

Something similar happens, perceptually, with bistable images. What does it mean to perceive (the image of) a duck-rabbit? We can certainly say that we “constatively” perceive (the image of) a duck or (the image of) a rabbit, while it is impossible to experience in a merely constative perception (the image of) a duck-rabbit as such. In fact, the experience we have with the (image of the) duck-rabbit takes place only during a process that immanently switches between two possible alternative and contradictory ascertainments, that is, when what is thematised is simultaneously also let operatively function, or in other terms when what is implicit and operative is sensed as almost but not yet fully and actually thematic. While eliminating this processuality, what we see is not the duck-rabbit, but either the duck or the rabbit – or, even a figural mess that appears nonsense (also: undetermined) in its alleged retinal stability. The adequate experience of it as in progress is, in fact, not *of* the figural whole as such, but *with* the figural whole as such. The duck-rabbit in picture triggers a practice that remains perceptual although it is not constative, while the picture of the duck or of the rabbit allows to contemplate perceptual and “static” factualities that contrariwise are (or better: can become) the negation of processuality itself.

What *Lucien Leuwen* realizes is somehow analogous to the figural experience with the duck-rabbit in its interweaving thematic level and operative level, the narrated and the narration, what can be narrated and what contrariwise one wants to do processually by means of the practice of narrating, that is, within a practice in which both elements cooperatively preserve their efficacy. Mocking Austin: Stendhal's narration is successful when by telling something it makes do, and does not just tell something. If it were only a matter of narrated, his creation would not be narration as (also) narrative performativity. And this accomplishment can well be realized outside the written pages, in the experience activated by their reading.

The crucial question with narration then becomes making perceive, or experiment, through narrative and representation. After all, this constitutes a precious key to generally access the aesthetic. So-called artworks are perceptual constructions that are never reducible to their percept exactly because they give rise to, as Cassirer (1944, 193) would say, a "process of perceptualization" that corresponds to perceptually operating *with* the percept. When we read a novel, we do not only want to read the words chosen by the author. We want to experience *with* what is narrated, while feeling ourselves in interaction with a device that, precisely with those elements, is able to mediate specific contents. These are contents that contribute to the constitution of a mind that includes the neural process as well as the support for the sake of something that is not reducible to either of them. In *Crime and Punishment* Dostoevsky's words become narration if we feel we are seeing Raskolnikov's staircase. By reading how a novelist talks about a battle, we do not simply want to understand the words through which the battle is described, but we want to participate in the battle as a holistic perceptual scene which is somehow taking place now.

This intensification of the perceptual praxis, which sometimes is intermedial, since it connects different channels, is fundamental for the good functioning of the aesthetic construct. When we see a painted basket of fruit, we do not simply limit ourselves to the ascertainment of a basket of fruit; this would reduce that painting to a mere signal. With what we see we aim at perceptually operating, also in the simulated modality of imagination. The experience with an artwork is carried out, at least ideally, when we feel that we have an ongoing task to perform further. That is why listening to a musical piece finds its fulfilment not in the experience of those sounds, but in the experience that is made with those sounds when, making use of them, we sense our feeling and our perceiving getting structured and shaped. In general, when we speak of aesthetic construct we are dealing with an at least potential perceptual intermediality that yields "sense" as something sensible-and-senseful at the same time and at the same point. A perceptual intermediality which is crucial in its interweaving feeling something and feeling ourselves – reflexively – in action as beneficiaries and executors of a promise which has always to still be kept.

11.1.4 The Aesthetic Creative Mind

If we understand what has emerged as the kernel of the concept of creativity, the focus of the attention goes on a liminal kind of competence that dwells on osmotic borders, on different levels and modalities of the perceptual and the cognitive in a mutual exchange between subjectuality and objectuality. With the creative mind the perceptual content transforms itself into a *device* that triggers experiences rather than losing its own processuality through its reduction to a mere percept or product. And this perspective sheds an interesting light also on that currently extraordinarily wide-spread phenomenon well-known as aestheticization of everyday life, which is equally based on the anthropologically fundamental and essential mechanism that concerns the potential transformation of an objective correlated element into a *device* and trigger of aesthetic experience.

In brief, it hence becomes possible to describe creativity as that ability to reciprocally corroborate what is thematic (by presenting itself in front of a subject) and what is operative (by surrounding every subjectivity immerged in the corresponding experiential field). This is the reason why, when we analyse creativity, it seems to be wrong to limit ourselves talking about the determination of rules that have perhaps been intentionally established. If anything, it describes a process of cooperative interaction within an experiential field whose elements are similar to rules that are ongoingly in the process of being established as trends which are both effective and always to be determined. As mentioned by Picciuto and Carruthers (2014), neuroscientific evidence shows how the creative act has to do with the "working memory" insofar as the latter does not simply keep for a brief time certain data, but actually anticipates them through manipulation. Thus, we are creative when we enucleate action schemes which are implemented in the framework of a practice, rather than binding contents which can be equated with neutral conceptual spaces. Creativity, in other words, is not the mere invention and establishment of rules or constraints, but the ability to play along with experience by making the trend force lines of a field emerge. Hence, it does not act in the transparent void of a mental theatre; it expresses itself within a viscous and extended field endowed with a nervation that orients the next moves and does not allow the deliberation in a specific moment of what will actually happen next. The constraint, in the case of creativity, has to be grasped at each step. And that specific trend exists only when it is "performed", while it simply does not exist before its instantiation has started. This is why creativity should be examined not so much from the standpoint of the application *of* a rule, as rather from the standpoint of the application *to* a rule: it is the search for a rule, an appeal to it, rather than its execution.

Paradoxically, what impedes the development of this approach is probably the most virtuous of the models which have traditionally been adopted in relation to the question at issue, that is, the model which finds its fundamental reference in Kant's *Critique* (see above all Garroni 1978). The difficulties it encounters are due to the transcendental formalism that connotes also the Kantian analysis of the nature of reflective judgments. The latter indeed concern rules that are established along the way, but these are nevertheless always conceived starting from a formal transcendental foundation in accordance to a "criticist" approach. After all, they remain rules, they define operative spaces within which, then, we act. According to Kant also reflective judgments, after all, extract a rule that only works as an operative framework, a formal condition of sense.

Studies such as those carried out by Carruthers (2011) go in a different direction. They suggest how the creativity constraint does not emerge inside the subject's intra-mental activity. What they seem to maintain is that it emerges in the perception understood in its complex articulation as extended practice, which includes the analytical-material component of what is senseful provided by what is perceived. The tendential constraint expresses a material operativity, rather than a formal one, which is already typical of the perceptual activity. It then expresses, at most, a "material apriori", as one would say by following a different model provided by contemporary classical philosophy, that is, the model of the passive syntheses' analysis provided by Husserl. In the light of this, creativity can be understood in terms of the ability to activate trends underlying the material process of an experience. This experience, though, is not an experience of something, but with something. For this reason it seems more correct to link the creative act to a necessarily extended mind: it is only by interacting with something that it is possible to "extract" trends that, as potential configurations of sense, fulfil themselves performatively (when their cognitive content does not merely remain a thematic one), and that therefore should not be predetermined, but rather should be configured while "sensing" the operative positivity. According to this view, creativity finally turns out to be a radically aesthetic competence in its performativity, the foundation of the mind extension's dynamics itself which is typical at least of human beings.

11.2 The General Paradigm of the Experience-With: The Aesthetic as Unfolding of the Extended Mind

11.2.1 An Unusual Conception of the Aesthetic

The elements that have been stressed so far outline a novel paradigm for aesthetic experience in general, which deserves to be examined in more depth. What I will carry out next is a generalization of the results emerged from the previously drafted analyses, by reconsidering some of the key notions that have been already introduced.

The critique against the approach which is also typical of Elster's contribution is due, if we take a closer look, to the fact that it remains loyal to a dichotomous, Cartesian structure according to which experience is explained starting from the contraposition between Subject and Object. Contrariwise, we have seen how creativity actually induces to consider experience beyond this dichotomy. Now, an experience that does not take place through linear yet biunivocal channels between constituted and stable entities, but implies an irreducible solidarity between *relata* and a distributed *agency* does not possess a substantial ownership, so to speak. It pertains to a whole field system. An example of this are the interfaces that populate our everyday life. They mediate aesthetic experiences that surely do not thematise the objective features of the device, although they are solicited thanks to those same features, and that surely are not due to a preventively adopted aesthetic attitude, given that such attitude is, if anything, generated in the course of the interaction: those who limit themselves to contemplate a device, or also what happens in it, know very little about its aesthetic potential.

Yet this, or at least something similar, seems to apply also to the works of great art. While reading a novel, that is, in the aesthetic practice of reading, we are not interested in the features that the novel preserves in itself as the object of both our perceptual and cognitive experience. By reading what is written, by experiencing words and propositions, we are interested in enjoying the qualities of the novel as such, and not those of its linguistic forms *per se*. Neither are we willing to taste the quality of our condition *per se*, given that in order to do so taking chemical substances or receiving neuro-physiological stimulations would be enough: we rather, through this (and here, perhaps only here, lies the importance of neuro-aesthetics' contribution), want to taste the quality of the novel in the ways it "gets us", in the ways it *becomes* our own way of feeling something. We want to taste the relational modality in its pregnant and involving contingency.

It is probably for this reason that some philosophers and critics have observed that aesthetic experience transforms both the perceiver – as individual and as community – and the artwork, that hence in its own historical efficacy proves to be irreducible to an absolute and atemporal datum.

What kind of experience is exactly aesthetic experience, then? What is at stake in it, if not the subject in him/herself and the object in itself or their features? In other terms, what is the mark of the aesthetic as such? "What" and "what kind of thing" is the aesthetic?

An important element is that the aesthetic can concern any experiential content, any sort of perception, belief, memory, knowledge, emotion, imagination ... On this basis some have suggested to consider it as a potential doubling of experience in general[3] or as a true and proper ontological transfiguration of it (as in the well-known philosophies of art provided by both Danto and Gadamer). At a closer look, yet, what emerges is the fact that the aesthetic is not really a "what" (e.g.: what is narrated), but rather a "how" (e.g.: how a narration develops itself), a modal index. It is the modality in which the interaction between organism and environment takes place that qualifies, if anything, the experience as aesthetic, and not single elements, contents, or acts belonging either to the organism or to the environment. What makes a private or public, an internal or external event aesthetic is not having specific

[3] See D'Angelo 2011, 78–83, and, to the extent it discusses evolutionary and cognitive elements linkable to this thesis, Consoli 2012.

subjective or objective substantial attributes, but entering a field where relational modalities accomplished in our experience matter more than any "relata".

In order to pinpoint this peculiar relational modality, which is prior to the single aspects that directly connote the *relata*, I think that we could at least heuristically agree that the aesthetic designates an organism-environment interaction so integrated that it generates a sort of full "collusion". In other words, it is a practice in which the organism and the environment are coupled and mutually supportive in a holistic experiential configuration. In this regard, strong evidence is provided by the previous analysis of literary mind's creativity as a whole.

Due to the lack of any ontological-substantial partition between Subject and Object, the aesthetic *agency* distributes itself in vectors devoid of predefined and specific ownership, to the extent that it generates a sort of bi-stability that makes the roles of the various correlated elements exchangeable. The same elements, then, can take on each role at any time, both actively and passively. They are experienced with in their shifting from one role to the other, and never in the simultaneous staticity of a specific and absolute function they would be endowed with. Hence, the aesthetic field has a performative and in itself indeterminable configuration in the most pregnant sense this term has in physics – but also exactly as it happens in the already mentioned case of the duck-rabbit, of which, in its gestaltic entirety, we do not have *per se* a perceptual experience unless we carry out its bi-stability, and never as a static figural pattern. Consequently, in the aesthetic field the object is not (or rather, no longer, in respect to Modernity) a mere object, but an appeal to us, and the subject is not (or rather, no longer, in respect to Modernity) a mere subject, but an embedded organism that corresponds to the environment by putting to the test its own skills. Both of them are players of a game, of a *ludus* (an intrinsically creative one), whose sense appears only when executed. Just as the object al-ludes, invites to the game, and in its extra-subjective passivity, in its materiality, reveals itself as effective, hence active, so the subject feels him/herself col-luded, taken into the game of the sensibly mediated sense, thus also by virtue of elements of passivity – of constraints – to which he/she is supposed to creatively correspond.

For this same reason, the aesthetic content cannot be reduced to the perceptual one. The experiential content that inheres in *aisthesis* goes beyond mere *aistheton*. The latter refers to a content of the senses inscribed in an order which is internal to the linear relationship between subject and object, and it hence gets structured as the articulation of a "noema", as phenomenology would call it. While the percept we can focus on is a center, a *fulcrum*, that absorbs the "rays", so to speak, of our attention that in turn shed light on it, the aesthetic in a wider and pregnant sense is a horizon that expands itself while involving us, it is the light both shaping and shed by what we are facing (as in various still lives by Chardin or Cézanne): it dictates the configuration of an experiential field while avoiding every factual ascertainment. If *aistheton* falls back into a noematic order, the aesthetic *per se* outlines an order. It is – we may say – an "aisthema", that is articulated not by virtue of acts of perception, but by soliciting creative practices of "perceptualization" (Cassirer). On the visual level, for instance, the aesthetic not only can be seen, but it also makes see, it takes on a performative status, which we know well every time we experience how a painting actually transforms our visual praxis: we cannot deny, in fact, that a straw chair indeed looks different after exposing ourselves to Van Gogh's works. According to a recurring metaphor in the philosophy of art between the nineteenth and the twentieth century, it is like the painter lent us his/her eyes through his/her works. Rather than seeing, it is a matter of making see, as Paul Klee teaches – more than perceiving, it is a matter of making perceivable.

Not being an *aistheton* but an *aisthema*, which generates sense in the simple form of relational efficacy ("captured" by its texture, we feel ourselves at home, welcomed, even only to participate in dissonances and disharmonies, without knowing "why"), it is not surprising that the aesthetic may even be factually inexistent. In the aesthetic field the topological constraintness that usually marks a perceptual content can be embodied by an imaginative *analogon* that is performative only by appearing, and that makes us feel it effective and present, as it eminently happens with literature. When in 1735 Baumgarten coins the term "Aesthetica", to describe that peculiar "gnoseologia inferior" that precisely concerns *aisthesis*, he seems already aware of all this, since he immediately extends the aesthetic beyond the perceptual content, while incorporating in it every element that impacts current perception, hence incorporating both the *sensualia* and the *absentia sensa* (see Baumgarten's *Meditationes philosophicæ de nonnullis ad poema pertinentibus*, § 116). It is exactly by virtue of this "aisthematic" nature, or in other terms as being a performative structure that makes something perceivable, that both makes someone feel and makes itself felt, that the aesthetic is fatally interwoven with the virtual, due to a common suspension of ontologically determined or noetically determinable entities.

An example of this efficacy is the way in which the aesthetic structure organizes time. It gives rise to an experience that is carried out in a contingent present and that is continuously searched for, precisely because it is unrepeatable. It is never enough, as shown by the fact that we continuously listen to those songs or look at those paintings we love. The same goes for the objects that inhabit our everyday spaces. What prevails is the inclination to see, to listen to, to meet again and again the same things yet with intensity, even when the cognitive content no longer changes although there is progression, succession, since it has fully unfolded itself. Knowing how it goes and ends does not prevent us from the pleasure of "falling into" it again and again: what is at stake here is an *aisthema* and not a *noema*, or even a scheme in the Kantian sense.

11.2.2 The Paradigm of Experience-With

As a relational modality, the aesthetic is hence pervasive (at least potentially) not because it doubles experience. It modifies the latter immanently, materially, by emphasizing those elements that, although inhabit it actively, would otherwise remain tacit. Specifically, the aesthetic alters the structure of the cognitive thematization: that which, from a functional point of view, is merely operative is here brought to the fore to the extent of becoming apparent. When this switch takes place, the field's energy lines emerge and acquire relevance, while the linear tension towards thematic contents loses its supremacy. These contents now cease being the terminal targets of our attention and become the catalysts of a different manifestation of the field. They switch from being ends to being means, from being goals to being vectors.

In order to clarify what all this means let's use some examples.

When I see a constellation in a starry sky, an operative structure that (as Gestaltpsychologie teaches) organizes my perception emerges: the experience of those stars becomes the apparition of a constellation. It is as if I made a particular use of those same stars, so that their configuration, which is operatively effective in perception, now becomes an apparent figure that is as real as the luminous dots that make up its vertices. In this sensible interaction with the perceptual pattern, the force lines that gestaltically keep its various elements (each single star) together, and hence the field vectors which the perception in progress operatively consists of, become visible as if they were actually drawn lines. And it is not a matter of an overlapping or an application of a mental image, since the constellation appears to my eyes properly, and I do not imagine it appearing, nor do I somehow project it. Otherwise there would not be any difference between only imagining to see things as constellations and actually seeing them, as it contrariwise somehow happens, despite the fact that nothing is added to cognitive contents. Nor it is a matter of quantitative increase of the objective content, given that nothing changes in my retinal ascertainment. The fact is that the constellation is "drawn" by operative and not thematic lines that nevertheless not only act but now actually appear. – The representational seeing-in Richard Wollheim has dealt with seems to me a peculiar and simplified case of this specific interaction with the content of seeing. And it is exactly because it concerns a relational modality rather than determined contents, that Wollheim's requisite of "twofoldness" becomes plausible.

When I read a novel, I do not (only) experience the narration by deciphering and understanding written words and propositions. Through them, what appears in my reading is a story, a narration which always operatively orients the development of the practice itself beyond the various semantically and cognitively determined contents, yet by their means. In this sense, before being knowledge, narration is an experience that takes place performatively in the course of the reading, as it is shown by the extraordinary narrative experiences which we enjoy despite the "failures" of the narrative content of Stendahl's *Lucien Leuwen* or, for other reasons, of Joyce's or Gadda's works. This is probably the reason why what sticks to our memory of movies and novels is their so-called atmospheres, rather than their detailed plots.

Analogously, when I listen to a song, I do not simply listen to sounds, nor I perceive only according to gestaltic structures, but, thanks to them, I participate in the increasing implementation of an efficacious mix of tones, melodies, rhythms, harmonies. Even a mediocre musician knows what a great difference there is between reproducing sounds and musical structures while solmizating (almost spelling out) them and, on the other hand, rendering the musical performativity underlying them while playing the same song that was the first time only reproduced, hence without modifying the cognitive content of the experience.

When I make an environment comfortable, I do not only facilitate the functionality of its components, but I correspond to its expressivity as a whole that operatively pervades its elements. And when I choose the venue for a meeting (with the right atmosphere), I do not choose the mere background for what will happen, but I posit myself into a sort of bubble that emanates from even apparently insignificant elements and that is able to provide a certain tone and a certain colour to the whole flow of what will happen.

What these various and mixed cases have in common is an emphasis on the operative which implies a different paradigm from that of the "experience-of" something, that is, the paradigm of the "experience-with" something. It is a wide range-paradigm, that covers various experiential phenomena, at least from the gestaltic to the imaginative.

In this framework, the distinction between experience-of and experience-with, which has been traditionally neglected, is crucial. Let's just think how different it is to ask on the one hand "what is seen *of* a painting" and, on the other hand, "what is seen *with* a painting". Moreover, such distinction, which is of a phenomenological if not even of a pragmatic (and certainly not ontological) kind, goes way beyond the most canonical aesthetic domain: if we ignore the difference between "smoking (cigarettes) is bad for the smoker" and "smoking (the practice) is good for the smoker" (it makes him/her feel better), namely between the experience *of* the cigarette (what a bad taste!) and the experience *with* the cigarette (what a relief!), anti-smoking advertising indeed fail.

We may sum this point up by saying that in the experience-of, "of" marks a distance that may generate distinction and abstraction, while in the experience-with, "with" marks a relationship that is always mutually supportive and material. The first one is inclined to generalization and hence risks being inefficacious in practice, while the second one is ineludibly topologically bound and hence it possesses a whole efficacy which yet is valid only for that specific moment.

By deflating the term, the aesthetic hence appears as something with which we experience – that is: when we experience with something, we are faced with aestheticity as a relational modality. In this case, the object, instead of being the target of a subject, performatively generates an experiential field which is aesthetically qualified as a whole. Hence, the table that I have experience *of* is a thematically experienced content, while the aesthetic I experience *with* the table is a field relationship that makes mediation inescapable, that is, it always, and *simultaneously* says something about me and about the world in the current circumstance (see Austin).

Since this manifestation pertains to operative, and not substantial elements, the kind of experience at issue here is radically contingent, as well as intrinsically creative. It hence forces to an exercise of competences: the organism does not merely attend to, but participates in the apparition of the *aisthema*, even when it plays the role of the "author" of an aesthetic structure, by also making use of itself, and not only of those same contents that are mere functional terms for its experience-of, that is, of the matter it interacts with. In the practice of the aesthetic, activity and passivity pertain to both *relata*, according to a performative intertwining between feeling and feeling-oneself that produces reflexivity. By virtue of this involvement the organism, in fact, from its interaction with the environment acquires plastic competences about the "self-in-the-world" (a non-quantifiable formula within itself) that are outside of merely functional relationships and whose ownership is to be ascribed to the field as a whole.

The aesthetic inter-play, or *Zusammen-spielen* does not concern faculties internal to a transcendental subjectivity in their indeterminacy in general (*überhaupt*), as implied by the Kantian way. It develops in relation to concrete and contingent usages of factual matter that become the experiential heritage of the organism as its own ways of operating with the material that then emerges. So, if the experiential arc describes the activity of a mind, the latter necessarily includes, in their own mutually supportive reciprocity, both the organism and the environment, since the *aisthema* ties up, just like the knots of a net, reciprocal extension deals. The aesthetic requires collusion, participation in a correspondence, between players who look for reciprocal agreement, and hence, a common expressivity. That is why the primary feature of the aesthetic is its expressive property.

If aesthetic expressivity is the non-substantial connotation of the operative factors which appear when the experience-of-something is de-functionalized, that is, when one experiences "with" that something, what is aesthetically expressive is precisely the experiential field as a whole, not its components as isolated and thematizable entities. Hence, the peculiar nature of aesthetic properties. The properties that we objectively attribute to perceived objects are non-aesthetic exactly because they pertain to the content of *aisthesis* as *aistheton*, as that which we have experience of: the fragility of a glass refers to the object of which I have an experience, its objective and knowable attributes. Contrariwise, aesthetic properties operatively subsist in the praxis of sensibility, they pertain to the content of *aisthesis* as *aisthema*, as that with which we experience: the fact that a melody expresses happiness refers to the manifestation of the way in which the elements of the corresponding perceptual field operatively connect to each other. In this case the listener is invited to participate in the contents of the experience (that is, to use what we have an experience of, the *aistheton*, that thus becomes something with which we experience, an *aisthema*), since if he/she remains extraneous to the field, the latter's operativity flows back to tacitness. Properties manifest their own expressive operativity when we experience with them. They then appear as that aesthetic property which overall orients the collusive interaction with the environment. Everything tends to seem happy when we listen to a happy song, as soundtrack composers as well as music-therapists know well, although they only offer us musical structures, not happy pills.

Another example: it is not only by seeing that the profiles of a figure are squared (which is an experience-of), but it is by making experience *with* them, that we can grasp the immanent aesthetic constitution of sense. Even "geometrical" becomes hence an aesthetic property, insofar as it allows us seeing differently (aisthematic connotation). Those who cannot grasp the latter will be invited not simply to see twice that the profiles of the figure are squared, but to look at how they are so: to use them in an experience that provides a knowing-how instead of a knowing-that. In this lies that peculiar aesthetic competence that we call taste, with its natural creative implication.

We will therefore say that aesthetic properties, instead of supervening in respect to non-aesthetic properties, *inter-vene* in the contingent and topologically embedded experiential field. The aesthetic property is the non-aesthetic property itself that takes on a different role: we no longer have experience of it, but we experience with it. Without implying continuity solutions (“superior levels” or new entities), it coincides with the inflection point that makes an *aistheton aisthema*.

For these reasons, the aesthetic does not establish a second world, neither does it depend on a specific set of beliefs, emotions, knowledge, etc. that would define a certain attitude the subject would be supposed to preliminarily assume. The aesthetic appears when, in the interaction between the same “subject” and the same “object” implied in the pragmatic-functional (and basically cognoscitive) relationship, they become opaque and reveal some factors that, when working in the framework of thematic acts, are actually transparent. Even if it has become opaque, the operative has not changed: it counts for “how it acts”, “how it operates”, and hence “how it appears” – contrariwise, the thematic counts for “what it is”. It is quite clear, then, that in the diatribe between being and appearing, the aesthetic definitely takes the side of semblance and *Erscheinen*, or even of phenomenology versus ontology – provided that it is a phenomenology understood as a “material analytic”.

Summarizing: Aesthetic experience as such is based on a model which is not ascribable to the linear (univocal or reciprocal) relationship between two separate entities, a subject and an object (“experience-of”). It rather consists of an “experience-with” something, that develops within the sphere of sensibility, or, in other words, of *aisthesis*, meant as a field in which one can orientate him or herself only by managing the expressive features of an ambiance-like situation. In this sense it is intrinsically creative. The lines of force that operate within such field should be understood as structures that are simultaneously endowed with activity and passivity, to the extent that they, in their expressivity, exceed every merely empirical, objective as well as subjective, content. I proposed thus to describe such a field force as “aisthema”, in order to emphasize the difference that exists from every structural relationship (“noema”) that connotes someone’s “experience-of” something.

11.2.3 Aesthetic Dimension and Extended Mind

One of the most relevant questions in my attempt to describe all this is the fact that aesthetic creativity, and aesthetic phenomena in general, necessarily imply a distribution of factors through which aesthetic experience runs, just like the energy of a field. Such a distribution breaks the boundary between inside and outside which the classic Modern Cartesian paradigm contrariwise relies on, and that at a closer look is actually at the origin of the “experience-of” model. In these terms, the analysis of aesthetic experience meets recent philosophical programs which aim at revising the traditional conception of mind, and specifically it meets the extended mind model, that precisely underlines how mental vectors are distributed in the environment (as scaffoldings) rather than confined inside the organism.

On the experiential, phenomenological rather than ontological, level what is extended is a type of mind in which the vectors of the interaction with the environment that are not always reducible to a subjective, intra-cranial interiority, are fluidly integrated. Precisely this sense of interaction prior to the contraposition between interiority and exteriority first and foremost belongs to the aesthetic.

Aesthetic are those "magical" practices that *Homo Sapiens* has always carried out in its interaction with the various dimensions of its own environment in the most diverse forms of experience-with: through images, with aspects of entities and of nature forces; through ritual performances and narrations, with elements that compose individuals and communities; through scarifications and ornaments, with portions and aspects of the body. All these are forms that imply both an artificial medium and a material engagement (see Malafouris 2013). It is not coincidental, as Andy Clark (2003) suggests, that *Homo Sapiens* as extended mind is a "natural-born cyborg". With the aesthetic artifice the mind extends beyond the boundaries of the brain, learns how to experience with the environment and stages itself by starting identity projects.

Yet, an epistemological problem still persists. The adoption of the extended mind model seems to entail the necessity to talk of the aesthetic in those functional terms which have been stigmatized at the beginning of this contribution, given that the model in question, at least in Clark's version, remains bound to functionalism. Nevertheless, two elements dismiss the possibility of ending up with a functionalist determination of aesthetic experience.

First of all, the topological contingency of the aesthetic, its materiality, which makes its every single element that occurs each time non-replaceable. Replacing a material component, as functionalism would imply, means distorting an aesthetic structure, since – we may say – the perceptualization of the *aisthema* is an extreme case of "grounded cognition". It even generates conceptual structures that do not work as "proto-types" (instantiated in tokens), but by "proxy-types", conceptual equivalents of "aisthemata", of which they possess the performative and operative nature.[4]

Secondly, the aesthetic resists to functionalism also macroscopically, as a whole. This has clearly emerged with the analysis of its adverbial nature, that is, its being a

[4]See Prinz (2002, 150): "If concepts are proxytypes, thinking is a simulation process [Barsalou 1999]. Tokening a proxytype is generally tantamount to entering a perceptual state of the kind one would be in if one were to experience the thing it represents. One can simulate the manipulation of real objects by manipulating proxytypes of them in their absence. The term 'proxytype' conveys the idea that perceptually derived representations function as proxies in such simulations. They are like the scale models that stand in for objects during courtroom reenactments. They allow us to reexperience past events or anticipate future events. Possessing a concept, on this view, involves having an ability to engage in such a simulation, what Barsalou calls a 'simulation competence.'"

relational modality. For this reason, it turns out to be elusive every time one attempts to determine its specific function, especially from the cognitive point of view. Perceptions, beliefs, memories, knowledge, emotions, imagination . . . can take on an aesthetic qualification, but asking someone to identify an aesthetic content that is not perception, belief, memory, knowledge, emotion, imagination, means – I believe – assigning an impossible task just as much as it is impossible to detect the "mark" of the aesthetic, if we limit our analysis to the contents of an experience-of any object, event or process because, as we have seen, the mind is aesthetic only if it is extended.

Symmetrically, the mind is extended when it is aesthetic. Irreducible to mere functionality, the aesthetic primitively expresses the experiential (and not the ontological) cell of our mind, of which it is hence a factor of extension, an "extensional functor" between organism and environment: it appears when the organism feels itself both active and passive by participating in an environment which it feels as equally active and passive in a unitary, at least possible, horizon of sense. In musical terms, it is a cadenza shared between soloist and orchestra in which, in every single moment we cannot but sense how boundaries, established roles are porous and evanescent. Something creative, apparently: as an extended mind *Homo sapiens* dwells on this aesthetic threshold, forced by its own nature to creativity.[5]

References

Barsalou, L.W. (1999). Perceptual symbol systems. *Behavioral & Brain Sciences, 22*, 577–660.

Boden, M.A. (1990). *The creative mind. Myths and mechanisms*. London/New York: Routledge. 2004^2.

Carruthers, P. (2011). Creative action in mind. *Philosophical Psychology, 24*(4), 437–461.

Cassirer, E. (1944). *An essay on man* (p. 1956). New York: Doubleday Anchor Books.

Clark, A. (2003). *Natural-born cyborgs. Minds, technologies, and the future of human intelligence*. Oxford/New York: Oxford University Press.

Consoli, G. (2012). A cognitive theory of the aesthetic experience. *Contemporary aesthetics, 10*. https://contempaesthetics.org/newvolume/pages/article.php?articleID=657

D'Angelo, P. (2011). *Estetica*. Roma-Bari: Laterza.

Elster, J. (2000). *Ulysses Ubound. Studies in rationality, precommitment, and constraints*. Cambridge: Cambridge University Press.

Garroni, E. (1978). *Creatività*, nuova ed., Macerata, Quodlibet 2010.

Grusin, R. (2015). Radical mediation. *Critical Inquiry, 42*(1), 124–148.

Levinson, J. (2003). Elster on artistic creativity. In B. Gaut, & P. Livingston (Eds.), *The creation of art: New essays in philosophical aesthetics* (pp. 235–256). Cambridge: Cambridge University Press.

Malafouris, L. (2013). *How things shape the mind. A theory of material engagement*. Cambridge, MA/London: The MIT Press.

[5]I am deeply indebted to Gioia Laura Iannilli for her suggestions on the final version of the manuscript.

Matteucci, G. (2015). *Il sensibile rimosso. Itinerari di estetica sulla scena americana*. Milano-Udine: Mimesis.

Novitz, D. (1999). Creativity and constraint. *Australasian Journal of Philosophy, 77*(1), 67–82.

Onarheim, B., & Biskjær, M.M. (2013). An Introduction to creativity constraints. In *Innovating in global markets: Challenges for sustainable growth* (pp. 1–16). Proceedings Lappeenranta University of Technology Press.

Picciuto, E., & Carruthers, P. (2014). Origins of creativity. In E.S. Paul, & S.B. Kaufman (Eds.), *The philosophy of creativity. New essays* (pp. 199–223). Oxford/New York: Oxford University Press.

Prinz, J. (2002). *Furnishing the mind. Concepts and their perceptual basis*. Cambridge, MA/London: The MIT Press.

Stendhal. (1952). *Romans et Nouvelles* (Vol. 1). Paris: Gallimard.

Part V
Naturalistic and Evolutionary Approaches

Chapter 12
Biological Individuality – A Complex Pattern of Distributed Uniqueness

Alessandro Minelli

Abstract None of the concepts thus far advanced by biologists or philosophers of life covers in a satisfactory way all instances and aspects of biological individuality. Two main, only partially overlapping notions must be distinguished: *physiological individuality*, based on morphological or molecular attributes, and *evolutionary individuality*, based on the uniqueness of the role played by the individual in evolutionary processes. The three individuality criteria suggested by Pradeu (2012), i.e. uniqueness, delineation and persistence, are useful as a rough guide, but their application faces serious problems or limitations, e.g. with polygenomic organisms or polyembryonic metazoans. Persistence of individuality throughout development deserves accurate revisitation.

Keywords Biological individual · Immune self · Pleiotropy · Polygenomic organism · Polyphenism

12.1 Biological Individual – A Fuzzy Set of Concepts

Everyday language and common sense have no difficulty accommodating rare exceptions to what otherwise works well as a description of the external world. This is especially true in so far as the external world is the world of humans, where the notion of individual does not seem to require a formal definition other than for use by philosophers or lexicographers. This is a world of younger and older individuals, female or male, healthy or ill, hungry or replete. We accept that our categories will be occasionally challenged, as in front of a hermaphrodite or, more disturbingly, of a pair of Siamese twins. But these are usually registered as exceptions that do not hamper the continuing use of the common categories and terms. Exceptions, we say,

A. Minelli (✉)
University of Padova, Padova, Italy
e-mail: alessandro.minelli@unipd.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_12

confirm the rule. How much this may satisfy the intellectual demands of scientists and philosophers, this is clearly a different point.

But in the course of time other problems, of quite more systematic occurrence, have emerged along with the use of those terms in describing and modelling ever larger domains of the living. We cannot take for granted that the whole living world is fundamentally organized in the same way as those parts (humans, or mammals at large, perhaps also birds and frogs and a few other animals) with which we have best familiarity. We have no a priori reason to suppose that every living organism should be easily recognizable as a distinct individual, or that every living organism belongs to a species (on the latter aspect, see eg Ghiselin 1997; Zachos 2016). To be sure, biology has progressed successfully even if a critical attitude towards these problems has been long limited to a few thinkers. A major cause of this disregard for an overdue revisitation of terms and associated concepts is the slow acceptance of the basic point, that life on Earth is a unitary domain, both for historical reasons (evolutionary relationships within the tree of life) and because the nature of its characterizing phenomena. Linnaeus (1758) was still following a very old tradition, when he divided nature into three kingdoms (the animal, the plant and the mineral) rather than drawing a primary divide between the living and the nonliving. From such a perspective, there was no need to identify a set of basic concepts and terms to be applied to the whole of the living. It must be mentioned, on passing, that in those years (more precisely, in 1766, in a monograph on the 'zoophytes', marine organisms – eg corals – apparently sharing traits proper of animals together with traits typical of plants), Peter Simon Pallas had already traced in explicit terms a divide between living and nonliving, but this only became accepted in the first decades of the following century, eg in the works of Georg Reinhold Treviranus (see Treviranus 1802–1822), but especially as a consequence of the formulation of the cellular theory (Schleiden 1838; Schwann 1839). Nevertheless, most problems of 'general biology' (as this is often pompously termed, especially in the titles of textbooks) continued to be considered within a taxonomically restricted perspective, that is, usually limited to either the animal or the plant kingdom.

This is true, in particular, of the notion of individual. Consider, for example, the following definition provided in 1852 by Thomas Henry Huxley: "The individual animal is the sum of the phenomena presented by a single life; in other words, it is all those animal forms which proceed from a single egg taken together". I will return on this definition later in this essay.

In recent times, efforts aiming at obtaining a definition of biological individuality possibly applying to all kinds of living organisms have emerged among biologists and philosophers of biology alike. However, formulating a satisfactory definition of biological individual of general applicability throughout the most disparate branches of the tree of life has always proved difficult. Eventually, many life scientists and philosophers of biology have accepted that individuality cannot be adequately captured by any single concept or criterion (e.g., Santelices 1999; Wilson 1999).

In a recent revisitation of the problem, Pradeu (2016) has argued that two different and only partly overlapping notions are included in the current concept of biological individuality.

Of these notions, one (*evolutionary individuality*) rests on the uniqueness of the role played by the individual in evolutionary processes. This is obtained either by equating the individual to any entity that may undergo natural selection (an *interactor* sensu Dawkins 1976), or to any reproductive unit behaving as a *Darwinian individual*, i.e. as a unit characterized by variation, heritability and differential fitness (Godfrey-Smith 2009).

The other notion (*physiological individuality*) is based instead on morphological or molecular attributes, these being for example the physical separation of one individual in respect to the others or its uniqueness as expressed in its genome or recorded in its immune system (Pradeu 2012).

In practice, biological individuals identified by physiological and evolutionary criteria do not necessarily coincide (Pradeu 2016). In the following I will restrict the focus on physiological individuality, with a discussion of problems a biologist faces when trying to apply the individuality criteria suggested by Pradeu (2012), i.e. uniqueness, delineation and persistence.

12.2 One or Many?

Individuals delimited according to one criterion, eg, physical separation from all other individuals, do not necessarily overlap with those identified according to a different criterion, eg genetic uniqueness. In plant biology, for example, genetically distinct individuals are contrasted to physically separated but genetically identical units belonging to the same clone: the former are described as *genets*, the latter as *ramet*s, following a couple of terms introduced by Harper and White (1974). Distinct ramets belonging to the same genet are produced, for example, in strawberries multiplying through runners. This contrast between genet and ramet is not limited to plants. In animals, the production of multiple, physically separate embryos (and eventually adults) with identical genome is obtained whenever the mass of blastomeres originated from one fertilized egg through repeated cell divisions eventually splits, at an early embryonic stage, into two physically separate cell clusters that proceed further through embryogenesis independently from one another. This process (polyembryony) occurs even in our species, albeit as an exception rather than the rule, the result being sets of two, rarely more, monozygotic twins. In other species, polyembryony is the rule. For example, the females of the nine-banded armadillo (*Dasypus novemcinctus*) regularly generate sets of four identical twins: an impressive feature perhaps, but one that pales if compared to the thousand or more embryos obtained by polyembryony from a single egg in some tiny parasitoid wasps, e.g. *Copidosoma floridanum* (Grbic 2003).

In other cases, physical separation fails as a criterion of individuality for the opposite reason, that is, because initially distinct individuals eventually merge into one. This behaviour has been recorded in some freshwater sponges, where two or more larvae metamorphosing in close vicinity on a suitable substrate fuse and give rise to a single, although genetically heterogeneous individual (Van de Vyver and Willenz 1975).

Splitting and fusing again may even represent two temporally contiguous events in the life history of one and the same biological system. A short-lasting binary splitting of the embryo is observed in some small fishes of the genus *Cynolebias* native to South American freshwaters. Starting with a fertilized egg, embryonic development proceeds in conventional way until the stage of gastrula, but at this point the embryo splits into two separately developing units, with full disruption of the spatial and functional organization obtained thus far. This phase of dispersion, however, does not last long: the two groups of cells (blastoderms) fuse back and remain united throughout further development to adult (Carter and Wourms 1993). Not less 'disquieting' is the case of some free-living flatworms, the freshwater planarians of the genus *Dendrocoelum*. Here, early development was described as an example of blastomere anarchy (Hallez 1887). Blastomeres are the cells originated by division of the (generally fertilized) egg. In these worms, following the third mitotic division, the eight blastomeres disperse into the yolk mass and only at a later stage the embryonic cells, whose number has increased in the meantime, will gather together to form a physically integrated embryo.

An even more fundamental challenge to the notion of biological individual as granted by the temporal continuity of the physical contiguity among its parts is provided by the uniquely independent behaviour of bacteriocytes in *Bemisia tabaci*, a small insect commonly known as a whitefly. Bacteriocytes are specialized cells, found in a number of insects including aphids and tsetse flies, that host symbiotic bacteria whose presence in the insect's body is a necessary requirement for their capacity of metabolizing their foodstuff. The recent discovery (Luan et al. 2018) is that in the whitefly each bacteriocyte can behave as an independent ('individual') organism; in particular, it can be transferred with its precious bacterial load to an egg, while the latter is still in the female insect's body. It will be further retained throughout the embryonic development and eventually multiply, giving rise to the offspring's set of bacteriocytes. Described by the authors as the first known example of maternal inheritance of a somatic cell bearing genes other than those of the remaining cells in the insect's body, this is also an overt challenge to our current concepts of biological individuality.

12.3 Ambiguous Genes

A different set of problems emerge when appealing to genetic distinctness or uniqueness as a criterion of individuality.

First, which set of genes is relevant to fixing an individual's identity: the genes in the nuclei of its cells, or the genes expressed in their cytoplasm (the transcriptome)? Second, do the vital functions of a biological individual rely on the expression of genes belonging to one genome only? Ambiguities are not confined to the obvious mismatch between the genes contained in the nucleus of a cell and those (a fraction of the former) that are expressed in its cytoplasm, neither to the fact that the transcriptome varies from cell to cell (especially, from a tissue or organ to another), but also, in the same cell, through time. There are also more fundamental problems with identifying the individual's uniqueness with the putative uniqueness of its genome. For example, in most animal species the genes expressed during the early stages of embryonic development are those of the mother rather than those in the nuclei of the embryo's cells. What the female gamete receives from the mother along the process of ovogenesis, in fact, is not limited to a haploid set of chromosomes (to which an equivalent paternal set, carried by the sperm cell, will be added at fertilization) plus nutritional reserves in form of more or less abundant yolk; no less important are a diversity of mRNAs derived from the transcription of maternal genes, and proteins obtained by the translation of those RNAs. For a more or less extended time following fertilization, all morphogenetic activities in the embryo will be controlled by these molecules of maternal origin, whereas the zygotic (=maternal+paternal) genome present in the nuclei of the embryo's cell is involved in a rapid sequence of DNA duplications but is not exposed to the complex machinery of translation. Only with the eventual slowing down of the mitoses will the zygotic genome start being expressed, thus functionally replacing the maternal gene products which are in the meantime disappearing from the scene, partly by simple decay, partly by actively controlled degradation of those macromolecules (eg, Tadros and Lipshitz 2009).

With this transition, but not before, will the developing embryo be sensibly identified in terms of its genetic identity. This is true, however, only provided that we strictly focus on the cells deriving from the zygote and thus on their genome. However, a number of biological systems, including humans, involve a functional association between cells of very different genetic identity, most of which are bacteria. Collectively, these form a microbiome that accompanies the animal throughout its life, and strongly influences its vital functions. According to Gilbert et al. (2012), the individual animal proceeds throughout its whole life only as a consortium of animal cells and microbes (cf. McFall-Ngai 2002; Pradeu 2011; Gilbert and Epel 2015).

This seems to offer a novel sensible perspective on how animals develop and function, but at the same time this opens new questions – specifically, how to reconcile this view with the traditional criteria to delimit individuals.

Further and even more intriguing difficulties are specific to some species. A well-studied example (Ross et al. 2007) is Wied's marmoset (*Callithrix kuhlii*), a small American monkey in which cells are regularly exchanged between twins, thanks to leakage of these cells into the blood they exchange with their mother during pregnancy: a minority of the sibling's cells will persist in each of them throughout life (*chimerism*).

12.4 Genotype vs. Phenotype

Useful as a genetic criterion of identity can actually be, despite the shortcomings outlined in the previous lines, it is nevertheless critically important to remark that the genotype is not necessarily a reliable proxy for the phenotype, with which we are eventually concerned as the actor in either a developmental, behavioural, ecological or evolutionary scenario. The relationship between genotype and phenotype, better known in the biological literature as the genotype→phenotype map (Alberch 1991; Wagner and Altenberg 1996; Pigliucci 2001; West-Eberhard 2003; Minelli 2017) is complex indeed; its predictability is limited, because of *pleiotropy* (multiplicity of phenotypic traits affected by one gene) and the rich regulatory networking in which genes and gene products are involved. Even when predictable, the correspondence between genotype and phenotype is not a simple one-to-one correspondence because of *polyphenism*, the production of different phenotypes in the absence of genetic differences but under different environmental conditions (Fusco and Minelli 2010).

Nongenetic factors involved in the production of distinct phenotypes despite genetic uniformity include temperature, food, physical stress caused by high population density, and also the photoperiod, ie the relative length of day and night. Development is generally subject to the influence of these factors only during a restricted temporal window, either in the embryonic phase or, in holometabolous insects, during the larval or pupal stage. Let’s briefly mention two examples.

Map is the English name for *Araschnia levana*, a butterfly found in the lowlands of central and eastern Europe. Every years, it alternates between a spring generation featuring on its wings black spots on a predominantly orange background, and a summer generation with orange, white and black bands. Due to the big differences in habitus, the two forms were initially described as two different species, under the names of *levana* and *prorsa*, respectively. However, not only do they not represent specifically distinct taxa, but no genetic difference at all is responsible for their obvious phenotypic distance. The switch between the two alternative forms is determined instead by the photoperiod in the season during which the insect is in the larval stage (Müller 1955) causing differences in the hormonal control of moulting and metamorphosis (Koch 1992). Caterpillars developing in late summer, thus receiving less than 8 hours of light per day, turn into overwintering pupae from which adults with *levana* phenotype will emerge. But the offspring of the latter, growing as larvae in the weeks closest to the summer solstice, turn quickly into pupae from which *prorsa* adults will soon emerge, ready to start a new cycle.

In a number of species, even a major alternative such as developing as a female or a male is under environmental rather than genetic (or chromosomal) control. For example, in alligators (Ferguson and Joanen 1982) and in some lizard species, eggs incubated at low temperatures develop exclusively into females, while eggs incubated at high temperatures all develop into males. In many turtles, the opposite is true, that is, only males develop at low temperatures and only females at high temperatures. In a few turtles and in crocodiles, incubation at intermediate temperatures will only give males, while both high and low temperatures will only give females (Valenzuela and Lance 2004; Booth 2006).

12.5 Immunological Memory, and an Odd Couple

The uniqueness of the individual is thus not completely fixed since the earliest stages of its ontogeny. The most important contributions to its steady increasing sharpness throughout life are stored in the individual's memory, in its two main aspects – memory in the conventional sense of the term, stored in the brain, and immunological memory, stored in the animal's immune system.

The latter indeed has been singled out by Pradeu (2012) as the most reliable specifier of an individual's identity. Good arguments support this choice, especially in the case of vertebrates, but comparative biology warns against running towards easy generalizations. There are species indeed to which the immunological criterion of individuality does not seem to apply. These are a number of fish species belonging to the Ceratioidei, deep-sea relatives of the angler fish, among which no immune rejection is released when a permanent graft, with establishment of a conjoined circulatory system, is established between a male and its partner, onto which it firmly settles and of which – due to its diminutive size – it becomes a kind of appendage, the whole pair thus becoming a sort of self-fertilizing hermaphrodite.

12.6 Where Are the Boundaries of a Biological Individual?

Physical distinctness is an obvious criterion but, as mentioned above, it fails to provide a final solution in the case of multiple ramets belonging to the same genet, as in strawberries. This contrast between genetic uniqueness and physical delineation is common in plants but not limited to them. In addition to polyembryony, animal examples include the hydra and similar polypoid organisms with asexual reproduction: here, no objective criteria can be applied to fix the time at which the bud ceases to be a part of the parent polyp to become instead an independent individual. Similarly, what about Siamese twins? The luckily low frequency of their occurrence does not cancel the difficulty in deciding how many individuals should be recognized in any individual case. Distinct heads and thus distinct brains are arguably the strongest criterion upon which we can base what eventually reduces to an operational and especially an ethical decision in matters where biology fails to provide definitive answer. In this respect, it is interesting to remark our different attitudes towards humans compared to other animals: we speak of (two) Siamese twins in cases morphologically equivalent to what we describe, for example, as a calf (one calf) with two heads.

More interesting, however, are other kinds of organisms, in which anatomical and physiological continuity is retained between two components, one of which could be considered the offspring of the other, the divide being marked by fertilization with the accompanying transition from haploidy to diploidy. This is indeed the case of the mosses, in which a leafy haploid gametophyte supports a diploid sporophyte represented by a leafless seta surmounted by the sporigenous capsule. In this case, the obvious difference in chromosome number marks a boundary between what we may define as genetic individuals, but the physical continuity between them may suggest otherwise. Indeed, using ploidy as the criterion to fix individuality would simply multiply problems. To give a couple of examples, are the haploid gametes produced by a diploid animal parts of the latter or independent individuals and if so, would these cells already deserve be called individuals at the time of the transition from diploid to haploid status during meiosis, thus even before being released? (cf. Minelli 2014). Much worse is the case of the fruits of the flowering plants, in which cells with three or four different nuclear conditions usually coexist.

12.7 Hermaphrodites

One more problem with the delineation of individuals is offered by primary hermaphrodites (to distinguish them from the rare secondary hermaphrodites, such as the deep-sea angler fishes mentioned above). In a primary hermaphrodite such as an earthworm, a leech, a snail, or a gilt-head bream (*Sparus aurata*), all cells derive from a single zygote and are thus genetically identical – including the cells from which the gametes, i.e. the eggs and the sperm cells, will be formed. Up to the release of the gametes, there is obvious physical continuity among all these cells. However, in ecological and evolutionary terms it may be sensible to acknowledge a degree of competition between the male and the female function: the resources allocated to the one are not available to the other. This helps explaining why hermaphroditism is often not simultaneous, but either protandrous (the animal undergoes a male phase, followed by a female one) or proterogynous (female first, then male). Therefore, by moderately stretching the notion of evolutionary individual, we might accept that hermaphrodites represent a set of conditions distributed at both sides of the divide between single and multiple individuality.

A double challenge to full, conventional individuality is offered by two genera of flatworms, *Diplozoon* and *Wedlia*, parasitic on freshwater fishes and on birds, respectively. As suggested by the genus name, the hermaphroditic 'individuals' of the former genus live in pairs, in permanent union with fusion of tissues and reciprocal conjunction of the female genital apparatus of one with the male genital apparatus of the other. Similarly, in *Wedlia bipartita*, the two partners are permanently associated, but their reproductive functions are distinct and complementary: the smaller individual has a complete male apparatus, but only rudiments of the female one, while the larger individual functions as a female, its male apparatus being atrophied (Matthes 1988).

12.8 The Persistence of Individuals Through Developmental Time

Persistence, or continuity, was basic to the definition of biological individuality formulated by Huxley in 1852, cited above. Admittedly, Huxley's definition brings us straight into the difficulties of the old paradox of the ship of Theseus: when all parts of the original ship have been replaced by new ones following a long series of shipwrecks, is Theseus' ship still the one with which he and his companions first sailed? Despite this logical conundrum, and also the fact that this definition does not apply to all kinds of organisms, Huxley's formulation nevertheless captures one important point, that is, that biological individuals are historical things, whose nature cannot be fully understood unless we study them in the light of development.

Unfortunately, focusing on the developmental dimension of biological individuals does not clear off all the uncertainties and ambiguities surrounding the notion of biological individual. Developmental biology is notoriously weak in terms of theoretical underpinnings, the lack of consensus extending even to the definition of its subject matter (Pradeu et al. 2016) and to the temporal delimitation of individual ontogenies (Minelli 2011). However, these difficulties are not a consequence of a lack of interest in a possible theory of development (Minelli and Pradeu 2014). but are largely due to the fact that in a broader, evolutionary dimension development, itself a historical aspect of life phenomena, is subject to long-term changes. As a consequence, defining development in general and individual development in particular, based on the comparative evidence provided by a small set of species (e.g., our own species, or mammals generally, or even vertebrates) unavoidably ends up with notions of development and biological individuality that do not apply universally.

12.9 Modularity and Individuality

Eventually, the study of the developmental history of the individual borders on the evolutionary history of the species, including its characteristic developmental schedule, in the domain of evolutionary developmental biology (evo-devo), a disciplinary domain that Winther (2015) has aptly defined as a trading zone where scientists and philosophers are lively debating questions such as the origin of evolutionary innovations (Müller and Wagner 2003; Müller and Newman 2005; Peterson and Müller 2013, 2016) and the evolvability of structural and functional traits (Hendrikse et al. 2007; Pigliucci 2008; Minelli 2017). Key to the current debate in evolutionary developmental biology is the notion of modularity, in its many declinations (e.g., Schlosser and Wagner 2003), including architectural (structural) vs. temporal modules, but also modules as unit processes in development. The relevance of modularity for a discussion of biological individuality is easily grasped when considering the dramatic metamorphosis that a number of animals undergo, for example flies, sea urchins and ribbon worms (nemerteans). Of the larval body of a fly, for example, most of the bulky musculature and other structures are rapidly broken down during the pupal stage, whereas the adult-specific organs such as legs, wings, eyes and antennae are rapidly formed starting from pre-existing tiny clusters of cells that survive from the sweeping destruction of most of the remaining of the body. In terms of cell population, the individual development of a fly from the egg till the adult is thus characterized by a severe bottleneck. Even more impressive is the origin of the adult body in some nemerteans, where a number of independent invagination of the larval epidermis eventually merge to form the little worm, while most of the larval body is discarded (eg, Maslakova 2010).

12.10 The Distributed Uniqueness of the Individual

Along the branches of the tree of life it would not be difficult to pick many more examples of organisms whose anatomical organization, developmental history or genome would further challenge one or more criteria of biological (physiological) individuality. Deliberately, I have not even mentioned the difficulties we face when we try to describe in terms of individual (or of colony, that is, integrated community of individuals) organisms like corals, or the society of bees, ants and termites. But I think that we do not need additional evidence to realize that in different kinds of organisms individuality materializes in very different ways, not necessarily specific to different major taxa (eg, mammals vs. insects vs. flowering plants) or levels of complexity (eg, unicellular vs multicellular). Along the many, divergent branches of the tree of life, different forms of physiological individuality have repeatedly evolved, have been perhaps lost or modified on occasion, sometimes only to open the way to individuals characterized by a new mix of physical separation or genetic uniqueness.

In the end, we must arguably become accustomed to the fact that different kinds and degrees of individuality are found in nature, and every living system materializes some but not necessarily others of the possible criteria of individuality. The analytical exploration of this diversity is a worth exercise involving many biological disciplines, from developmental biology to the study of evolution, from genetics to reproductive biology. On the other hand, insisting on our search for the definition of individual (even restricting this search to the physiological, rather than evolutionary notion, following the distinction presented in the first section of this paper) would probably be ill-advised.

In recent years, largely under the stimulus of the opportunities for communication and standardization offered by the modern digital technology, numerous projects have been cropping up, aiming at fixing the meaning and thus the use of terms for an increasing number of disciplinary domains within biology. The target of these projects is often defined as an ‘ontology’ (eg, Gene Ontology Consortium 2000; Vogt 2008, 2009; Vogt et al. 2010; Hoendorf et al. 2016). Irrespective of the legitimacy or opportunity of using the latter term in this novel meaning, the scientific community should seriously weigh the potential gain deriving from a standardized use of terms against the danger of closing our eyes towards a complexity of natural phenomena that requires flexible mind and not less flexible terminology: "resorting to formal and machine languages in an attempt to "fix" or "stabilize" the semantics of natural languages is not always a successful or desirable strategy" (Epstein 2012).

References

Alberch, P. (1991). From genes to phenotype: Dynamical systems and evolvability. *Genetica, 84*(1), 5–11.

Booth, D.T. (2006). Influence of incubation temperature on hatchling phenotype in reptiles. *Physiological and Biochemical Zoology, 79*(2), 274–281.

Carter, C.A., & Wourms, J.P. (1993). Naturally occurring diblastodermic eggs in the annual fish *Cynolebias*: Implications for developmental regulation and determination. *Journal of Morphology, 215*(3), 301–312.

Dawkins, R. (1976). *The selfish gene*. New York: Oxford University Press.

Epstein, M. (2012). Nomenclature, terminology and language. *Bionomina, 5*, 1–56.

Ferguson, M.W., & Joanen, T. (1982). Temperature of egg incubation determines sex in *Alligator mississippiensis*. *Nature, 296*(5860), 850–853.

Fusco, G., & Minelli, A. (2010). Phenotypic plasticity in development and evolution. *Philosophical Transactions of the Royal Society of London, 365*(1540), 547–556.

Gene Ontology Consortium. (2000). Gene ontology: Tool for the unification of biology. *Nature Genetics, 25*(1), 25–29.

Ghiselin, M.T. (1997). *Metaphysics and the origin of species*. Albany: State University of New York Press.

Gilbert, S.F., & Epel, D. (2015). *Ecological developmental biology: The environmental regulation of development, health, and evolution* (2nd ed.). Sunderland: Sinauer.

Gilbert, S.F., Sapp, J., & Tauber, A.I. (2012). A symbiotic view of life: We have never been individuals. *The Quarterly Review of Biology, 87*(4), 325–341.

Godfrey-Smith, P. (2009). *Darwinian populations and natural selection*. New York: Oxford University Press.

Grbic, M. (2003). Polyembryony in parasitic wasps: Evolution of a novel mode of development. *International Journal of Developmental Biology, 47*(7/8), 633–642.

Hallez, P. (1887). Embryogénie des dendrocoeles d'eau douce. *Mémoires de la Société des sciences, de l'agriculture et des arts de Lille, 16*, 1–107.

Harper, J.L., & White, J. (1974). The demography of plants. *Annual Review of Ecology and Systematics, 5*, 419–463.

Hendrikse, J.L., Parsons, T.E., & Hallgrímsson, B. (2007). Evolvability as the proper focus of evolutionary developmental biology. *Evolution & Development, 9*(4), 393–401.

Hoendorf, R., Alshahrani, M., Gkoutos, G.V., Gosline, G., Groom, Q., Hamman, T., Kattge, J., de Oliveira, S.M., Schmidt, M., Sierra, S., Smets, E., Vos, R.A., & Weiland, C. (2016). The flora phenotype ontology (FLOPO): Tool for integrating morphological traits and phenotypes of vascular plants. *Journal of Biomedical Semantics, 7*, 65.

Huxley, T.H. (1852). Upon animal individuality. *Proceedings of the Royal Institution of Great Britain, 11*, 184–189.

Koch, P.B. (1992). Seasonal polyphenism in butterflies: A hormonally controlled phenomenon of pattern formation. *Zoologische Jahrbücher, Abteilung für Allgemeine Zoologie und Physiologie der Tiere, 96*, 227–240.

Linnaeus, C. (1758). *Systema Naturae per regna tria Naturae secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*, Editio decima, Holmiae, apud Laurentium Salvium.

Luan, J.B., Sun, X.P., Fei, Z.J., & Douglas, A.E. (2018). Maternal inheritance of a single somatic Animal cell displayed by the bacteriocyte in the whitefly *Bemisia tabaci*. *Current Biology, 28*(3), 459–465.

Maslakova, S.A. (2010). Development to metamorphosis of the nemertean pilidium larva. *Frontiers in Zoology, 7*, 30.

Matthes, D. (1988). *Tierische Parasiten. Biologie und Ökologie*. Braunschweig-Wiesbaden: Vieweg.

McFall-Ngai, M.J. (2002). Unseen forces: The influences of bacteria on animal development. *Developmental Biology, 242*(1), 1–14.

Minelli, A. (2011). Development, an open-ended segment of life. *Biological Theory, 6*(1), 4–15.

Minelli, A. (2014). Developmental disparity. In A. Minelli & T. Pradeu (Eds.), *Towards a theory of development* (pp. 227–245). Oxford: Oxford University Press.

Minelli, A. (2017). Evolvability and its evolvability. In P. Huneman & D. Walsh (Eds.), *Challenges to evolutionary theory: Development, inheritance and adaptation* (pp. 211–238). New York: Oxford University Press.

Minelli, A., & Pradeu, T. (Eds.). (2014). *Towards a theory of development*. Oxford: Oxford University Press.

Müller, H.J. (1955). Die Saisonformenbildung von *Araschnia levana*, ein photoperiodisch gesteuerter Diapauseeffekt. *Die Naturwissenschaften, 42*(5), 134–135.

Müller, G.B., & Newman, S.A. (2005). The innovation triad: An EvoDevo agenda. *Journal of Experimental Zoology (Molecular and Developmental Evolution), 304B*(6), 487–503.

Müller, G.B., & Wagner, G.P. (2003). Innovation. In B.K. Hall & W.M. Olson (Eds.), *Keywords and concepts in evolutionary developmental biology* (pp. 218–227). Cambridge, MA: Harvard University Press.

Pallas P.S. (1766). *Elenchus zoophytorum sistens generum adunbrationes generaliores et specierum cognitarum succinctas descriptiones cum selectis auctorum synonymis*, Hagae, apud Petrum van Cleef.

Peterson, T., & Müller, G.B. (2013). What is evolutionary novelty? Process versus character based definitions. *Journal of Experimental Zoology (Molecular and Developmental Evolution), 320B*(6), 345–350.

Peterson, T., & Müller, G.B. (2016). Phenotypic novelty in EvoDevo: The distinction between continuous and discontinuous variation and its importance in evolutionary theory. *Evolutionary Biology, 43*(3), 314–335.

Pigliucci, M. (2001). *Phenotypic plasticity: Beyond nature and nurture*. Baltimore: John Hopkins University Press.

Pigliucci, M. (2008). Is evolvability evolvable? *Nature Reviews Genetics, 9*(1), 75–82.

Pradeu, T. (2011). A mixed self: The role of symbiosis in development. *Biological Theory, 6*(1), 80–88.

Pradeu, T. (2012). *The limits of the self: Immunology and biological identity*. Oxford: Oxford University Press.

Pradeu, T. (2016). Organisms or biological individuals? Combining physiological and evolutionary individuality. *Biology and Philosophy, 31*(6), 797–817.

Pradeu, T., Laplane, L., Prévot, K., Hoquet, T., Reynaud, V., Fusco, G., Minelli, A., Orgogozo, V., & Vervoort, M. (2016). Defining "Development". *Current Topics in Developmental Biology, 117*, 171–183.

Ross, C.N., French, J.A., & Orte, G. (2007). Germ-line chimerism and paternal care in marmosets (*Callithrix kuhlii*). *Proceedings of the National Academy of Sciences of the United States of America, 104*(15), 6278–6282.

Santelices, B. (1999). How many kinds of individual are there? *Trends in Ecology & Evolution, 14*(4), 152–155.

Schleiden, M.J. (1838). Beiträge zur Phytogenesis. *Archiv für Anatomie Physiologie und wissenschaftliche Medicin, 1838*, 137–176.

Schlosser, G., & Wagner, G.P. (2003). Introduction: The modularity concept in developmental and evolutionary biology. In G. Schlosser & G.P. Wagner (Eds.), *Modularity in development and evolution* (pp. 1–11). Chicago: University of Chicago Press.

Schwann, T. (1839). *Mikroskopische Untersuchungen über die Uebereinstimmung in der Struktur und dem Wachsthum der Thiere und Pflanzen*. Berlin: Sander.

Tadros, W., & Lipshitz, H.D. (2009). The maternal-to-zygotic transition: A play in two acts. *Development, 136*, 3033–3042.

Treviranus, G.R. (1802–1822). *Biologie: oder Philosophie der lebenden Natur*. Gottingen: Röwer.

Valenzuela, N., & Lance, V. (Eds.). (2004). *Temperature-dependent sex determination in vertebrates*. Washington, DC: Smithsonian Institution.

Van de Vyver, G., & Willenz, P. (1975). An experimental study of the life-cycle of the freshwater sponge *Ephydatia fluviatilis* in its natural surroundings. *Wilhelm Roux's Archives of Developmental Biology, 177*(1), 41–52.

Vogt, L. (2008). Learning from Linnaeus: Towards developing the foundation for a general structure concept for morphology. *Zootaxa, 1950*, 123–152.

Vogt, L. (2009). The future role of bio-ontologies for developing a general data standard in biology: Chance and challenge for zoomorphology. *Zoomorphology, 128*(3), 201–217.

Vogt, L., Bartolomaeus, T., & Giribet, G. (2010). The linguistic problem of morphology: Structure versus homology and the standardization of morphological data. *Cladistics, 26*(3), 301–325.

Wagner, G.P., & Altenberg, L. (1996). Complex adaptations and evolution of evolvability. *Evolution, 50*(3), 967–976.

West-Eberhard, M.J. (2003). *Developmental plasticity and evolution*. New York: Oxford University Press.

Wilson, J. (1999). *Biological individuality: The identity and persistence of living entities*. Cambridge: Cambridge University Press.

Winther, R.G. (2015). Evo-devo as a trading zone. In A.C. Love (Ed.), *Conceptual change in biology: Scientific and philosophical perspectives on evolution and development* (pp. 459–482). Dordrecht: Springer.

Zachos, F.E. (2016). *Species concepts in biology. Historical development, theoretical foundations and practical relevance*. Cham: Springer International Publishing Switzerland.

Chapter 13
Aspects of the Ongoing Debate on Animal Communication. (Zoo)semiotics and Cognitive Ethology

Stefano Gensini

Abstract After a flashback on the history of zoosemiotics, the paper focuses on the way the "embodied" paradigm of post 1980s cognitivism helped renew the debate on animal communication. It is suggested that research on alarm-signals in vervet monkeys and other species encouraged closer relations between communication studies and the philosophy of mind, then giving rise to a "referential functionality" theory which attenuated the mentalistic assumptions of the beginning. Today the traditional dichotomy between symbolic and emotional features of animal communication is being gradually replaced by a pragmatic perspective that sees them as complementary and mutually integrated. The abandonment of the chomskyan view of language as disembodied and merely symbolic is increasingly emerging as the preliminary step towards a unitary reconsideration of human and non-human communication systems.

Keywords Animal communication · Ethology · Semiotics · Embodiment · Alarm-signals · Functions of language

1. The term *zoosemiotics* was coined in 1963 by Thomas Sebeok to define an area of research jointly investigated by linguists, as well as ethologists and biologists studying forms of communication typical of non-human animal species (Sebeok 1968a, b). This project revolved around the idea that there is significant continuity between all kinds of communication in the animal world (human and non-human) and that this should be explored by taking an interdisciplinary approach. Semiotics (which had been establishing itself internationally since the late '50s as the key to such an approach) took charge of promoting the exchange and interaction between the different fields of expertise involved and of theoretically capitalizing on the possible results. Classical cases such as that of bees' communication (von

S. Gensini (✉)
Sapienza University of Rome, Rome, Italy
e-mail: sgensini53@gmail.com

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_13

Frisch 1950) and bats' echolocation (brought to light by the work of Donald Griffin, starting in the '40s) seemed to promise that such research would yield plenty of results. Among other things, these studies demonstrated that only a close collaboration between biologists and ethologists (with their attention to species' different types of perception and behaviour) and scholars well versed in linguistics and philosophy of language could ensure effective understanding of such complex phenomena.

Anyone today wishing to understand the spirit that animated this period of research can refer to Charles Hockett's papers from 1957 to 1968. Hockett was an American linguist in the Bloomfieldian tradition who suggested investigating animal as well as human languages by means of the so-called 'design features' model. The basic idea was that it was possible to adopt a set of distinctive semiotic features (e.g. arbitrariness, directionality, interchangeability etc.) from which each species-specific language carved out its own set of constituents. The chart of features enabled immediate comparison between the species. While each species took its place in the zoosemiotic realm, human language proved to be the most complex, the one in which the majority of features were integrated.[1] Another important figure at the time was the ethologist Peter Marler, who studied at Cambridge under eminent scholars such as W. H. Thorpe and R. Hinde and later became the teacher of generations of researchers in the field of primatology, avian studies, etc. On several occasions, Marler, also motivated by dialogue with Hockett, tried to develop a method to study animal communication (see, e.g., Marler 1961). By 1967 the basic guidelines for its study were already fixed: the integration of the ethologist's experience with the categories of the linguist or semiotician had to especially take into account the following issues: (1) the presence of symbolic (arbitrary) components in animal signals had to be investigated; (2) the receiver's response was deemed essential to understanding the operation of the code; (3) the coexistence of different sensory modalities in animal communication (multimodality[2]) was a promising field for future researches. Notable inclusions in this article's bibliography, alongside the writings of the aforementioned von Frisch, S. A. Altmann and E. O. Wilson (a future sociobiology theorist), are Hockett, Birdwhistell and a key text of twentieth-century semiotics, *Signs, Language and Behavior* (1946) by Charles Morris.

The impressive collection of essays on *Animal Communication*, edited by Sebeok and published in 1968, is a fascinating summary of the period of research we have discussed. In it we find not only the two key figures – Hockett (in this instance as a co-author with Altmann) and Marler –, but also a group of scholars destined to play an important role in the years to come, from W. John Smith to the aforementioned Wilson, along with Griffin, Gregory Bateson and Eric C. Lenneberg; it also contains the latest available information on the communication of different species, from bees to certain species of mammals, arthropods and various types of birds.

[1] Hockett's classification is still considered a reference point in the field of ethology. For the most complete version, see Hockett and Altmann (1968). For a recent critical point of view from a cognitive perspective, see Wacewicz and Zywiczyński (2015).

[2] This aspect was developed many years later in Partan & Marler (2005).

Nonetheless, anyone who has the patience to leaf through the book, quickly realizes that the unified zoosemiotics project, initiated by Sebeok, was already falling apart. First of all, it is interesting to note the cautious and even sceptical references to Darwin, an author who today – 50 years later – is almost universally considered a key voice on the subject of both human and animal communication. Secondly, various contributors (including the editor in the preface) refer to Chomsky (it should be remembered that *Cartesian Linguistics* was published in 1966) as the scientist who demonstrated the impossibility of studying animal communication in the same theoretical framework as human language, on the premise that they are two qualitatively different phenomena. This laid the ground for the separation between zoosemiotics and anthroposemiotics which Sebeok explicitly acknowledged shortly afterwards and which heavily influenced the debate around the most famous ethological-semiotic experiment of those years: the teaching of *American Sign Language* to a female chimpanzee – Washoe – by Allen and Beatrice Gardner and their assistant Robert Fouts.

The singular paradox underlying this experiment is worthy of note. The Gardners (two psychologists trained according to behaviourist methodology and unburdened by any "mentalist" hypotheses) understood the great novelty of the semiotic research of the time: the first description of the language of deaf Americans in terms of a genuine sign system (Stokoe 1960); a discovery that not only broadened the spectrum of the notion of historical-natural languages, but also illustrated the semantic possibilities of a non-verbal communication system, reviving the views of eighteenth-century philosophers such as G. B. Vico and É. Bonnot de Condillac regarding the communicative power of gestures and of the body as a whole. Although it required long, patient training, Washoe was able to learn and master approximately 250 ASL signs and even to syntactically combine some of them into elementary sentences. However, though on the one hand this experiment demonstrated the importance of semiotics for the study of animal communication, on the other it ended up clashing with the linguistic and philosophical-linguistic theories of the time. The alleged uniqueness of human language, the crux of Chomsky's innatist and syntacticist paradigm, was clearly under question. Gardners' experiment received considerable criticism, aiming to show that Washoe's language was in no way comparable to human language and that the research project behind it (which was fundamentally compatible with the behaviourist paradigm) was groundless. Today, reading the collection of studies *Speaking of Apes* (1980), edited several years later by Sebeok, gives the impression of a kind of *de profundis* for the early days (and juvenile dreams) of zoosemiotics.[3]

[3]This does not in any way devalue Sebeok's excellent work in establishing a semiotic approach within a biological framework, starting from the theories of Estonian biologist Jakob von Uexküll. The Department of Semiotics at the University of Tartu (which includes eminent scientific figures such as Kalevi Kull, Peeter Torop, Timo Maran and other younger theorists) continues to cultivate and develop this research perspective, which is organized internationally through the International Society for Biosemiotic Studies. The quarterly *Biosemiotics* journal (founded in 2008) is the main scientific publication for this kind of research.

2. The birth of cognitive ethology is generally traced back to Donald Griffin's book *The question of animal awareness* (1976). In this work, the traditional behaviourist outlook, according to which it was considered unscientific to look into the black box of the mind and every hypothesis had to be constructed on the basis of observable data, elicited by means of consolidated research techniques, was extensively and systematically replaced for the first time by a mentalist approach. Varying levels of awareness were attributed to animal species on the assumption that the "mental" components of behaviour had an adaptive value: in other words, that they had developed for the fitness of the species under investigation. Communication, no longer considered an exclusive prerogative of the human species, was the central point of this new approach. This made it possible to open "a window" into the mind of non-human animals, leading to an initial understanding of how a non-human species "sees the world". The horizon opened up by Griffin's work (also see Id. 1995 as well as Cheney and Seyfarth 1990) was soon complemented by two fundamental elements, one of an experimental nature and the other of a theoretical nature. The experimental element was taken from the famous study of vervet monkeys' alarm system in Ambroseli National Park (Kenya), which began with an article by Robert M. Seyfarth and Dorothy L. Cheney in collaboration with Peter Marler, published in *Animal Behavior* (cf. Seyfarth et al. 1980). Expounding upon a discovery by another of Marler's collaborators, T. T. Struhsaker, dating back to 1967, the researchers presented evidence about the existence of a genuine communicative code, featuring acoustically distinct and specific referential signals emitted when three of the species' natural predators were present, namely the martial eagle, leopard and python. When a signal was emitted, the conspecifics that heard it exhibited, with significant consistency, different behaviours, such as, respectively, hiding in a bush, escaping to the highest branches of trees (which leopards cannot reach due to their weight) or moving to a high viewing position, looking towards the ground in search of danger. The "symbolic" (and non-emotional) nature of such behaviours was demonstrated by a playback experiment. Alarm signals emitted in natural conditions were recorded and replayed using loudspeakers in the absence of predators. The fact that a significant percentage of subjects reacted to the playback in the same way in which they reacted to a natural danger signal seemed to conclusively confirm this hypothesis. In a similar way to how human words function, the vervet monkeys' alarm calls seemed to function independently of the physical presence of their referents. In other words, they were both referential (since they identified states of things) and symbolic (since physical presence was not a necessary condition for the signal utterance).

In 1983, a collaboration between the Amboseli team and the philosopher Daniel Dennett added significant theoretical depth to the puzzle. Referring to the debate, which was very much alive in the philosophy of mind, concerning intentionality (understood as 'aboutness') of the human mind and the problem of meaning, Dennett introduced a mentalistic perspective into the experiment. It can be roughly summarized as follows. If it is true – as Franz Brentano first suggested in 1874 – that intentionality is the hallmark that distinguishes mental phenomena from physical phenomena; and if it is true that the ability to refer to state of affairs is the trait that reveals the presence of a mind, then the vervet monkeys' behaviour strongly suggests the presence of a mind.

Today one could legitimately argue that both the premises of reasoning were too rigid: the idea that only rational behavior is intentional or that the function of the reference operates in language in isolation from the others, except in specific cases, does not seem sustainable. However, at the time there seemed to be compelling arguments to define the code of alarm calls as "semantic" and "intentional": as playback experiments demonstrated, these signals were able to arouse in the receivers a mental state even independently of contextual cues and therefore without the impact of emotional pressure. The view outlined in Darwin's book *The Expression of Emotion in Man and the Animals* (1872) (which is often considered to be the source of the hypothesis that animal signals are purely emotional[4]) therefore seemed now to be contradicted by solid empirical data. Dennett proposed different "degrees" of intentionality: from the first degree (*x* believes that *p*) or the second degree (*x* wants *y* to believe that *p*) to highly complex forms, probably unique to human beings. It was not about pigeonholing vervet monkeys into one of these categories, but rather about encouraging the method of attributing intentional states as a stimulus for empirical research and for the adoption of increasingly precise tests and tools to elicit behaviours characterized by mentalist features. It was not a matter of reviving a "Panglossian" myth, presenting ethology with anthropomorphically inspired shortcuts, but rather of asking the right questions of the natural world, attempting to explain *why* evolution followed that route, rather than another. In his words:

> The most important parallel I wished to draw is this: psychologists can't do their work without the rationality assumption of the intentional stance, and biologists can't do their work without the optimality assumptions of adaptionist thinking – though some in each field are tempted to deny and denounce the use of these assumptions. [..] We take on optimality assumptions not because we naively think that evolution has made this the best of all possible worlds, but because we must be interpreters, if we are to make any progress at all, and interpretation requires the invocation of optimality" (Dennett 1987, 277, 278–79).

Experimental evidence and theoretical arguments thus joined forces in the early 1980s to construct a new animal communication research paradigm. Firstly, unlike in the pilot experiment conducted on Washoe, in this case the study's focus was the communicative behaviour of a species in its natural habitat, without human conditioning. Possible similarities with human sign systems were found *within* the code adopted by the species under consideration, in which the symbolic component of communication played a decisive role. Secondly, the adoption of a mentalist strategy reversed the assumption of the unknowability of other species' minds. This had been widely discussed over the years, starting with the famous article by Thomas Nagel ("What is it like to be a bat?", 1974). However, the principle of

[4]Darwin's theory cannot be reduced to the idea that animal languages are purely emotional. This is incontrovertibly demonstrated by the *Language* section in the 1871 work, *The Descent of Man*, part of a longer chapter that illustrates the relative continuity of higher cognitive functions among animal species. Refer to Gensini (2014) for details.

the continuity of mental experience, which underpinned the darwinian perspective, helped look in a new way at the adaptations of non-human animal species and their means of communication. This paradigm was effectively consecrated in the 1990 work *How monkeys see the world. Inside the mind of another species* by the aforementioned Cheney and Seyfarth and in the collection of essays dedicated to Donald Griffin, *Cognitive ethology. The mind of other animals* (Ristau ed. 1991) in which both the theoretical themes of the cognitive approach and the more typical case studies and research themes (the "social" awareness of chimpanzees, the cognitive abilities of the African grey parrot Alex, studied by Irene Pepperberg, and above all the cases of "deceptive" signals documented for various species) were reviewed. Finally, in 1997, the work *Species of Mind* by Colin Allen and Marc Bekoff, both connected to Griffin's teaching, offered a sort of theoretical arrangement of the state of cognitive ethology, a discipline created to build a "new synthesis" together with comparative psychology and philosophy.

3. The concept of 'meaning' lies at the heart of the method of approaching animal communication described above (Evans et al. 1993; Evans and Marler 1995). In other words, the idea is that communication exchanges are regulated by a code made up of a certain number of signals and that *information* is (somehow intentionally[5]) transmitted by them. The signs used (for example, alarm calls or food-associated calls) would therefore be meaningful in a similar sense to how "meaningful" is understood in relation to human communication. This approach – the common core of cognitive ethology – was opposed, starting in the late 1970s, by a different approach that rejects the concept of meaning and replaces it with that of 'manipulation'. The seminal papers by Dawkins and Krebs[6] reject the idea that animal signals transmit information, since they consider this notion to be modelled on human communication. Proposing (what they consider to be) a strictly Darwinian approach, the two authors suggest that the crux of the matter is the adaptive value of signals, whose natural purpose is to *influence* the behaviour of conspecifics to the advantage of the signaller. According to this approach, signals develop in close relationship with the perceptual system, according to the laws and time scale of any natural system and do not require a high-level cognitive explanation to justify how they function. The Shannon-Weaver engineering model of communication (1949) is applied in a different way in this new approach. It proposes a concept of information in terms of statistical probability and reduction of uncertainty that excludes any semantic interpretation. It should be noted that the same model was used in the early days of zoosemiotics to frame human and animal communication in the same proto-semiotic conceptual perspective (see Cherry 1957); it is now used to eliminate the risk of overlap between the two research areas.

[5]The term 'intentional' is used here in its ordinary sense and should therefore be distinguished from *intentionality* in the philosophical sense referred to in § 2.

[6]See in particular Krebs & Dawkins (1984), which revises a previous formulation of the theory proposed in 1978.

The proposal by Dawkins and Krebs received great attention from biologists and ethologists suggesting an alternative to the "semantic" framework. A relatively recent version of this proposal, by Owings and Morton (1997), refers to it as the 'assessment/management approach'. The concept behind this approach is that it is necessary to take into account the biological characteristics of the observed species (above all its perceptual system) in relation to its natural environment and to the context in which the communicative event occurs. Thus, the emotional and excitatory states of the observed animals receive renewed attention, which Darwin purposely placed at the centre of his analysis of species' expressive behaviour. From this different point of view, the semantic-informational approach "seems to neglect" the "motivational" components of the communication process, resulting in a "disembodied" concept of behaviour. On the contrary, the context of communication, with its relational and emotional pressures, is the key to understand its functioning. In the aforementioned essay, Owings and Morton clearly illustrate this point:

> In the A/M [= assessment/management] approach, the central question about communicative behaviour, from the perspective of management, is not "what does it stand for?", but "what does it serve to accomplish, and under what constraints?" By substituting the latter question for the former, we approach the management side of communication in a way that recognizes the distinct properties of assessment and management. By looking to the interface of assessment and management, we maximize our chances of understanding the complex causal processes underlying communication (1997, 367).

For example, if we are trying to understand *why* different species of mammals have developed low-pitched and broad-band threat vocalizations, the A/M model suggests taking the following considerations into account:

> (1) Body size constrains both pitch of vocalizations and danger posed to others. (2) Assessment systems are constrained to use reliable cues, so they judge risk in part on the basis of body-size related factors, such as call pitch. (3) Management systems are constrained by this assessment rule of thumb to use pitch to maximize their apparent threat to others [. . .]. Thus "informative" signals result from a process of attempts to manage and attempts to assess (*ibid*.).

It is questionable whether the critique of the "informational" model was entirely appropriate. As will be discussed further on, since the 1990s, supporters of this model have striven to integrate the study of symbolic components of communication with "motivational" components. In other words, they have tried to re-integrate the "context" into their approach to alarm calls. Admittedly, however, they have found little support in the most widespread linguistic studies in the ethological field. In the old, invariably cited book by Ogden and Richards, *The Meaning of Meaning* (1923), the language's referential and affective resources were explicitly distinguished and juxtaposed. Moreover, the emotional component was excluded from the more recent and dominant Chomskyian paradigm, which left no room for pragmatic considerations. Finally, neither Roman Jakobson's theory of communication nor any of its developments have had any success in ethology: even though it was intended for human language, Jakobson's approach proposed a scenario in which any communicative act could be affected by multiple functions; recognizing an utterance as (above all) referential did not signify that it did not *also* have (for example) an emotional value or a phatic function.

However, as early as 1980, Peter Marler suggested that, generally, symbolic and affective elements should not be considered mutually exclusive. On the contrary, in a remarkable range of cases, the affective element supplemented and reinforced the indication of the referent, thus determining a communication that is more complex from a cognitive point of view than it is usually considered. Marler developed the idea of a *continuum* between a maximum of arbitrariness/symbolicity (of which Amboseli's vervet monkeys could be considered an example) and a maximum of affectivity (where the degree of referential specificity decreases and the "sense" of each signal is derived from the concrete situation that signallers and receivers are immersed in). A typical example is the vocalizations of baboons, which are notoriously limited in number and type, but can have different meanings depending on circumstances (e.g. contact signals in the group while parading; signals exchanged between females, other conspecifics and their offspring, etc.[7]). In 1992, Marler (in an article co-authored with C. S. Evans and M. D. Hauser: see Marler et al. 1992) put forward a conclusive formulation of this theory: both symbolicity and affectivity coexist, albeit in varying degrees, in every type of animal communication. Separating the two factors in the analysis of concrete cases would radically impoverish our understanding of communication processes. Even signals' morphological features cannot be studied without taking into consideration, on the one hand, the characteristics of the stimulus-referent and on the other hand, the motivational state(s) of the communicators. A typical example – studied by Macedonia and Evans (1993) – is that of California ground squirrels, which have also developed a system of referential alarm calls, in which symbolic and motivational elements strongly interfere. Given that these squirrels (unlike vervet monkeys) live in an open and barren environment, where hiding places are limited to burrows, the structure of the alarm call incorporates vocal elements that reveal the degree of *urgency* of the danger, thereby influencing the behaviour of the recipients. Another example is that of meerkats, a kind of mongoose, whose alarm calls (which are also specific to different kinds of predators) vary in acoustic-auditory terms in relation to the degree of urgency: they are clearer and more harmonious when there is no imminent danger and louder and more strident when there is danger close by (see Manser, Seyfarth and Cheney 2002). The concept of 'signal variation' according to context is therefore a motivational integration, which (to put it in traditional semiotic terms) reduces the signal's degree of arbitrariness, reinforcing its iconic component.

Another variable taken into consideration by information-signal theorists is that of the so-called 'audience effect'. The traditional reading of Darwin (1872) generalized the idea that animal signals are not only intrinsically emotional, but forced and involuntary. A series of studies on domestic roosters has led to a re-evaluation of this consolidated view. As Evans and Marler (1995) cogently explain, the domestic rooster has a typical food call that consists of high-pitched pulses.

[7] For examples of this research, see Rendall et al. (1999; 2000).

This signal is directly connected to the receiver's gender. In the presence of hens, the rooster emits its signal, which the hens usually react to by approaching and taking food either directly or from the signaller's beak. Evans and Marler observed that this type of signal is emitted both when the rooster is alone (with particular intensity if the food is especially appealing) and when it is in the presence of hens (with particular intensity if the hens are from outside its harem); however, the rooster is silent in the presence of other males. The identity of the receiver therefore seems to play a decisive role in how this type of communication functions. This clearly contradicts the idea that the emission of signals is forced; it remains to be discussed whether the behaviour of the rooster, which "chooses" whether or not to emit its food call based on context, can be described as intentional. Intriguing cases of deception observed in nature raise similar questions. When the *Cebus apella nigritus* (tufted capuchin monkey) emits alarm calls to scare off possible rivals from a food source (Wheeler 2009), rather than to warn conspecifics that a predator is nearby, the audience effect is clearly very important. The theory of the "involuntary" nature of animal signals is thus undermined.

It is notoriously problematic to make generalizations about cases of deception, since their observation has a highly anecdotal character. However, the instances of audience effect investigated so far confirm that the pragmatic dimension of communication has begun to influence the informational theory, significantly correcting its primitive formulation in strictly symbolic terms. The terminology related to this approach (centred around the concept of 'inference') and the models of communication that depend on it (such as Grice's concept of non-natural meaning and Sperber and Wilson's relevance theory) have significantly enriched the debate on non-human animals' signalling systems.

4. The strategy for the attribution of intentional stances proposed by Dennett has been followed especially in studies on apes and to a much lesser extent on animals that are phylogenetically more distant from humans. The debate on apes, opened by Woodruff and Premack's famous essay (1978), was enlivened by the opposing points of view of Povinelli and his collaborators on the one hand and Michael Tomasello and his team on the other. Refuting Povinelli's distinctly denialist position, Call and Tomasello returned to Premack's question, "Does the chimpanzee have a theory of mind?" thirty years later (2008), answering in the affirmative, while clarifying that the analogy with humans' mental abilities ends with the false belief test, which the chimpanzees do not seem able to overcome[8]

There has been less recourse to the mentalist strategy in studies of other species. The possible overlap between reference skills and intentionality has been set aside and a model has been adopted – so-called 'referential functionality' – that attempts to summarize the parameters discussed in § 3. with more parsimonious use of

[8]More recent research (Krupenye et al. 2016), with the help of new means of observation capable of capturing the anticipatory looks of the animals being studied, has suggested that chimpanzees are able – at least implicitly – to make inferences about conspecifics' false beliefs. If this hypothesis is confirmed, it further reduces the boundary that separates (in qualitative terms) human intelligence from the intelligence of our closest relatives.

mentalist categories. In the words of one of the paradigm's theorists, Christopher S. Evans:

> Systematic studies of animal signal systems can only establish that our subjects behave *as if* their vocalizations encode information about events in the external environment. The term 'functional reference' has been coined to describe this property [. . .] and is intended to be neutral about philosophical issues that are not addressed directly by empirical evidence (1997, 103).

Although this approach undoubtedly represents a step backwards from Griffin's research program, at least it has the advantage of positing the theme of animal communication into a clear, compelling framework. This also does not preclude philosophical problems from being posed again at a certain stage of research. The functional referentiality paradigm has inspired numerous studies in the last twenty or so years that have followed its definition and the problem of overcoming it has only recently been addressed. In its standard formulation, outlined by Joseph M. Macedonia and Chistopher S. Evans (1993), it entails (1) a 'production criterion', according to which signals that are (considered) referential must have a significant degree of stimulus specificity, i.e. they must refer to a certain category (more or less precisely defined) of predators; and (2) a 'perception criterion', in the sense that receivers must be able – after hearing the signal, even in the absence of physical cues – to respond appropriately (e.g. by choosing the most suitable escape route). However, both of the authors and Marler (from whom the paradigm originates) admit that, especially in the case of species distinguished by a highly organized social life, this type of communication rarely functions in a context-independent manner. It is nonetheless normal that the symbolic components of the message are integrated by a multimodal variety of cues (gestures, frequency and tone of the signal, etc.: see Partan and Marler 1999), *also* giving them a motivational element in the sense already discussed. The model has been adopted with notable results not only in the classic case of vervet monkeys, but also in studies of Californian ground squirrels, Diana monkeys (Zuberbühler 2000), meerkats (Manser et al. 2002), chimpanzees (Slocombe and Zuberbühler 2005) and numerous bird species (Smith 2017). The degree of dependence on the context and the degree of integration with motivational elements varies from species to species, but results appear to confirm the theory that signals (certainly alarm calls and also food-associated calls in some species) function referentially. Thus, an element of effective continuity between human language and communication systems of non human-species emerges: significantly, an element that is not limited to the world of primates, our closest "relatives" in phylogenetic terms.

The case of the reference is particularly significant, but it is not the only case. It is also accompanied by new evidence regarding embryonic syntactic abilities found in some species of birds (Carolina chickadees), monkeys (putty-nosed monkeys in Nigeria) and dolphins. Meanwhile, elementary forms of signal articulation (an ability which scholars, starting with Aristotle, have considered to be specifically human) appear in rhesus monkeys, for example. This has nothing to do, of course, with human beings' immense combinatorial abilities and with that ability to modulate the acoustic signal that depends on fine-grained control of both the laryngeal mechanism and the supralaryngeal tract: however limited these articulatory and combinatorial skills are, we are faced with “precursors” of individual components of the language whose existence cannot be denied. The traditional paradigm of human uniqueness is at least partially contradicted by this kind of evidence. An alternative scenario takes shape according to which certain fundamental characteristics of human language are “pre-dated”. They emerge in many different species which, in evolutionary terms, are sometimes separated from us by tens of millions of years. Verbal language (and perhaps the whole human cognitive structure) could therefore be a kind of puzzle in which even very ancient evolutionary components are reused and integrated, resulting in an original and extraordinarily powerful form of semiosis. This hypothesis, anticipated in a 2003 article by Zuberbühler (and again in Id. 2015), is fully explained by De Waal and Ferrari (2010), who thus invite scholars to adopt a ‘bottom-up’ approach to comparative studies. The spread of traits that are considered human among different species extends from language to more general problems as we gradually increase our knowledge of the role subcortical structures play in cognition. Even in human beings, they are involved in high-level cognitive functions to an extent that was unknown until a few years ago. The case of the basal ganglia, effectively studied by Philip Lieberman, is an important part of this unified approach.[9]

5. Among the various objections to the theory of referential functionality, those raised by Wheeler and Fischer (2012), in an essay that has been widely discussed, are of particular interest. The authors do not contest the existence of reference in animal communication, even though (with Rendall et al. 2009) they believe that the signaller-receivers relationship (e.g. in the case of alarm calls) is essentially hard-wired into the species’ biological characteristics. Rather, they argue that the referential use of signals is less interesting from a cognitive point of view than signalling practices that are less dependent on external eliciting stimuli. A typical example are baboons’ vocalizations (see Cheney and Seyfarth 2007 on this), which not only give information about external referents, but also about the group’s complex social dynamics in which hierarchical relationships between individuals form a kind of labyrinth of knowledge and practices that are sometimes conciliatory and sometimes conflicting. Given that such vocalizations are very limited in number and type, it is evident that the vast majority of communication hinges on the receivers’ ability to *integrate* the signal with information from the context: an ability that can be reasonably considered much higher, in cognitive terms, than that of extracting *all* the information from the signal, independently of the context in which it is emitted. Wheeler and Fischer essentially overturn the referentialist paradigm by reducing it *ad absurdum* and contrasting it with a pragmatic methodology aimed at

[9] According to Lieberman (2007), the basal ganglia (and even more archaic structures such as the cerebellum) are involved in the “fine” motor mechanisms that govern language production. In his view, even a component traditionally considered to be species-specific, such as syntax, would be at least partly conditioned by the functioning of the basal ganglia.

examining "the role of context in shaping meaning of linguistic utterances" (2012, 203). They argue that the referentialist paradigm should therefore be abandoned, since it is not capable of achieving the scientific goal that it set itself. In their view, the pragmatic approach would be the best starting point for readdressing the theme of comparison with human language, in which inferential practices (Grice's theory – see Grice 1957, 1975 – is constantly referred to) are known to play a supporting role.

A response to the aforementioned objections came from Scarantino and Clay (2015). Although they partially agree with Wheeler and Fischer's discussion of referentialism, they suggest that the referential functionality model should not be abandoned, but corrected, by incorporating the role of context into the paradigm. The role of context is prominent both in cases in which alarm calls are emitted in response to non-predatory stimuli, or even deceptively, and in cases in which the receivers seem to interpret signals differently based on the situation. Scarantino and Clay therefore propose redefining the meaning that the signals transmit as 'correlation', rather than 'reference', arriving at the following operative formulation:

> A signal of type X in context C functionally refers to, or means$_R$ a state of affairs of type Y if (1) Xs in context C correlate with Ys (i.e. Xs carry information about/mean$_C$ Ys (information criterion)), and (2) presentations of Xs in context C and in the absence of Ys reliably elicit contextually adaptive responses in receivers specific to Ys (response criterion) (2015, e4).

In contrast to detractors of the informational approach (see esp. Rendall & Owren (2013)), the authors emphasize that animal signals carry information, which can be defined in the aforementioned way in terms of meaning. The notion of reference is therefore significantly expanded to include (from the point of view of both the signaller and the receiver) all the informational power of the context, a variable that multiplies the possible readings of the signals and the behavioural responses to them. Scarantino and Clay's idea is that their reformulation of the method encourages both a multimodal interpretation of signalling systems (conflating the study of gestures with that of vocalizations) and a more effective comparative approach, since the cognitive mechanisms that they presuppose seem to be "potentially closer to the mechanism of linguistic comprehension" than has traditionally been thought.

Recent writings by Seyfarth and Cheney (2017, 2018) return to the themes considered here, not so much to revive or refine the referentiality paradigm as to reaffirm the centrality of the notion of *information* in studies of animal communication. Both the signaller and the receiver seemingly manipulate signals in terms of information, on the premise that both enjoy – *to some extent* – that pragmatic flexibility which, by unanimous consent, constitutes the core of human communicative skills. Once this is admitted, pragmatic flexibility re-opens the difficult question of whether animals' signals (at least, of *some* animal signals) should be considered innate or voluntary. To tell the truth, Marler himself did not consider it prudent to question the traditional interpretative framework. The authors leave the final judgment open, pending further evidence, but suggest that the traditional *yes/no* response to the question is surely obsolete. The hypothesis that pragmatics plays a relevant role in animal communication has an evident bearing on how scholars reconstruct a species' adaptative history and its deployment of at least elementary mind-reading skills. Both adaptation to context and mind-reading are activated and strengthened within sufficiently complex social networks, such as those of highly social species and above all of primates. Social cognition would therefore be the natural terrain on which genuine communication can be established. It therefore does not seem unjustified to claim that that pragmatics is the true precursor of language: the evolutionary engine that would have guided the development of semantics, of syntax and finally of verbal language as a whole.[10]

Research focused on information is undoubtedly the most stimulating for anyone who approaches ethological studies with a philosophical-linguistic or semiotic background. It also stimulates some concluding remarks relating to the history of the relationship between linguistic studies (in a broad sense) and "animal" studies. In light of considerable evidence, the rift that emerged between these disciplines in the 1960s and 1970s has slowly healed since the 1990s. The advent of a "pragmatic" perspective in place of the syntacticist approach, advocated by Chomsky and his supporters, has facilitated the identification of a common ground. This is naturally very positive. However, it should be pointed out that the pragmatic perspective is much older and more deeply rooted than ethologists appear to believe. It dates back to the works of linguists such as Philip Wegeners (1885) and Alan Gardiner (1932), psychologists like Karl Bühler (1934) and philosophers such as the late Wittgenstein (1958, 1st ed 1953[11]), all authors who have been excluded from the literature of ethology and – in some cases, paradoxically – of comparative psychology. Since the 1960s, even Saussure (1984, 2nd ed 1922), who has been superficially considered the initiator of a 'disembodied' vision of language, has found his place in the pragmatic tradition due to his attention to the 'speaking community' (*masse parlante*) and to 'time' as internal factors of language functioning. Ignoring or neglecting this "continental" tradition of linguistic thought, many ethologists have acritically subscribed to the principles of the analytic philosophy of language, variously combined with the 'generative' tradition. Accordingly, thay have accepted the idea that meaning is conventionally encapsulated in the linguistic sign,[12] that the concept of 'code' implies symmetry and parity of roles between sender and receiver, and that reference is the main function of language, to the detriment of functions that (with Malinowski and Jakobson) are customarily called phatic, conative, etc. If their sources of information in the field of linguistics had not been only or not predominantly analytic and/or generative, ethologists would

[10]On the role of pragmatics in current biolinguistics, see Pennisi and Falzone (2016), especially ch. 16.

[11]Wittgenstein's well-known statement that "[f]or a *large* class of cases–though not for all–in which we employ the word "meaning" it can be defined thus: the meaning of a word is its use in the language." (1953: § 43) synthetizes the perspective on the meaning-use relationship which was common to the aforementioned scholars. See Albano Leoni (2016) for a recent overview of this "proto-pragmatic" tradition.

[12]The Gricean distinction between natural meaning and non-natural or conventional meaning (Grice 1957) has often led to more confusion than clarity in this regard.

have noticed that many of the features found in animal communication systems were not inconsistent with those typical of human language. Ironically, since the 1960s ethologists could have borrowed from non-generative linguistics, hypotheses combining the referential moment and motivational moment of communication which, as we have seen, only emerged, with great difficulty, 30 years later. The unidimensional model of communication that Reddy criticized his 1979 essay on the so-called "conduit metaphor", had little to do with the theoretical framework shared by most "continental" philosophy of language or (later) by post-1980 cognitive linguistics.[13] It would of course be completely unreasonable to only blame ethologists (or mainly ethologists) for this error of perspective, which led them to avoid any contamination with concepts, and even terms, developed within the study of speech. Since around the 1970s, Semiotics, which was primarily responsible for keeping the channel of scientific exchange open, decided to ignore animal communication, focusing its attention only on human languages and relegating (except for peripheral exceptions) the animal question to particular sectors of human culture (such as art or advertising) where animals enter only as an object of our intellectual elaborations. There is therefore much to be done to reactivate the channels of communication and collaboration between semiotics and ethology that Sebeok commendably established almost 60 years ago and which have been unfortunately interrupted in the following decades.

Today's neuroscience probably offers a new and productive framework in which this meeting can take place. The brain function models that we currently have available reveal that it makes little sense to look for the "organ" that generates one or another higher cognitive function, in particular with regard to language. One need only consider how the discovery of the existence and functioning of 'mirror neurons' in macaques (for a summary, see Rizzolatti and Sinigaglia 2006) has enabled us to reconsider the role of the so-called Broca and Wernicke areas, which, for at least 150 years, have generally been considered specific for language production and comprehension (see Deacon 1997). The "bottom-up" approach referred to by De Waal and Ferrari (2010) seems to be generalizable not only to the set of skills that form the basis of language, but also to most cognitive abilities: from orientation and navigation skills to the ability to conceptualize experience. The very idea of a symbolic "mental representation", a leitmotif in traditional cognitive approaches since Fodor's formulation of the 'language of thought' hypothesis, is today radically questioned. A good case in point is the way in which the brain's "atlases" – obtained through sophisticated functional imaging techniques – illustrate the participation of disparate areas of the brain, from the two hemispheres of the cortex to the subcortical areas, in the implementation of lexical meaning (see Huth

[13] See the observations of Owren, Rendall and Ryan (2010), which, although very convincing, appear not to notice how Reddy (1979) is supporting that "embodied" paradigm (based on the theory of metaphor) that enables a reconciliation between ethology and linguistics.

et al. 2016).[14] The time when we will have a greater insight into other species' brain activity appears to be drawing nearer (see for example Cuaya et al. 2016) and this is likely to encourage us to rethink the basic concepts of the semiotic and philosophical-linguistic vocabulary: *sign*, *code, meaning* and so on. It is reasonable to wish – at least this is the conclusion of the reasoning attempted in these pages – that semiotic and philosophical-linguistic studies draw all the consequences from the epistemological framework that neurosciences have helped to design and fully reposition language in its own biocognitive context. In this regard, having access to (and profiting from) the results of research in the field of animal communication seems not only useful, but necessary even to strictly theoretical ends. A discussion of the traditional nature/culture dichotomy (as it was formulated in authoritative semiotic textbooks) will probably be the first step required.

References

Albano Leoni, F. (2016). Da Philipp Wegener a Karl Bühler. Una linea interrotta e ripresa. In M. Selig, E. Morlicchio, & N. Dittmar (Eds.), *Gesprächsanalyse zwischen Syntax und Pragmatik. Deutsche und italienische Konstruktionen* (pp. 301–313). Tübingen: Stauffenburg.

Allen, C., & Bekoff, M. (1997). *Species of mind*. Cambridge, MA: The MIT Press.

Bühler, K. (1934). *Sprachtheorie. Die Darstellungsfunktion der Sprache*. Jena: Verlag von Gustav Fischer.

Call, J., & Tomasello, M. (2008). Does the chimpanzee have a theory of mind? 30 years later. *Trends in Cognitive Sciences, 12*(5), 187–192.

Cheney, D.L., & Seyfarth, R.M. (1990). *How monkeys see the world. Inside the mind of another species*. Chicago/London: University of Chicago Press.

Cheney, D.L., & Seyfarth, R.M. (2007). *Baboon metaphysics. The evolution of a social mind*. Chicago: The University of Chicago Press.

Cherry, C. (1957). *On human communication*. Cambridge, MA: The MIT Press.

Chomsky, N. (1966). *Cartesian linguistics. A chapter in the history of rationalist thought*. New York: Harper & Row.

Cuaya, L.V., Hernández-Pérez, R., & Concha, L. (2016, March). Our faces in the dog's brain: Functional imaging reveals temporal cortex activation during perception of human faces. *PLOS One, 2*, 1–13.

Darwin, C. (1871). *The descent of man and selection in relation to sex*. In two vols. London: John Murray.

de Saussure, F. (1984). *Cours de linguistique générale*. Publié par Charles Bally et Albert Sechehaye avec la collaboration de Albert Riedlinger. Éd. critique préparée par Tullio de Mauro. Paris: Payot.

De Waal, F.B.M., & Ferrari, P.F. (2010). Towards a bottom-up perspective on animal and human cognition. *Trends in Cognitive Sciences, 14*(5), 201–207.

Deacon, W.T. (1997). *The symbolic species. The co-evolution of language and the brain*. New York/London: W. W. Norton & Company.

[14]The abandonment of the concept of mental representation in fields of study such as teleosemantics and, more recently, enactivism, could open up a further area of comparison, in this case between ethology and philosophy of mind. However, this possibility has been so far – to my knowledge – little explored. See for example Rowlands (1997) and Stegmann (2009).

Dennett, D. (1987). *The intentional stance*. Cambridge, MA: The MIT Press.
Evans, C.S. (1997). Referential signals. In D.H. Owings, M.D. Beecher, & N.S. Thompson (Eds.), *Communication. Perspectives in ethology* (Vol. 12, pp. 99–143). Boston, MA: Springer.
Evans, C.S., & Marler, P. (1995). Language and animal communication: Parallels and contrasts. In H. Roitblat & J.-A. Meyer (Eds.), *Comparative approaches to cognitive science* (pp. 341–382). Cambridge, MA: The MIT Press.
Evans, C.S., Evans, L., & Marler, P. (1993). On the meaning of alarm calls: Functional reference in an avian vocal system. *Animal behavior*, *46*, 23–38.
Gardiner, A. (1932). *The theory of speech and language*. Oxford: At the Clarendon Press.
Gensini, S. (2014). Darwin's view of language in *The Descent of Man*. An intertextual reading. *Human Evolution, 29*(4), 303–318.
Grice, H.P. (1957). Meaning. *The Philosophical Review, 66*(3), 377–388.
Grice, H.P. (1975). Logic and conversation. In P. Cole, & J.L. Morgan, (Eds.), *Syntax and semantics, Vol. 3, Speech Acts* (pp. 41–58). New York: Academic.
Griffin, D. (1976). *The question of animal awareness. Evolutionary continuity of mental experience*. Birmingham: Rockfeller University Press.
Griffin, D. (1995). Windows on animal minds. *Consciousness and Cognition, 4*, 194–204.
Hockett, C., & Altmann, F.S.A. (1968). A note on design features. In T. Sebeok (Ed.), *Animal communication. Techniques of study and results of research* (pp. 61–72). Bloomington/London: Indiana University Press.
Huth, A. G., De Heer, W. A., Griffiths, T. L., Theunissen, F. E., & Gallant, J. L. (2016). Natural speech reveals the semantic maps that tile humans cerebral cortex. *Nature, 532*, 453–458.
Krebs, J.R., & Dawkins, R. (1984). Animal signals. Mind-reading and manipulation. In Id. (Eds.), *Behavioural ecology. An evolutionary approach* (2nd ed., pp. 380–402). Oxford etc.: Blackwell Scientific Publications.
Krupenye, C., Kano, F., Hirata, S., Call, J., & Tomasello, M. (2016). Great apes anticipate that other individuals will act according to false beliefs. *Science, 354*, 110–113.
Lieberman, P. (2007). The evolution of human speech. Its anatomical and neural bases. *Current Antrhopology, 48*(1), 39–66.
Macedonia, J.M., & Evans, C.S. (1993). Variation among mammaliam alarm call systems and the problem of meaning in animal signals. *Ethology, 93*, 177–197.
Manser, M.B., Seyfarth, R.L., & Cheney, D.L. (2002). Suricate alarm calls signal predator class and urgency. *Trends in Cognitive Sciences, 6*(2), 55–57.
Marler, P. (1961). The logical analysis of animal communication. *Journal of Theoretical Biology, 1*, 295–317.
Marler, P. (1967). Animal communication signals. *Science, 157*, 769–774.
Marler, P. (1980). Primate vocalization: Affective or symbolic? In T. Sebeok & J.U. Sebeok (Eds.), *Speaking of apes. A critical anthology of two-way communication with man* (pp. 221–229). Boston: Springer.
Marler, P., Evans, C.S., & Hauser, M.D. (1992). Animal signals: Motivational, referential, or both? In H. Papoušek, U. Jürgens & M. Papoušek (Eds.), *Studies in emotion and social interaction. Nonverbal vocal communication: Comparative and developmental approaches* (pp. 66–86). New York: Cambridge University Press; Paris: Editions de la Maison des Sciences de l'Homme.
Morris, C.W. (1946). Signs, language and behavior. New York: Prentice Hall.
Owings, D. H., & Morton, E. S. (1997). The role on information in communication: An assessment/management approach. In D. H. Owings, M. D. Beecher, & N. S. Thompson (Eds.), *Communication. Perspectives in ethology* (Vol. 12, pp. 99–143). Boston: Springer.
Owren, M. J., Rendall, D., & Ryan, M. J. (2010). Redifining animal signalling: Influence versus information in communication. *Biology and Philosophy, 25*, 755–780.
Partan, S., & Marler, P. (1999). Communication goes multimodal. *Science, 283*, 1272–1273.
Partan, S. R., & Marler, P. (2005). Issues in the classification of multimodal communication signals. *The American Naturalist, 166*(2), 231–245.
Pennisi, A., & Falzone, A. (2016). *Darwinian biolinguistics. Theory and history of a naturalistic philosophy of language and pragmatics*. Cham: Springer.

Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences, 1*(04), 515–526.

Reddy, M.J. (1979). The conduit metaphor. A case of frame conflict in our language about language. In A. Ortony (Ed.), *Metaphor and thought* (pp. 284–324). Cambridge/London etc.: Cambridge University Press.

Rendall, D., Seyfarth, R. M., Cheney, D. L., & Owren, M. J. (1999). The meaning and function of grunt variants in baboons. *Animal Behavior, 57*, 583–592.

Rendall, D., Cheney, D. L., & Seyfarth, R. M. (2000). Proximate factors mediating "contact" calls in adult female baboons (*Papio cynocephalus Ursinus*) and their infants. *Journal of Comparative Psychology, 114*(1), 36–46.

Rendall, D., & Owren, M.J. (2013). Communication without meaning or information: Abandoning language-based and informational constructs in animal communication theory. In U. Stegmann (Ed.), *Animal communication theory. Information and influence* (pp. 151–182). Cambridge, MA: Cambridge University Press.

Rendall, D., Owren, M.J., & Ryan, M.J. (2009). What do animal signals mean? *Animal Behavior, 78*, 233–240.

Ristau, C.A. (ed.) (1991). *Cognitive ethology. The minds of other animals. Essays in honor of Donald Griffin*. Hillsdale/Hove/London: Lawrence Erlbaum Associates editors.

Rizzolatti, G., & Sinigaglia, C. (2006). *So quel che fai. Il cervello che agisce e i neuroni specchio*. Milano: Raffaello Cortina.

Rowlands, M. (1997). Teleological semantics. *Mind, 106*(422), 279–304.

Scarantino, A., & Clay, Z. (2015). Contextually variable signals can be functionally referential. *Animal Behavior, 100*, e1–e8.

Sebeok, T. (1968a). Zoosemiotics. *American Speech, 43*(2), 142–144.

Sebeok, T. (Ed.). (1968b). *Animal communication. Techniques of study and results of research*. Bloomington/London: Indiana University Press.

Sebeok, T., & Sebeok, J.-U. (Eds.). (1980). *Speaking of apes. A critical anthology of two-way communication with man*. Boston, MA: Springer.

Seyfarth, R.M., & Cheney, D.L. (2017). The origin of meaning in animal signals. *Animal Behavior, 124*, 339–346.

Seyfarth, R.M., & Cheney, D.L. (2018). Pragmatic flexibility in primate vocal production. *Current Opinion in Behavioral Sciences, 21*, 56–61.

Seyfarth, R.M., Cheney, D.L., & Marler, P. (1980). Vervet monkey alarm calls: Semantic communication in a free-ranging primate. *Animal Behavior, 28*, 1070–1094.

Shannon, C., & Weaver, W. (1949). *The mathematical theory of communication*. Urbana: The University of Illinois Press.

Slocombe, K.E., & Zuberbühler, K. (2005). Functionally referential communication in a chimpanzee. *Current Biology, 15*, 1779–1784.

Smith, C.L. (2017). Referential signalling in birds: The past, present, and future. *Animal Behavior, 124*, 315–323.

Stegmann, U.E. (2009). A consumer-based teleosemantics for animal signals. *Philosophy of Science, 76*(5), 864–875.

Stokoe, W. (1960). *Sign language structure: An outline of the visual communication systems of the American Deaf*. Buffalo: University of Buffalo.

von Frisch, K. (1950). *Bees: Their vision, chemical sense and language*. Ithaca: Cornell University Press.

Wacewicz, S., & Zywiczyński, P. (2015). Language evolution: Why Hockett's design features are a Non-starter. *Biosemiotics, 8*, 29–46.

Wegener, P. (1885). *Untersuchungen über die Grundfragen des Sprachlebens*. Halle: Max Niemeyer.

Wheeler, B.C. (2009). Monkeys crying wolf? Tufted capuchin monkeys use anti-predator calls tu usurp resources from conspecifics. *Proceedings of the Royal Society, 276*, 3013–3018.

Wheeler, B.C., & Fischer, J. (2012). Functionally referential signals: A promising paradigm whose time has passed. *Evolutionary Anthropology, 21*, 195–205.

Wittgenstein, L. (1958). *Philosophische Untersuchungen/Philosophical investigations* (G. E. M. Ascombe, Trans., 2nd ed.). Oxford: Blackwell Publishers.
Zuberbühler, K. (2000). Referential labelling in Diana monkeys. *Animal behavior, 59*, 917–927.
Zuberbühler, K. (2003). Referential signaling in non-human primates: Cognitive precursors and limitations for the evolution of language. In P.J.B. Slater et al. (Eds.), *Advances in the study of behavior* (Vol. 33, pp. 265–307). London: Academic.
Zuberbühler, K. (2015). Linguistic capacities of non-human animals. *WIREs Cognitive Science, 6*, 313–321.

Chapter 14
Natural Performativity: How to Do Things with Body Constraints

Alessandra Falzone

Abstract The purpose of this work is to define performativity as a natural component of human cognition. The notion of performativity has many applications in various fields from performance studies to pragmatics, but in the recent years it has been introduced within cognitive science studies, where it is currently a subject of great debate. A working definition of performativity as a central component of the human mind that determines the relationship between the individual and the world is proposed. This definition is intentionally general, because it works for every species, not only for humans. Performativity, in fact, is a capacity present in all cognitive systems that have a body because it allows the utilization of those cognitive abilities that evolutionary history has delivered to a species. The concept of performativity with a naturalistic and biologically based approach is analysed taking into account both evolutionary continuity and species-specific functions. In conclusion, an application of the natural performativity of language, a uniquely human function characterized by species-specific morphological structures that constitute constraints for language performativity, is proposed.

Keywords Performativity · Natural performativity · Language · EVO-DEVO · Language evolution

14.1 Which Kind of Performativity?

The notion of performativity has a relatively short history and a niche within linguistic studies. Over the past century, pragmatics as an area of linguistics has been defined as the power of language to have effects on the world and on the relationships that (speaking) men entertain themselves with.

A. Falzone (✉)
Department of Cognitive Science, Psychology, Education and Cultural Studies, University of Messina, Messina, Italy
e-mail: amfalzone@unime.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_14

John Austin (1975) contrasted *constative statements* (which simply describe a certain condition or fact and upon which it is possible to formulate a judgement of truth or falsehood based on their correspondence with reality) with *performative statements* (which correspond to an action that is carried out due to the utterance of the statements themselves). For example, the public formulas with which marriage is contracted are, according to Austin, performance statements because the statements themselves allow the formation of the "conjugal union" action. In the concept of performative utterance, therefore, there is a conception of language as a function that is not only used to represent or describe the world, but is itself acting on the world by carrying out a social action (Austin 1975). It is no coincidence, in fact, that this notion of performative language has also been used in the sociological and anthropological field and has been relegated even to a legal and ethical role. An example is the notion of genre performativity which was formulated by Judith Butler (1999). Butler suggests that gender is neither a purely natural fact nor a cultural construction, but is the outcome of a performative construction. The genus, according to Butler, consists of a "repeated stylization of the body, a set of repeated acts within a highly rigid regulatory framework that freezes over time to produce the appearance of a substance, of a natural type of being" (Butler 1990, 33).

The performative iteration of the act constitutes the genre. The idea of a genre that is constructed from the repetition of acts (linguistic and bodily) has consequences on the notion of gender identity and therefore on how it is regulated and evaluated on a social level.

These applications of the concept of performativity are not to be confused with the notion of performance that comes from the performing arts, where in recent years there has been a transformation of the notion of performance from the execution of a set of actions by the performer in front of viewers to artistic actions guaranteed by biological structures, the body, the performer that involves the viewer on the basis of a common sharing of the possibilities offered by body constraints (Schechner 2013; Tomasello 2014).

What binds these applications of the concept of performativity is the idea that something must be put into action through a body and that this is a constraint for the realization of a certain function, a social and/or cognitive possibility or behavior. It is on this that the most recent notion of performativity in the cognitive field is founded. Particularly within the cognitive sciences, the embodied perspective has placed the body at the center of the studies of the mind, thereby showing the weakness of the more traditional abstract, artificial and computational approaches of the cognitive sciences of the very first generation, and also the partiality of strictly cerebro-centric approaches of the second generation cognitive sciences (Pennisi and Falzone 2016a).

The attention to the role of the body within the definition of the procedures of the human mind, on the one hand, has finally assigned a cognitive value to the body within our cognition, focusing on some aspects of human intelligence placed in brackets (if not neglected) or analyzed only in terms of neural activations, such as the role of the sensorimotor system in complex cognitive processes such as memory (Wilson 2001; Gallese and Lakoff 2005).

On the other hand, however, the interest in the body component of mental functioning has opened up a complex and articulated debate on the role of physiological, environmental, relational and even individual and subjective constituents in the redefinition of human cognition (see Gallagher 2005, 2015).

This debate, still on, has pushed Gallagher and Rowlands, to draw a complex theoretical framework that holds at least four meanings of "embodied" cognition together. These are the well-known 4E: embedded, extended, enacted and embodied cognition (Menary 2010).

Each of these perspectives is characterized by the role of the body in the knowledge of the world. Without going into the details of the debate, for the supporters of embedded cognition, the most appropriate level of analysis to explain human cognitive processes is that of the context or better of the relationship that the subject maintains with the context. Cognitive processes cannot be defined except in relation to the interaction of the agent with the context (see, for example, Rupert 2004; Adams and Aizawa 2001).

For the proponents of extended cognition, on the other hand, cognitive processes are defined by the interaction between the body and the external world, emphasizing the defining role of the relationship with the structures external to the organism with greater force so as to hypothesize that the mind can extend beyond the borders of the cranium (see Chalmers and Clark 1998 and Rowlands 2006). According to the advocates of enacted cognition, the defining role of human cognition is to be assigned to the sensory-motor system because knowledge of the world is obtained by integrating perceptive-sensorial and motor skills and abolishing the old distinction between perception, cognitive processing and action (labeled as a "sandwich model", Hurley 2001) which in this perspective are considered essential and codetermined processes (Hutto and Myin 2013; Noë 2009, Brooks 1999). Finally, the embodied approach considers cognition as determined by bodily structures, to the point of hypothesizing that different body organization implies different cognitive procedures. This perspective can be considered the most classic of cognitive science which employs a "corporeal" approach, although some radical versions hypothesize that the same body structures are constitutive of mental processes (see Gibbs 2006; Shapiro 2004; Barsalou 1999).

In our view, the different modes of the role of the body declination within the '4E cognitions' revolve around the notion of performativity.

In this contribution, in fact, the theoretical proposals and the debate related to embodiment will not be analyzed, but we will focus on the concept of performativity and in particular propose a brief analysis of the concept of performativity from an evolutionary point of view.

14.2 Doing Things with Body Constraints, That Is, Natural Performativity

To apply the evolutionary perspective to the concept of performativity, in the first instance it is useful to provide a working definition of this concept.

In this work, in fact, there is no reference to performativity in the sense of motor activities that can be performed by a body (as a body can put into action a certain type of movement), nor to performativity as a product nor to the performance intended as an object, as it can be a theatrical representation or even an artistic product.

We refer to a type of performativity that we could define as natural performativity, a central component of the human mind that determines the relationship between the individual and the external world. This definition is intentionally general, as it is a component that can be traced in any form of cognition, not only human: natural performativity, in fact, is a capacity present in all cognitive systems that possess a body because it allows the use of those cognitive abilities that the history of evolution has given us as a species. For this reason, natural performativity cannot be defined as a special condition of the human being or as a special dimension of human cognition. The relevant point to define natural performativity is that it does not concern the individual subject but regards the whole species. Moreover, at the same time it is species-specific and guarantees evolutionary continuity.

In our opinion, the different modes of declination of the role of the body within the cognition of the 4E cognitions revolve around the notion of performativity.

In fact, in this paper the theoretical proposals and the debate concerning embodiment will not be analyzed, but we will concentrate on the concept of performativity and in particular we will propose a brief analysis of the concept of performativity from an evolutionary point of view.

It is necessary to provide a working definition for applying the evolutionary perspective to the concept of performativity. We are not referring to performativity in the sense of motor activities that can be performed by a body (as a body can carry out a certain type of movement), nor to performativity as a product, nor performance understood as an object, such as a theatrical performance or an artistic product can be.

We refer to a type of performativity that we could define as natural performativity, a central component of the human mind that determines the relationship between the individual and the external world. This definition is intentionally general, since it is a component that can be traced in any form of cognition, not only human: natural performativity is a capacity present in all cognitive systems that have a body because it allows the utilization of those cognitive abilities that the evolution has given a species. For this reason, natural performativity cannot be defined as a special condition of the human being nor as a special dimension of human cognition.

The important point to keep in mind about natural performativity is that it does not concern a single subject but concerns the whole species. And at the same time it is species-specific and guarantees evolutionary continuity.

So performativity on the one hand acquires a species-specific value, and on the other guarantees evolutionary continuity, thus preventing insidious forms of "evolutionary leaping" that tend to develop into anti-evolutionary or quasi-evolutionary approaches (see the last theoretical positions of the Chomskyan biolinguists, such as Di Sciullo and Boeckx 2011) when analyzing human cognition (and linguistics in particular).

By shifting the focus from the individual to the species in an evolutionary key, performativity is the realization of the functional possibilities offered by the body of that given species. The morphological structures of the body constitute the constraints of possible performativity. Each animal species, therefore, performs what the constraints allow, in relation to the environment in which it lives. The evolutionary constraint of development, EvoDevo (Minelli 2007) very clearly explains the role of constraints on functional possibilities. As is known, according to EvoDevo every animal species is subject to the laws of form. These laws are present in the DNA of all animal species which express phenotypic characteristics often precisely in the same genetic versions. The laws of form dictate the timing of the embryogenetic production of body. For example, these laws "force" all vertebrates to have seven cervical vertebrae (from the giraffe to the marmoset). The "temporal law" of expression of these laws underlies the modular composition of many species of invertebrates. For example, the constraints within the DNA determine an odd number of pairs of legs in the scolopender, either 21 or 23, and so on. Ontogenetic development is subject to these rules and each species shows a specific reassembly of these general rules (Minelli and Fusco 2004; Minelli 2015). It is not only the constraint that determines the form; there is another type of conditioning within the EvoDevo perspective and it is the fact that body forms are directly connected to functions. This actually determines a priority of the form over the function. In this definition there is no reference to the *telos* (Pennisi and Falzone 2016b; Falzone 2006) (objective of the structure) but to the series of possibilities that a given structure, shape or body morphology allows. For example, the shape of the cervical vertebrae makes it possible to support a skull of a certain size and a certain weight, for humans well as for giraffes. In essence, forms determine functional possibilities.

Obviously a reflection on functional possibilities cannot take into account only the external phenotypic form of the bodies, but also calls into question internal organization and nervous coordination systems (the nervous system as a whole) which make interaction with the environment possible as well as the comprehension of the world by the individual member of a species: essentially the performative dimension of each species.

14.3 The Linguistic Function: An Application of Natural Performativity

It is evident that performativity is a cognitive mechanism of the human species precisely in the case of language, the species-specific capacity of the sapiens. Language is ontogenetically and phylogenetically linked to performative components, constrained by body structures. A complex analysis of the theories on the nature of human language is beyond the scope of this work, both because they are rooted in the classical western philosophical tradition, and because even today the discussion on the relationship between innate components of language and environmental influences is active (see Chomsky 2006; De Busser and LaPolla 2015).

In the debate on the nature and evolution of language, in fact, there are still residual forms of computationalist and generativist dualism. For example, those advocated by Chomsky (see Berwick and Chomsky 2016) consider performance to be an irrelevant component both for evolution and for the definition of language itself as a cognitive function. It is argued that the sensory-motor component and the conceptual component can be defined in relation to language and its functional components in the same way in which we would define the relationship between a computer's CPU and a printer: the performance would be nothing but a mere *externalization device* (see Pennisi and Falzone 2016b).

Although the Chomskyan position sees the linguistic function as still unanchored from the biological-performative dimension, the vast majority of biolinguistic approaches consider language as the evolutionary result of the possibilities offered by the body of the sapiens, the relationship existing between biological structures and language, between morphological and performativity natural linguistics. From the structural point of view, the supralaryngeal vocal tract is considered the ratchet of human linguistic possibilities (Falzone 2014). For a long time, in fact, several theories (see Lieberman 1984 and 2006; Boë et al. 2002; de Boer and Fitch 2010) have indicated that the SVT is a guarantee of the uniqueness of human language. This is because of its double canal system, where the horizontal canal is the same size as the vertical one. This allows the formation of resonance boxes which in turn allow the air escaping from the lungs during phonation to resonate and produce the formants that are constantly produced with a very wide frequency range in human articulated language (source/filter theory, see Taylor and Reby 2010; Gamba 2014; Favaro et al. 2015). In reality, the EvoDevo perspective eliminates the aura of uniqueness from anatomical structures: defining the SVT as a morphological constraint, on the contrary, and highlighting both species-specificity and the evolutionary continuity of the vocal tract.

In fact, several researchers have shown that there is a morphological continuity in the SVT and that it is also partially functional because it is used for reproductive purposes. In a now classic work, for example, Fitch (2000) showed that many animals at rest demonstrate a SVT with a ratio between a horizontal and vertical larynx which is disadvantageous for the production of formants. However, during certain periods of their group life such as during the reproductive period, they can develop a SVT configuration similar to the human one: for example, the male red deer is able to lower the vertical larynx to the physiological limits to obtain this configuration so as to produce severe and defined form frequencies, thus seeming to be physically larger.

This is a type of morphological continuity that is partially functional to vocal production. It is also true, however, that there are structures in our phonatory apparatus that we can consider as functional specializations to the vocalization within our morphological configuration that allow us to produce articulated language. Among these we have some muscular structures present inside the vocal cords such as the *vocalis* (Hirano et al. 1969; Han et al. 1999) that is a specific muscle that moves the vocal cords during phonation which, from the evolutionary point of view, is characterized by the presence of very fast moving thin muscle fibers. According to Stedman and collaborators (2004), during the course of evolution some genetic components must have been selected to allow the reduction of these fibers including the inactivation of the so-called myosin heavy chain. This produces an effective reduction both in facial bone size (as a consequence) but above all the size of the oral facial muscles such as the masseter and the temporo-mandibular muscle. This would have ensured a new functional possibility with respect to morphological configurations present in other species, namely to move the facial and laryngeal muscles in a coordinated and complex way and to coordinate these movements with respiratory ones (see for a discussion Falzone 2012, 2014). How do you translate these constraints that determine forms from the functional point of view? What is the relationship between the morphological components, both those that show continuity and those specific to the sapiens, with functional possibilities?

From the point of view of functional possibilities, if we consider language as a vocal production tool, in reality there is an evolutionary continuity. Numerous studies have shown that in many species that use vocal communication to build relationships within groups or to communicate with other species (Zahavi 1975, 1993, 2008), the modulation of the formant frequency is very widespread in order to show their body dimensions or communicate their status within the group. This type of perception and use of vocality is present in a continuous way by analogy within the sapiens. Sapiens also often use auditory perception to estimate body size, even if the visual one has priority, but above all to identify psychological characters (age, arousal, emotional condition, hormonal condition, and so on) (see Pisanski et al. 2012; Van den Stock et al. 2008; Winer and Schreiner 2011).

Some scholars have also applied the EvoDevo perspective to functional aspects such as voice communication and in particular to vocal learning systems. Indeed, the vocal learning system would demonstrate that continuity and species-specificity is then reflected in articulated human language. An impressive amount of data, in fact, has demonstrated the need to produce basic vocalizations for the development of language in the sapiens and that the acquisition of language skills depends on the complex of motor-imitative and performative abilities that are exhibited by infants in the first months and years of life (see Smith and Gasser 2005; Needham and Libertus 2011; Shield and Meier 2018).

Comparative studies have also traced similar mechanisms in other animal species. For example, Ghazanfar and Takahashi (2014) have hypothesized the presence of a common nervous mechanism (in the autonomic nervous system) in humans and white-tufted marmosets (a cebid of the New World) that allows the acquisition of species-specific vocalizations in both.

White-tufted marmosets, phylogenetically distant from the sapiens, present a type of social organization very similar to that of the human being; the care of the offspring, for example, takes place not only on the part of the parents but also on the part of other members of the group, not necessarily related. Social organization and in part also the survival of the offspring therefore depends on this type of parental care (Takahashi et al. 2017). Marmosets spontaneously show a type of babbling similar to that of human beings in the sense that the initial production resembles human pre-babbling or cooing from the moment of birth. Immediately after the activation of babbling-like vocalization, the selection of some specific vocalic sounds by the adults begins. These sounds are selected by the parents in a turn-taking system (Takahashi et al. 2013, 2017) which is similar to the one established between the parents of the sapiens and newborns or infants, with a specific purpose: the adults of the marmosets select the sounds that are precisely formant frequencies, sounds that are similar to the adult sound of the *phee* or the typical sound used to establish relationships within individual groups. It is a decisive sound for accessing adult life and also for sharing food and defining territory.

14.4 Conclusions: The Natural Performativity of Language and Communication

What happens to marmosets when they start producing these sounds? Adults select and exclusively transmit the *phee* while the range of frequencies that is produced by the little ones in the learning phase is gradually eliminated so as to lead the little ones to only and exclusively produce the *phee*. The interesting aspect of this work is that according to the authors, the cyclic activation of the autonomic nervous system and arousal determine the random onset of sounds in marmosets in the first months of life. The same type of random activation occurs in humans. There would therefore exist an analogy in the forms of communication that links the spontaneous production of sounds, turn taking and social feedback by the little ones of both sapiens and marmosets. In particular marmosets and human beings learn to relate to adults by performing, by implementing a typical production sound.

Learning modalities would therefore be determined by how the nervous circuits are formed and in particular by the rhythmic cycles of the autonomic/arousal nervous system (this constitutes a constraint of the form that is common to many animal species that use vocal communication), from biomechanical constraints determined by the shape of the vocal production equipment and auditory feedback.

Obviously there are species-specific differences in the vocal "phenotypes" produced by each species: white-tufted marmosets will start from various babbling-like sounds to produce a single adult sound (*phee*) thanks to vocal performativity stimulated by parental care. The sapiens will start from some universal non-specific sounds of a language (babbling) in order to produce a sequence of sounds specific to the language of the parents, quantitatively and combinatorially more numerous than the cooing and the beginning babbling.

This determines absolutely species-specific vowel communications, bound by a common evolutionary base and a specific body structure, and determined by the performativity that this structure allows.

The acquisition of linguistic sounds, therefore, is an example of natural performativity: a competence that manifests itself thanks to the phylogenetic presence of morphological constraints (structures of phonation/decoding of sounds) which constitute the body base for performing language. Without the anatomical constraints and the natural performativity allowed by these constraints, the ontogenetic acquisition of human language could not take place. Furthermore, this type of performative competence is not unique to the sapiens but can be found in various animal species that use vocalizations as a tool of social organization and communication of primary needs. The notion of natural performativity, therefore, includes within it mechanisms that act from the phylogenetic-evolutionary level (the morphological constraints) to the individual (the performativity of the individual in the selection of linguistic sounds), to the social (the adaptability of linguistic sounds in relational contexts).

In conclusion, performativity can be defined as that competence which allows us to know the inner and surrounding world starting from developmental and evolutionary constraints that dictate possibilities in relation to the external environment. Linguistic performativity is an example of this, in that language is ontogentically and phylogenetically linked to the constraints which in turn allow performative possibilities and these possibilities are implemented through social feedback.

References

Adams, F., & Aizawa, K. (2001). The bounds of cognition. *Philosophical Psychology, 14*(1), 43–64.

Austin, J.L. (1975). *How to do things with words* (2nd ed.). Oxford: Oxford University Press.

Barsalou, L.W. (1999). Perceptual symbol systems. *Behavioral and Brain Sciences, 22*, 577–660.

Berwick, R.C., & Chomsky, N. (2016). *Why only us. Language and evolution*. Cambridge, MA: The MIT Press.

Boë, L.J., Heim, J.-L., Honda, K., & Maeda, S. (2002). The potential Neanderthal vowel space was as large as that of modern humans. *Journal of Phonetics, 30*, 465–484.

Brooks, R.A. (1999). *Cambrian intelligence: The early history of the new AI*. Cambridge, MA: The MIT Press.

Butler, J. (1990). *Gender trouble: Feminism and the subversion of identity*. New York: Routledge.

Butler, J. (1999). *Gender trouble: Feminism and the subversion of identity* (2nd ed.). New York: Routledge.

Chalmers, D., & Clark, A. (1998). The extended mind. *Analysis, 58*(1), 7–19.

Chomsky, N. (2006). *Language and mind* (3th ed.). New York: Cambridge University Press.

Clark, A. (2015). Embodied prediction. In T. Metzinger & J.M. Windt (Eds.), *Open MIND. Frankfurt am Main, MIND Group*.

de Boer, B., & Fitch, W.T. (2010). Computer models of vocal tract evolution: An overview and critique. *Adaptive Behavior, 18*, 36–47.

De Busser, R., & LaPolla, R.J. (Eds.). (2015). *Language structure and environment. Social, cultural, and natural factors*. Amsterdam: John Benjamins.

Di Sciullo, A.M., & Boeckx, C. (Eds.). (2011). *The biolinguistic enterprise. New perspectives on the evolution and nature of the human language faculty*. New York: Oxford University Press.

Falzone, A. (2006). Biologia, linguaggio, evoluzione. In A. Pennisi & P. Perconti (Eds.), *Le scienze cognitive del linguaggio*. Bologna: Il Mulino.

Falzone, A. (2012). Specie-specificità, linguaggio, rappresentazione: la tecnologia uditivo-vocale nel sapiens. *RSL. Italian Journal of Cognitive Sciences, 1*, 44–47.

Falzone, A. (2014). Structural constraints on language. *RSL. Italian Journal of Cognitive Sciences, 2*, 13–36.

Favaro, L., Gamba, M., Alfieri, C., Pessani, D., & McElligott, A.G. (2015). Vocal individuality cues in the African penguin (Spheniscus demersus): A source-filter theory approach. *Scientific Reports, 5*, 17255.

Fitch, W.T. (2000). The evolution of speech: A comparative review. *Trends in Cognitive Science*, *4*(7), 258–267.

Fitch, W.T. (2012). Evolutionary developmental biology and human language evolution: Constraints on adaptation. *Evolutionary Biology, 39*, 613–637.

Gallagher, S. (2005). *How the body shapes the mind*. Oxford: Oxford University Press.

Gallagher, S. (2015). Reuse and body-formatted representations in simulation theory. *Cognitive Systems Research, 34–35*, 35–43. https://doi.org/10.1016/j.cogsys.2015.07.003.

Gallese, V., & Lakoff, G. (2005). The brain's concepts: The role of the sensory-motor system in conceptual knowledge. *Cognitive Neuropsychology, 22*(3–4), 455–479.

Gamba, M. (2014). Vocal tract-related cues across human and nonhuman signals. *RSL. Italian Journal of Cognitive Science, 1*(1), 49–68.

Ghazanfar, A.A., & Takahashi, D.Y. (2014). The evolution of speech: Vision, rhythm, cooperation. *Trends in Cognitive Sciences, 18*(10), 543–553.

Gibbs, R.W., Jr. (2006). Metaphor interpretation as embodied simulation. *Mind & Language, 21*(3), 434–458.

Han, Y., Wang, J., Fischman, D.A., Biller, H.F., & Sanders, I. (1999). Slow tonic muscle fibers in the thyroarytenoid muscles of human vocal folds; A possible specialization for speech. *The Anatomical Record, 256*(2), 146–157.

Hirano, M., Ohala, J., & Vennard, W. (1969). The function of laryngeal muscles in regulating fundamental frequency and intensity of phonation. *Journal of Speech, Language, and Hearing Research, 12*(3), 616–628.

Hurley, S. (2001). Perception and action: Alternative views. *Synthese, 129*, 3–40.

Hutto, D., & Myin, E. (2013). *Radicalizing enactivism: Basic minds without content*. Cambridge, MA: MIT Press.

Lieberman, P. (1984). *The biology and evolution of language*. Cambridge, MA: Harvard University Press.

Lieberman, P. (2006). *Toward an evolutionary biology of language*. Cambridge, MA: Harvard University Press.

Menary, R. (2010). Introduction to the special issue on 4E cognition. *Phenomenology and the Cognitive Sciences, 9*, 459–463.

Minelli, A. (2007). *Forme del divenire. Evo-devo: la biologia evoluzionistica dello sviluppo*. Torino: Einaudi.

Minelli, A. (2015). Biological Systematics in the Evo-Devo era. *European Journal of Taxonomy, 125*, 1–23.

Minelli, A., & Fusco, G. (2004). Evo-devo perspectives on segmentation: Model organisms, and beyond. *Trends in Ecology & Evolution, 19*(8), 423–429.
Needham, A., & Libertus, K. (2011). Embodiment in early development. *Wiley Interdisciplinary Reviews: Cognitive Science, 2*(1), 117–123.
Noë, A. (2009). *Out of our heads. Why you are not your brain, and other lessons from the biology of consciousnes*. New York: Hill and Wang.
Pennisi, A., & Falzone, A. (2016a). *Darwinian biolinguistic. Theory and history of a naturalistic philosophy of language and pragmatics*. Switzerland: Springer International Publishing.
Pennisi, A., & Falzone, A. (2016b). Può esistere una biolinguistica darwiniana? *Versus, 123*(2), 231–256.
Pisanski, K., Mishra, S., & Rendall, D. (2012). The evolved psychology of voice: Evaluating interrelationships in listeners' assessments of the size, masculinity, and attractiveness of unseen speakers. *Evolution and Human Behavior, 33*(5), 509–519.
Rowlands, M. (2006). *Body language: Representation in action*. Cambridge, MA: The MIT Press.
Rowlands, M. (2010). *The new science of the mind: From extended mind to embodied phenomenology*. Cambridge, MA: The MIT Press.
Rupert, R. (2004). Challenges to the hypothesis of extended cognition. *Journal of Philosophy, 8*, 389–428.
Schechner, R. (2013). *Performance studies: An introduction*. London: Taylor & Francis.
Shapiro, L.A. (2004). *The mind incarnate*. Cambridge, MA: The MIT Press.
Shield, A., & Meier, R.P. (2018). Learning an embodied visual language: Four imitation strategies available to sign learners. *Frontiers in Psychology, 9*, 811.
Smith, L., & Gasser, M. (2005). The development of embodied cognition: Six lessons from babies. *Artificial Life, 11*, 13–29.
Stedman, H.H., Kozyak, B.W., Nelson, A., Thesier, D.M., Su, L.T., Low, D.W., Bridges, C.R., Shrager, J.B., Minugh-Purvis, N., & Mitchell, M.A. (2004). Myosin gene mutation correlates with anatomical changes in the human lineage. *Nature, 428*(6981), 415–418.
Takahashi, D.Y., Narayanan, D.Z., & Ghazanfar, A.A. (2013). Coupled oscillator dynamics of vocal turn-taking in monkeys. *Current Biology, 23*(21), 2162–2168.
Takahashi, D.Y., Fenley, A.R., Teramoto, Y., Narayanan, D.Z., Borjon, J.I., Holmes, P., & Ghazanfar, A.A. (2015). Language development. The developmental dynamics of marmoset monkey vocal production. *Science, 349*(6249), 734–738.
Takahashi, D.Y., Fenley, A.R., & Ghazanfar, A.A. (2016). Early development of turn-taking with parents shapes vocal acoustics in infant marmoset monkeys. *Philosophical Transactions of the Royal Society B, 371*(1693), 20150370.
Takahashi, D.Y., Liao, D.A., & Ghazanfar, A.A. (2017). Vocal learning via social reinforcement by infant marmoset monkeys. *Current Biology, 27*(12), 1844–1852.
Taylor, A.M., & Reby, D. (2010). The contribution of source-filter theory to mammal vocal communication research. *Journal of Zoology, 280*(3), 221–236.
Tomasello, D. (2014). Una via evoluzionista allo studio del rito e della performance. *Culture teatrali, 23*, 238–249.
Van den Stock, J., Grèzes, J., & de Gelder, B. (2008). Human and animal sounds influence recognition of body language. *Brain Research, 1242*, 185–190.
Wilson, M. (2001). The case for sensorimotor coding in working memory. *Psychonomic Bulletin & Review, 8*, 44–57.
Winer, J.A., & Schreiner, C. (2011). *The auditory cortex*. New York: Springer.
Zahavi, A. (1975). Mate selection: A selection for a handicap. *Journal of Theoretical Biology, 53*, 205–214.
Zahavi, A. (1993). The fallacy of conventional signalling. *Philosophical Transactions of the Royal Society, London B, 338*, 227–230.
Zahavi, A. (2008). The handicap principle and signalling in collaborative systems. In *Sociobiology of communication*. Oxford: Oxford University Press.

Chapter 15
The Contribution of Biolinguistics to the Debate of Performativity

Laura Giallongo and Gessica Fruciano

Abstract The performativity in Cognitive Sciences raised a great debate. The researchers questioned the role of the performance in cognition and strongly oppose cerebrocentrism, to support the embodied cognition. Moreover, recent research conducted in the biolinguistic field has examined the performativity in linguistic knowledge and provide a contribution to the controversy. In this framework of studies this paper analysed the performativity in the ontogenesis of language, adopting the perspective of biology. One of the different applications of naturalistic views to the performative theory of knowledge is the ethological comparison of the acquisition of species-specific vocal repertoire and the effect of the biological constraints on sapiens linguistic performances. The ontogenetic stages of language, both on structural and functional levels, and the data obtained from ethology show that vocal performativity is a knowledge process of linguistic cognition. Therefore, the linguistic act determines the neural circuits for cognitive processing of linguistic sounds.

Keywords Performativity · Biolinguistics · Language · Biological constraints · Ethological comparison

15.1 Cognitive Sciences and Performativity

The research on the performativity of knowledge is one of the most researched areas of current Cognitive Sciences, which have tried to clarify the issue by expanding the boundaries of each discipline. Cognitive Sciences undertake an ambitious

L. Giallongo (✉) · G. Fruciano
CRISCAT (International Research Center for Theoretical and Applied Cognitive Sciences), University of Messina and Universitary Consortium of Eastern Mediterranean, Noto (CUMO), Noto, Italy
e-mail: lgiallongo@unime.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_15

multidisciplinary approach that uses linguistics, anthropology and philosophy, as well as modern neuroimaging, informatic and psychological techniques.

The term performance is defined for the first time by Chomsky (1965) to differentiate the speaker's linguistic act (performance) from the linguistic knowledge possessed by the speakers (competence). Chomsky does not consider the performance as decisive in linguistic cognition, in fact it is not included in its theoretical framework on Generative Grammar.

Performativity has become a subject of fervent research not only by linguistics, but also by many disciplines for example in theatre, photographic art, sociology and cultural anthropology. In the field of Cognitive Sciences the recent debate on embodied cognition has been intense, above all as a response to the crisis of cerebrocentrism, which starting from the Cartesian dualism to the advent of neurosciences influenced scientific research. Furthermore, the overcoming of the representational-computational theory of mind and of the sandwich metaphor (Caruana and Borghi 2016) culminated in the famous expression of "brain in a vat" (Putnam 1981) or in books such as "Why You are not your brain" by Alva Noë (2009), in which On the contrary, embodied cognition attributes a decisive role to the action and to the interaction of the body with the environment. Mental activity is therefore embodied in the action and the body is extended in the environment. As argued by Merleau-Ponty, in fact, "Le corps est le véhicule de l'être au monde, et avoir un corps c'est pour un vivant se joindre à un milieu défini" (1945, 115).

The embodied cognition has been studied from different perspectives, sometimes opposed and resumed by Gallagher's and Rowland's 4E cognition: Extended, Embedded, Embodied and Enacted (Rowlands 2010; Gallese and Sinigaglia 2011; Shapiro 2011; Noë 2009; Gallagher 2017).

But the contrast to the cerebrocentrism involves the risk of a return to behaviourism. By explaining cognition through the action and the interaction of the body with the environment, the mental or linguistic elaborations are denied, as it has been underlined also by important authors of embodied cognition (Gallagher 2017; Aizawa 2014).

A valid alternative theory to the cerebrocentrism and extremist expressions of embodied cognition, is to realise what Edelman (1992) defined "The third phase of Cognitive Sciences". According to Edelman human superior cognitive abilities such as language, memory and thought are allowed by the body and the body determines knowledge through learning processes and social relationships with conspecifics.

By assuming the perspective of biology and considering the organism through a mechanicist tendency that tries to analyse internal organisation (Noë 2009), but as extended to the environment, it is possible to realise the third phase of the Cognitive Sciences. Through the action, in fact, the cognitive processes happen and are influenced by the body that interact with the world and by biological constraints. The knowledge of the world should not be considered as an internal state that is externalised, but it occurs by the performance and the way of the body to interact with the environment depends on the biology of the body that is species-specific.

In order to really adopt a biological perspective in the theory of knowledge it is necessary to investigate the species-specific modalities of knowledge of the world not only of human, but also of animal performances, thanks to ethological research. This perspective, to be called naturalistic, must explain in terms of necessity the gradual variations of the species-specific cognitive systems, as a result of the natural selection that has acted in the bodies which constrain functional possibilities. And one of the different applications of evolutionism to the performative theory of knowledge is the comparison of cognitive abilities due to the morphological structures of sapiens with other species in the vocal and linguistic communication. In this framework of studies the contribution of the ontogenesis of species-specific vocal repertoire in the field of biolinguistics can be decisive (Giallongo, 2018).

15.2 Performance in the Ontogenesis of Language

Biolinguistics, through an interdisciplinary approach, researches the biological foundations of language, in order to re-construct its origin and understand the involved brain activations, the genetic causes and the cognitive processes that it determines (Di Sciullo and Boeckx 2011).

The ontogenesis of language is one of the most interesting aspects in biolinguistics and is certainly of fundamental importance to the study of cognitive performativity. In fact, it is only through the performance that each individual acquires the linguistic abilities that will inevitably influence all cognitive processes.

Theories about the development of language in the embodied perspective have proved the activation of the sensorimotor system in linguistic production, in opposition to the propositional theory which considers the semantic of the words arbitrary and differentiates those from the processes of object recognition. The action-based language theory considers the language based on action. For example to listen to verbs that evoke actions determines a cerebral sensorimotor activation of the action also thanks to the mirror neuron system (Glenberg and Gallese 2012). Further research has shown that if the verbs referred to the actions involve, for example, the limbs an activation of the motor cortex occurs when this action is performed, especially the dorsal regions, while in the case of the mouth the ventral regions (Pulvermuller 2002).

In an evolutionary perspective such activations would be explained by exaptation (Pennisi and Falzone 2010). Language would have exploited the motor system and with evolution this system is utilised for linguistic cognition (neural exploitation hypothesis) (Gallese 2008).

Tomasello attributes an important role of social interaction in the acquisition of language thanks to the attention and joint action with other social actors (Akhtar and Tomasello 2000). The ability to coordinate actions in order to reach a common goal would be uniquely human and is considered at the base of language evolution (Tomasello 2014).

The involvement of the body in the development of language has also been studied in numerous experimental protocols that propose embodied selective action: children through eye and head movements, approach objects to examine them better.

Children have an active role in the semantic attribution of the word (Yu and Smith 2012).

Anyone who has ever observed a child in the early stages of language development has certainly noted the effort that he makes to produce the first words of the mother tongue. In fact, language is not acquired immediately, as is the case of bipedal locomotion, but the ontogenetic phases that characterize its development are different (Karmiloff-Smith 1992).

In the first months the children produce sounds like cries and guttural sounds that they can control starting from the fifth month, above all to express emotions. The voluntary controls of the vocalizations occur through the modulation of the volume of the voice and is manifested with pre-linguistic vocalizations (babbling), observed in all languages, characterized by repetitions of syllables (canonical babbling). It is in this phase that the effort takes place.

Around 10 months the syllables are combined (varied babbling) and are often associated with gestures. After what is defined as a pre-linguistic period of around 12 months, the child expands his vocabulary more and more combining words and takes over the use of social forms as graces, yes or no, until at the age of two they form the first sentences (Guasti 2007).

Children around 18 months (even if the ontogenetic development of every child requires its own timing) produce language and although they are equipped with peripheral and central structures, only by performing continuous attempts and efforts will produce the language spoken by adult (Pennisi and Falzone 2016).

Certainly the role of learning at this stage is decisive. Although all peripheral and central structures are innate, linguistic performance doesn't occur without social activation. *Enfants sauvages* have much to teach, not only on language but also on bipedal locomotion, in fact less than 15% have a bipedal locomotion and almost all the children don't speak the language (Pennisi and Perconti 2006). As demonstrated by much research, language learning already takes place in the mother's uterus. In fact the auditory system is completely developed during gestation and allows access to the sound of the world, but above all to the maternal voice (Pennisi 2003).

Several studies have shown, through the frequency of the number of pacifier suction, that children in the first hours of life are able to recognize the mother's voice and the language spoken by the mother (Moon et al. 2013), confirming that language is learned already in the uterus.

At the end of one year the children listening to the sounds of other languages lose interest, focusing only on the sounds of their own language. This happens probably because in this period the first vocal productions and physical efforts for linguistic performance take place and the native language requires special attention compared to other language (Kuhl et al. 2006).

The role of the mother does not end in the uterus, as it has been underlined by Falk (2004), and is decisive in the development of language. The mother's voice has been defined motherese, that is a language common to all cultures, very repetitive with raising the tone of the voice, signed and rhythmic, with reduction of production time and allows the linguistic performance. It is in fact to show this tendency, not only of the mother but also of the caregivers, to accentuate the prosody when they address the children, permits the acquisition of language. Since the phrases with accentuated prosody attract attention and stimulate the repetition of the children. Furthermore, motherese reinforces the relationship of reciprocity with the child and facilitates the recognition of the mother. It also increases the production time and accentuating prosody allows the development of syntactic and semantic skills (Falk 2009; Gleitman and Wanner 1982; Pennisi and Falzone 2016; Goldstein and Schwade 2008).

The importance of performance in language ontogenesis has been demonstrated in the study of asymmetry between skills and prosodic performance in children around the age of four. These studies conducted with children of different historical-natural languages have shown that they use this (performance) easily, but when they are asked to recognise they may have difficulties. So we notice the asymmetry, which was also found in other aspects of language, especially in the use of pronouns (Cutler and Swinney 1987; Hendriks 2014).

These researches prove that in the language acquisition phases the linguistic performance, the linguistic act, is a means of knowledge. In fact, it would precede the algorithms that at this point would not be innate, but after the structures have determined the possibilities (biological constraints) is the linguistic performance that dictates such algorithms. This is the reason why the study of the ontogenesis of language is important for the debate of performativity.

Further proof of the role that linguistic performance has in the ontogenesis of language is given by the temporary arrest and often the involution of cognitive abilities in children. As if in some ways the linguistic performance, which requires a strong effort and concentration in coordination for linguistic articulation, takes precedence over other cognitive functions (Spelke et al. 2013). At the end of the process of language acquisition occurs also a surprising development of cognitive skills.

15.3 Ethological Comparison

The comparison of communication skills and human vocal performances with other species arose from the need to clarify the origin of language. Furthermore, it can also allow us to comprise the performative component of the sapiens cognition that is expressed linguistically, or in the case of other species vocally, especially in the study of the acquisition of species-specific vocalizations.

Observations and research conducted in the field of parental care ethology have clarified the role of caregivers in the acquisition of the species-specific vocal repertoire and have shown that, amongst other species, but especially primates and birds, social activation is decisive for the development of the vocal repertoire. In fact there are numerous ethological evidence of babbling and motherese (Giallongo 2015).

Mother-infant communication is especially vocal. It is also a reciprocal and not unidirectional communication, as shown by data on non-human primates and birds (Masataka 1985; Jovanovic et al. 2000; Cheney and Seyfarth 1980; Beecher 1988).

Crying is certainly the first element of comparison between primates infants and children, in fact in both cases the vocalizations are emotive, driven by the need to reunite with the mother or to express their feelings. The weeping is widespread in many species and is species-specific, but it is noted that nocturnal species produce short cries with few acoustic elements, compared to the diurnal species. Moreover, the evolutionary function of crying to strengthen the mother-infant relationship and the rapid reunification with it, make us assume that crying is a form of ancestral vocal communication and that the neural activity involved are the same for the production of vocalizations (Newman 2007).

Motherese has been observed regularly among primates. The vocalizations of the mothers when they address the infant have large points of contact with those produced by their infants, as happens in the case of human (Maestripieri and Call 1996; Masataka 2003, 2007).

The infant-directed speech was observed among the gibbons, a species particularly studied for singing productions; in fact they perform very complex songs, often called duets. The researchers noted that during the singing of the mother, the young females of the group, often perform very rudimentary songs, which have points of contacts with the mother's songs. Above all there is a variation of the behaviour of the mother, that as in the motherese, makes the song very stereotyped, very musical and varies both in time and structure. To the improvement of the performances of the young females the variations of the mother's songs are reduced, showing how the mother allows the learning of the songs and that the young females only perform acquiring the species-specific vocal repertoire (Koda et al. 2013). Even among gorillas and macaques, infant-directed communication is observed (Luef and Liebal 2012; Whitham et al. 2007).

Babbling, the first vocal productions that precede full control of vocalization, have been studied among non-human primates, in particular among pygmy marmosets. In several species, in fact, the infants after few weeks of life produce a series of very repetitive vocalizations that resemble adult vocal productions. All the infants use vocalizations that are not found in the adult repertoire, but they have a different point of contact. With time and social independence these are replaced by the typical species-specific calls (Elowson et al. 1998; Snowdon et al. 1997).

Even among baboons, are observed in the production of infants different variants of adult vocalizations. Only performing and with the time and growth they will be able to produce and discriminate the vocalizations of the adult repertoire (Fischer et al. 2000).

Despite the attention of the ethology of babbling, this was predominantly for non-human primates, given the commonality with the sapiens, many studies have described this phenomenon in many species and is widespread among mammals and birds. For example, among bats, infants produce adult vocalizations of both sexes by combining them in different social contexts. Only when they reach maturity they will acquire the specific repertoire of the sex and the social relevance of vocalizations (Knörnschild et al. 2006). The crystallization of the song after a phase of continuous exercise and performative effort occurs among birds, which have many homologies in the development of vocal repertoire with children (Goldstein et al. 2003; Doupe and Kuhl 1999). Even in the species that use the voice to communicate in a social network a decisive role is played by the performance in the acquisition of species-specific vocal repertoire as happens in human.

15.4 Biology of Constraints

The ontogenesis of the species-specific vocal repertoire is constrained by the possibilities of the biology of the organisms. The biological constraints influence the structure of the body and fix its limits and the range of performativity.

The vocal tract is certainly a structural constraint that make humans unique. Morphological studies have clarified the anatomical differences of our vocal tract with non-human primates: the difference lies in the supralaryngeal vocal tract, in the ratio between the horizontal tract (from the lips to the back of the pharynx) and vertical tract (from the soft palate to the vocal folds). Only in man the two tracts have the same proportion because of the low position, whose evolutionary causes have been well explained (Lieberman and McCarthy 2007; Fitch 2000, 2002, 2005).

Moreover, thanks to a process of exaptation of the structure used before for different functions- as in the case of the low larynx for sexual purpose (size exaggeration theory)- and subsequently re-functionalized for linguistic purpose, this form of communication has become decisive for sapiens (Pennisi and Falzone 2010).

Obviously the genetic variations are very important. The gracilization, that has affected the human bone structure, in particular the face with the reduction of the mandible due to the myosin gene (MYH16), that in sapiens is inactivated, but also the role of the famous foxp2 on the basal ganglia in the control of fine orofacial movements (Falzone 2012a, b) are important examples.

The vocal track does not have the low position already at birth, the children in fact have the vocal track in a higher position, because of sharing the stretch also for feeding allows to reduce the risk of suffocation for newborns (Zmarich 2010). The descent of the larynx coincides with the first vocal productions, in particular babbling, and also the molars make their appearance.

Around 18 months the cognitive regression, sustained by Spelke et al. (2013), occurs because cognitive attention is for linguistic performance, which requires a great effort to coordinate the auditory inputs, thanks to the complete development of the motor cortex, with the linguistic articulation. Every child in this stage carries out a series of attempts performing sounds in order to achieve complete competence of language. The role of the performance as a cognitive process is in its most decisive period.

Recent research on the auditory cortex give much information about human linguistic species-specific. Indeed in humans, as in primates, the removal of parts of the auditory cortex or its totality causes very severe hearing deficits, while in other species such as mice, there is a slow recovery. Moreover for primates, sapiens included, the secondary auditory cortex is mainly active for linguistic sounds, thus demonstrating a specialization for language (Kanwal and Ehret 2011; Harrington 2002; Zatorre et al. 1996; Heffner and Heffner 1990; Falzone 2012b).

This specialization of the auditory cortex in human and other primates give us important information on the evolution of language. Given that primates use vocal communication in many social contexts for very different purposes, such as group decision-making, parental care, social networks (Pennisi and Giallongo 2018; Giallongo 2015, 2017a, b) suggest that it has therefore been selected for important communication tasks and indicating how much the vocal communication is decisive in the sociality of the primates.

Compared to primates sapiens have an area in the motor cortex that is responsible for the voluntary control of laryngeal muscles: the larynx area. Neuroscientific research has in fact tested the ability of vocal control isolating the components of the joint and movements of the lips and tongue. The results show in the motor cortex an area responsible for controlling the movements of the larynx (Brown et al. 2007). The comparison of a corresponding area in primates has failed. In fact the cortical position is different, in primates it is in the ventral premotor cortex. The cerebral connections with the laryngeal motor neurons are only indirect and has not the same degree of involvement in spontaneous vocalization (Simonyan and Horwitz 2011). Such data seem to suggest not only a human specificity, but also a possible evolutionary process that involved this and other areas to allow the use of language.

In addition the data provided by psychobiology on neurocerebral development and plasticity provide further elements for reflection. Indeed, the synaptogenesis (the formation of new synapses) reaches completion at different times in different areas: the auditory cortex develops until the eight month of life, the prefrontal cortex until the (Pinel 2006).

15.5 Conclusion

The biolinguistic research on the ontogenesis of language and on the structural biological constraints, as well as recent psychobiological knowledge and the ethological comparison on the acquisition of species-specific vocal repertoire, make an important contribution to the debate on performativity.

The stages of the development of the language both of biological structures and of vocal performance show a clear correspondence: the children begin around 8-10 months the phase of the varied babbling and it is the period in which the synaptogenesis of the auditory cortex is completed. In the same way the formation of the synapses in the prefrontal cortex reaches its completion around two years, and it is in this period that the children have full control of articulation.

It is important to underline that if the cerebral voluntary control of language takes place for approximately two years, the previous period characterized by vocalizations and continuous attempts, clearly demonstrates that performance is a cognitive process for knowledge. Only with the linguistic practice the neural circuits for language develop.

Furthermore, the ethological comparison of the development of the vocal repertoire in the case of babbling in other species, especially of social species with vocal social network, suggests that even in other cognitive domains performance is a cognitive process and influences cerebral elaboration. This hypothesis can certainly be analysed with an evolutionary point of view.

Biolinguistic studies show that in language acquisition stages the performance precedes the algorithms that are not innate, but after the effect of the biological constraints, performance determines such algorithms. The importance of the biolinguistics on the debate of performativity lies within this stage; it is indeed only through practice that children can learn to speak.

References

Aizawa, K. (2014). The enactivist revolution. *Avant, 5*(2), 19–42.

Akhtar, N., & Tomasello, M. (2000). The social nature of words and word learning). In R. Micknick Golinkoff e Kathryn Hirsh-Pasek (Ed.), *Becoming a word learner: A debate on lexical acquisition* (pp. 115–135). Oxford: Oxford University Press.

Beecher, M.D. (1988). Kin recognition in birds. *Behavior Genetics, 18*(4), 465–482.

Brown, S., Ngan, E., & Liotti, M. (2007). A larynx area in the human motor cortex. *Cerebral Cortex, 18*(4), 837–845.

Caruana, F., & Borghi, A.M. (2016). *Il cervello in azione. Introduzione alle nuove scienze della mente*. Bologna: Il Mulino.

Cheney, D.L., & Seyfarth, R.M. (1980). Vocal recognition in free-ranging vervet monkeys. *Animal Behaviour, 28*(2), 362–367.

Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge: The MIT Press.

Cutler, A., & Swinney, D.A. (1987). Prosody and the development of comprehension. *Journal of Child Language, 14*(1), 145–167.

Di Sciullo, A.M., & Boeckx, C. (2011). *The biolinguistic enterprise. New perspective on the evolution and nature on the human language faculty*. New York: Oxford University Press.

Doupe, A.J., & Kuhl, P.K. (1999). Birdsong and human speech: Common themes and mechanisms. *Annual Review of Neuroscience, 22*(1), 567–631.

Edelman, G.M. (1992). *Bright air, brilliant fire. On the matter of the mind*. New York: Basic Books.

Elowson, A.M., Snowdon, C.T., & Lazaro-Perea, C. (1998). Babbling' and social context in infant monkeys: Parallels to human infants. *Trends in Cognitive Sciences, 2*(1), 31–37.

Falk, D. (2004). Prelinguistic evolution in early hominins: Whence motherese? *Behavioral and Brain Sciences, 27*(04), 491–503.

Falk, D. (2009). *Finding our tongues: Mothers, infants and the origins of language*. New York: Basic Books.

Falzone, A. (2012a). *Evoluzionismo e comunicazione. Nuove ipotesi sulla selezione naturale nei linguaggi animali e umani*. Roma: Corisco.

Falzone, A. (2012b). Specie-specificità, linguaggio, rappresentazione: la tecnologia uditivo-vocale nel sapiens. *Reti, saperi, linguaggi, 4*, 44–47.

Fischer, J., Cheney, D.L., & Seyfarth, R.M. (2000). Development of infant baboons' responses to graded bark variants. *Proceedings of the Royal Society of London B: Biological Sciences, 267*(1459), 2317–2321.

Fitch, W.T. (2000). The evolution of speech: A comparative review. *Trends in Cognitive Sciences, 7*, 258–267.
Fitch, W.T. (2002). Comparative vocal production and the evolution of speech: Reinterpreting the descent of the. In L.A. Wray (Ed.), *The transition to language* (pp. 21–45). Oxford: Oxford University Press.
Fitch, W.T. (2005). The evolution of language: A comparative review. *Biology and Philosophy, XX*(2–3), 193–203.
Gallagher, S. (2017). *Enactivist interventions. Rethinking the mind*. Oxford: Oxford University Press.
Gallese, V. (2008). Mirror neurons and the social nature of language: The neural exploitation hypothesis. *Social Neuroscience, 3*(3–4), 317–333.
Gallese, V., & Sinigaglia, C. (2011). What is so special about embodied simulation? *Trends in Cognitive Sciences, 15*(11), 512–519.
Giallongo, L. (2015). I vincoli ecologici e la dimensione vocale della socialità. In *Origini, Immaginari, etiche* (pp. 56–70). Roma-Messina: Corisco Edizioni.
Giallongo, L. (2017a). Biopolitics, language and social sciences. *Reti, saperi, linguaggi, 6*(12), 267–280.
Giallongo, L. (2017b). Comunicazione e social learning nei Primati. In A. Pennisi & A. Falzone (Eds.), *Linguaggio, evoluzione e scienze cognitive: un'introduzione* (pp. 225–242). Roma-Messina: Corisco Edizioni.
Giallongo, L. (2018). Naturalistic approaches to performativity. Reti saperi, linguaggi 2/2018 a. 7(14), 263–270.
Gleitman, L.R., & Wanner, E. (1982). Language acquisition: The state of the art. In E. Wanner & L.R. Gleitman (Eds.), *Language acquisition: The state of the art*. New York: Cambridge University Press.
Glenberg, A.M., & Gallese, V. (2012). Action-based language: A theory of language acquisition, comprehension, and production. *Cortex, 48*(7), 905–922.
Goldstein, M.H., & Schwade, J.A. (2008). Social feedback to infants' babbling facilitates rapid phonological learning. *Psychological Science, 19*(5), 515–523.
Goldstein, M.H., King, A.P., & West, M.J. (2003). Social interaction shapes babbling: Testing parallels between birdsong and speech. *Proceedings of the National Academy of Sciences, 100*(13), 8030–8035.
Guasti, M. (2007). *L'acquisizione del linguaggio. Un'introduzione*. Milano: Cortina.
Harrington, I.A. (2002). *Effect of auditory cortex lesions on discriminations of frequency change, amplitude change and sound location by Japanese Macaques (Macaca fuscata)*. Unpublished doctoral dissertation, University of Toledo.
Heffner, H.E., & Heffner, R.S. (1990). Effect of bilateral auditory cortex lesions on sound localization in Japanese Macaques. *Journal of Neurophysiology, 64*, 915–931.
Hendriks, P. (2014). *Asymmetries between language production and comprehension*. Dordrecht: Springer.
Jovanovic, T., Megna, N.L., & Maestripieri, D. (2000). Early maternal recognition of offspring vocalizations in rhesus macaques (Macaca mulatta). *Primates, 41*(4), 421–428.
Kanwal, J.S., & Ehret, G. (2011). In A. Winer & C.E. Schreiner (Eds.), *The auditory cortex Communication sounds and their cortical representation* (pp. 343–367). New York: Springer.
Karmiloff-Smith, A. (1992). *Beyond modularity. A developmental perspective on cognitive science*. Cambridge, MA: The MIT Press.
Knörnschild, M., Behr, O., & von Helversen, O. (2006). Babbling behavior in the sac-winged bat (Saccopteryx bilineata). *Naturwissenschaften, 93*(9), 451–454.
Koda, H., Lemasson, A., Oyakawa, C., Pamungkas, J., & Masataka, N. (2013). Possible role of mother-daughter vocal interactions on the development of species-specific song in gibbons. *PLoS One, 8*(8), e71432.

Kuhl, P.K., Stevens, E., Hayashi, A., Deguchi, T., Kiritani, S., & Iverson, P. (2006). Infants show a facilitation effect for native language phonetic perception between 6 and 12 months. *Developmental Science, 9*(2), F13–F21.

Lieberman, P., & McCarthy, R. (2007). Tracking the evolution of language and speech: Comparing vocal tracts to identify speech capabilities. *Expedition: The magazine of the University of Pennsylvania, 49*(2), 15–20.

Luef, E., & Liebal, K. (2012). Infant-directed communication in lowland Gorillas (Gorilla gorilla): Do older animals scaffold communicative competence in infants? *American Journal of Primatology, 74*(9), 841–852.

Maestripieri, D., & Call, J. (1996). Mother-infant communication in primates. *Advances in the Study of Behavior, 25*, 613–642.

Masataka, N. (1985). Development of vocal recognition of mothers in infant Japanese macaques. *Developmental Psychobiology, 18*(2), 107–114.

Masataka, N. (2003). *The onset of language*. Cambridge: Cambridge University Press.

Masataka, N. (2007). Music, evolution and language. *Developmental Science, 10*(1), 35–39.

Merleau-Ponty, M. (1945). *Phénoménologie de la perception*. Paris: Gallimard.

Moon, C., Lagercrantz, H., & Kuhl, P.K. (2013). Language experienced in utero affects vowel perception after birth: A two-country study. *Acta Paediatrica, 102*(2), 156–160.

Newman, J.D. (2007). Neural circuits underlying crying and cry responding in mammals. *Behavioural Brain Research, 182*(2), 155–165.

Noë, A. (2009). *Out of our heads: Why you are not your brain, and other lessons from the biology of consciousness*. New York: Hill and Wang.

Pennisi, A. (2003). *Mente, cervello, linguaggio: una prospettiva evoluzionistica*. Messina: E.D.A.S.

Pennisi, A., & Falzone, A. (2010). *Il prezzo del linguaggio. Evoluzione ed estinzione nelle scienze cognitive*. Bologna: Il Mulino.

Pennisi, A., & Falzone, A. (2016). *Darwinian biolinguistics. Theory and history of a naturalistic philosophy of language and pragmatics*. Cham: Springer.

Pennisi, A., & Giallongo, L. (2018). Animal Biopolitics: How Animals Vote. *International Journal for the Semiotics of Law-Revue internationale de Sémiotique juridique,* 1–9, Springer.

Pennisi, A., & Perconti, P. (Eds.). (2006). *Le Scienze cognitive del linguaggio*. Bologna: Il Mulino.

Pinel, J.P. (2006). *Biopsychology*. Boston, MA: Pearson Education/Allyn & Bacon.

Pulvermuller, F. (2002). *The neuroscience of language: On brain circuits of words and serial order*. Cambridge: Cambridge University Press.

Putnam, H. (1981). *Reason, truth and history* (Vol. 3). Cambridge: Cambridge University Press.

Rowlands, M. (2010). *The new science of the mind: From extended mind to embodied phenomenology*. Cambridge, MA: MIT Press.

Shapiro, L. A. (2011). *Embodied cognition*. London/New York: Routledge.

Simonyan, K., & Horwitz, B. (2011). Laryngeal motor cortex and control of speech in humans. *The Neuroscientist, 17*(2), 197–208.

Snowdon, C.T., Elowson, A.M., & Roush, R.S. (1997). Social influences on vocal development in New World primates. In C.T. Snowdon & M. Hausberger (Eds.), *Social influences on vocal development*. Cambridge: Cambridge University Press.

Spelke, E.S., Bernier, E.P., & Skerry, A.E. (2013). Navigating the social word: What infants, children, and other species can teach us. In C.M.R. Banaji (Ed.), *Core Social*. Oxford: Oxford University Press.

Tomasello, M. (2014). *A natural history of human thinking*. Cambridge, MA: Harvard University Press.

Whitham, J.C., Gerald, M.S., & Maestripieri, D. (2007). Intended receivers and functional significance of grunt and Girney vocalizations in free-ranging female rhesus macaques. *Ethology, 113*(9), 862–874.

Yu, C., & Smith, L.B. (2012). Embodied attention and word learning by toddlers. *Cognition, 125*(2), 244–262.

Zatorre, R.J., Meyer, E., Gjedde, A., & Evanz, A. (1996). PET studies of phonetic processing of speech: Reviews, replication, and reanalysis. *Cerebral Cortex, 6*, 21–30.

Zmarich, C. (2010). Lo sviluppo fonetico/fonologico da 0 a 3 anni. In B. S. & H. S. L (Ed.), *L'intervento precoce nel ritardo di Linguaggio. Il modello INTERACT per il bambino parlatore tardivo* (pp. 17–39). Milano: FrancoAngeli.

Part VI
Neuroscientific Approaches

Chapter 16
It Doesn't Seem_It, But It Is. A Neurofilmological Approach to the Subjective Experience of Moving-Image Time

Ruggero Eugeni, Stefania Balzarotti, Federica Cavaletti, and Adriano D'Aloia

Abstract This article illustrates the first steps of a research project concerning the "Subjective Experience and Estimation of Moving-Image Time" (SEEM_IT). After introducing the theoretical background of the research, that links time perception to the embodied experience of movement, the article presents the main empirical results of an experiment aimed at assessing how spectators' time perception is affected by the style of editing and the type of represented action in short video clips. Though the style of editing played a major role in influencing SEEM_IT, it also significantly interacted with the type of represented action. The article reassesses these findings by discussing them within the theoretical framework of the research.

Keywords Time perception · Film experience · Neurofilmology · Duration estimation · Time passage · Editing · Action

16.1 Introduction

As we exit a movie theatre after a film screening, it frequently happens that we have the impression that time flew or dragged by, or even that a single scene of a film seemed to pass slower or faster than it actually did. Time perception at the cinema depends on a complex combination of several factors both objective (i.e. related

R. Eugeni (✉) · F. Cavaletti
Department of Communication and Performing Arts, Università Cattolica del Sacro Cuore, Milan, Italy
e-mail: ruggero.eugeni@unicatt.it

S. Balzarotti
Department of Psychlogy, Università Cattolica del Sacro Cuore, Milan, Italy

A. D'Aloia
Department of Architecture and Industrial Design, Università degli Studi della Campania "Luigi Vanvitelli", Caserta, Italy

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_16

to the concrete modalities of aesthetic presentation and physical performance of actions, to the specific nature of the depicted actions and to the narrative context in which they take place) and subjective (for instance, the spectator's affective attitude and sensitivity in that precise moment, his or her genre preferences, etc.). Despite the complexity and apparent impenetrability of the matter, specific aspects and dynamics of moving-image time perception can be isolated and investigated.

This article illustrates the first theoretical and empirical results of a research project concerning the perception of time during the course of a moving-image experience (e.g. fiction and non-fiction films, tv series, commercials, video clips). This research on the "Subjective Experience and Estimation of Moving-Image Time" (SEEM_IT) is set within the framework of "neurofilmology" (D'Aloia and Eugeni 2014), which is an epistemological and methodological approach based on the dialogue between film theories and both the experimental and speculative tools of cognitive psychology and neurocognitive sciences. One of the aims of this research program is to refine and update the current models of moving-image spectatorship. After introducing the general theoretical framework of the research (Sect. 16.2), the procedures and the main results of a psychological-behavioural experiment conducted on SEEM_IT are described and discussed (Sects. 16.3, 16.4, and 16.5). The conclusions are devoted to reassessing the experimental findings within the theoretical framework of the research (Sect. 16.6).

16.2 Theoretical Framework

16.2.1 Time and Moving-Image Theory

Throughout the history of film theory and cinema studies, scholars have developed more or less systematic analyses of time as a specific feature of the film experience. During the era of narratological semiotics in the seventies, the temporal dimensions of the film experience were conceived of as a textual effect of the interactions between story and discourse (Chatman 1978; Genette 1972) or of an enunciational dynamic (Bettetini 1979). Afterwards, beginning in the nineties, cognitive-analytic aesthetics started to pay greater attention to time as a fundamental aspect of the film experience while rejecting the idea of a real interaction between the fictional representation of time and its subjective experience. Gregory Currie (1995, 2004), for example, argued that the spectator cannot experience the fictional events as happening in his own actual present (the so-called "claim of presentness") because he has no place in the fictional world physically, and thus there is no interaction between the spectator's egocentric (bodily and proprioceptual) sense of time and the time of the fictional world (for the opposite stance, see Terrone 2017). Such an approach risks denying the qualitative articulation of the spectator's temporal experience. Totally different – and in our view more productive – is the position expressed by Paul Ricoeur (1984–1988) from a phenomenological and hermeneutic point of view. Following the French philosopher, the textual plot as "configured time" is an instrument of mediation between individual and "prefigured" time on the one hand, and cultural and "refigured" time on the other. Although developed in the field of literary analysis, this perspective allows for the rethinking of the temporal experience of film narrative in a post-cognitive key.

More recently, this landscape has widened under a twofold pressure: on the one hand, the increasing attention to Gilles Deleuze's works on film time, distinguishing between a classical "movement-image" and a modernist "time-image" (Deleuze 1986, 1989; see Mroz 2012), and on the other, the presence of new, complex time architectures in contemporary cinema (Carruthers 2016; McGowan 2011; Mulvey 2006; Stewart 2007; Trifonova 2007) and television storytelling (Ames 2012; Mittel 2015). More generally, scholars have started to focus on the "cultural" nature of cinematic time and its relationship with the social shapes of time (Doane 2002; Ethis 2006; Powell 2012). From this point of view, cinema and audiovisual media have been more or less explicitly linked to the collective experience of time (see for instance Adam 2004; Burges and Elias 2016; Crow and Heath 2002; Keightley 2012), both in the "classical" and "modern" era (characterized by time's spatialization, compression, and acceleration) and in the "postmodern" condition (characterized by time's extension, fragmentation, and fluidity, and by the dominance of a "broader/enlarged present"; see for instance Sobchack 2004).

Finally, in the last few years, many scholars have tackled the issue of time experience in film viewing from a cognitive or neurocognitive perspective. A first group of interventions addressed the problem from the Event Segmentation Theory perspective (Magliano and Zacks 2011; Radvansky and Zacks 2014; Shipley and Zacks 2008; Zacks 2015; Zacks and Magliano 2011). In this case, the discussion concerned the relationship between transitions inside the represented world (including temporal transitions), film editing processes, and the spectator's segmentation of events and actions. On the one hand, the debate gave rise to an analysis of the processes that constitute continuous diegetic time on the basis of continuity editing (Berliner and Cohen 2011; D'Ydewalle et al. 1998; D'Ydewalle and Vanderbeeken 1990; Germeys and D'Ydewalle 2007; Smith 2012, 2013; for a critical review, see Poulaki 2015). On the other hand, such an approach promoted the identification of the basic units of narrative comprehension (micronarratives), linked in turn to the experience of cinematic "nowness" (Tikka and Kaipainen 2014, 2015). In this way, the discussion has oscillated between the processes of the constitution of diegetic (i.e. represented) temporality and the experience of the "nowness" of spectators' temporality. However, it has not investigated the (possible) relationships between the represented action, its understanding and segmentation by viewers, editing styles, and the qualitative and quantitative experience of temporal duration – what we call SEEM_IT.

A second group of cognitive and neurocognitive contributions has focused on the perception of temporal duration by using naturalistic moving images as stimuli (see for instance Wearden 2005, 2008). In particular, these kinds of studies have investigated the relationships between estimations of temporal duration and either emotional factors (Fayolle et al. 2014; Loftus et al. 1987) or the "neural engagement" of viewers (Cohen et al. 2017). In other terms, these interventions analyse SEEM_IT, but without referring to the textual and semiotic processes and styles of the moving images (editing, in particular).

Finally, a third limited group of cognitive and neurocognitive interventions has analysed the relationship between SEEM_IT and editing processes. Leaving aside the compelling but non-systematic observations on the "elasticity" of time experienced in film viewing by Damasio regarding Alfred Hitchcock's *Rope* (Damasio 2002), it is worth mentioning here the works of De Wied et al. (1992) and Manoudi (2015). The first study (on which see also De Wied 1994) focuses on the estimation of temporal durations in viewing suspense movie scenes; Manoudi's work instead analyzes the effects of editing techniques and styles in determining viewers' estimation of time duration (see our discussion in Sect. 16.5).

In conclusion, SEEM_IT appears to be a multi-faceted and multi-disciplinary object: although intrinsically characterized by a subjective dimension, SEEM_IT interacts on one hand with the semiotic structures of moving images, and on the other with the social shapes of time experience. In Ricoeur's terms, we could say that *subjective experience translates textual forms into socially shared shapes of temporal experience*. On the basis of this framework, we decided to start the SEEM_IT survey from an empirical, psychological, and behavioural investigation concerning the interactions between the semiotic construction of moving images and the subjective experience of time. The strategic design of the research considers a subsequent shift towards the social dimension of the phenomena of time perception (see discussion in Sect. 16.6).

16.2.2 From Time Perception to Embodied Timing

The choice to base the analysis of SEEM_IT on an empirical ground leads our research toward the broader field of psychological, cognitive and neurocognitive studies of timing and time perception. We need to carefully consider what the theoretical implications of such a methodological move are.

"Timing" – a general label encompassing qualitative and quantitative experience, perception, judgement, estimation of time speed, order and duration – has become a central issue of neurocognitive studies in the last few years (Arstila and Lloyd 2014; Block and Grondin 2014; Buonomano 2017; Benini 2017; Drayton and Furman 2018; Matthews and Meck 2014; Merchant and De la Fuente 2014; Merchant et al. 2013; Roenneberg 2012; Vatakis et al. 2018; Wearden 2016; for less specialist yet well documented studies see Burdick 2017; Hammond 2012; Klein 2007. For the philosophical background of subjective time experience see also Mölder et al. 2016; Phillips 2017). In this context, scholars have underlined different aspects of the experience of time, in particular its subjective dimension, its different "windows", and the multiplicity of psychological mechanisms and underlying neural dynamics responsible for its constitution, perception, and evaluation. In any case, the empirical research focused in particular on two aspects of the subjective perception of time:

qualitative judgement (speed) and *quantitative* estimation (duration), considered as separate variables (Wearden 2015; Wearden et al. 2014; Droit-Volet and Wearden 2016; Droit-Volet et al. 2017).

Within this field, a relatively recent trend outlines the *embodied* nature of timing experiences (Altshuler and Sigrist 2016; Flaherty 2011; Meck and Ivry 2016; Wittmann 2009; Wittmann 2016). Among the different (and not necessarily competing) theories of embodied timing, we decided to pay special attention to the models that link timing to the planning, coordination, and monitoring of *movement* and *action* (Droit-Volet et al. 2013; Gallagher 2011; relevant precursors of this tendency have been Fraisse 1964; Guyau 1890; Piaget 1969), since these are central features of moving images. Following this trend, "the sensory-motor states acquired during experience ... provide the material for certain judgments of time, and at least for explicit judgments of time or human awareness of time" (Droit-Volet 2014: 494). Moreover, from this point of view, *the experience of time is considered as deriving from both the personal performance of actions (including their proprioception), and the observation of the other's actions and movements*: indeed, perceived moving objects and/or subjects, as well as pictures of bodies in dynamic postures are subjectively evaluated as longer in duration than the same objects and subjects pictured as static, in standing postures, or moving away from the observer (Brown 1995; Nather et al. 2011; Nather and Oliveira Bueno 2012; Droit-Volet et al. 2013; Nather et al. 2014; Vatakis et al. 2014; Wang and Jiang 2012; Wittmann et al. 2010). These findings can possibly be interpreted as referring to a process of *embodied simulation* of the other's actions and movements (Gallese 2005) on the basis of mirroring brain circuits (Ferrari and Rizzolatti 2015; Rizzolatti and Sinigaglia 2007; Rizzolatti and Sinigaglia 2016), a process assumed to be active within dynamic and reciprocal interactions of subjects in *joint action* regimes, (Aglioti et al. 2008; Colling et al. 2014; Sebanz et al. 2006; Sebanz and Knoblich 2009; Vesper and Van Der Wel 2013; Vesper et al. 2016), such as couples of dancers or musicians (Vicary et al. 2017; Wolf et al. 2018). Although we chose not to investigate the neural bases of such phenomena at this stage of our research, we should nonetheless note that the evidence gathered by some studies directs scholars' attention to certain areas responsible for the computation of time in connection with movement and proprioception, in particular, the Supplementary Motor Area (see for instance Coull et al. 2016) and the insular lobe (Wittmann 2016).

These considerations take on particular relevance in the visual perception of moving images (see Gallese and Guerra forthcoming). In this case, in fact, we find the coexistence of at least three types of movement: (a) *Diegetic movements* of represented subjects and objects, and in particular actions or gestures performed by the characters; (b) *Discourse movements* linked to camera movements, image sliding rate (normal, fast, time-lapse, slow, freeze frame), editing pace, and variations in angle and distance/size between shots in editing; (c) *Bodily movements* enacted by the viewer, and particularly head/eye movements (fixations, saccades), startled responses, muscular movements, etc.

In conclusion, our decision to ground the analysis of SEEM_IT on empirical research entails two main theoretical consequences. On the one hand, the complexity of the subjective experience of time is reduced – at least temporarily – to the two variables of the qualitative judgment of speed and of the quantitative estimation of duration: other aspects (such as the perception of the order of events and their eventual iteration) are traced back to these two basic variables. On the other hand, the connection with empirical research drives SEEM_IT towards an embodied and inter-embodied foundation, and more generally towards a conception of moving image experience as based on embodied simulation.

16.3 An Experiment on SEEM_IT: Premises and Method

Our pilot experiment on SEEM_IT was conducted in collaboration with a professional film crew and a team of psychologists from the Università Cattolica del Sacro Cuore in Milan. The experiment aimed at understanding the interactions between Action types and editing styles in ten short video clips specially designed for the purpose of this research. The spectator's temporal experience was measured both in qualitative terms (time passage judgment and action speed judgment) and in quantitative terms (estimation of duration). The actions were differentiated in terms of intentionality/goal-orientation and in terms of linearity/absence of internal iteration of sub-actions. As for the Editing styles, in this pilot experiment we voluntarily avoided any kind of manipulation of time (e.g. ellipses, slow or accelerated motion, alteration in the order or repetition of sub-actions). Consequently, in all videos, the editing affected only the spatial dimension (angle and size) and the pace of shot changes.

16.3.1 Stimuli Construction

16.3.1.1 Editing Style

A professional film crew shot three different routine actions in a professional studio with two sets of seven cameras and using nine different shot sizes and angles. For each action, we edited the videos using three different styles: (A) master shot (no editing); (B) slow-paced editing; (C) fast-paced editing. In the editing process, we were careful to maintain an identical duration for the three videos representing the same action: in other terms, although differently edited, the three videos of the same action have the same duration.

In the master shot version (A), the entire action was shown from a frontal perspective, medium shot, without any cut interrupting it. Version (B) was edited according to *match-on-action* cuts (5 shots from different angles and distances, including establishing shots): this style implies a high possibility of "edit blindness", (Smith and Henderson 2008) typical of *continuity editing*, which in turn is functional to a clear and "economical" narrative understanding of the represented action (Cutting 2005; Cutting and Candan 2013; Magliano and Zacks 2011). Version (C) presented a higher number of cuts (11–13) and more angle/distance changes (7~), including point-of-view shots, *plongées*, close-ups, and cut-in shots; this style was intended to emulate *intensified continuity editing* (Bordwell 2006; see also Cutting and Candan 2015) by increasing the number and varying the angle of shots while avoiding clear violations of continuity rules.

16.3.1.2 Action Types

The potential effect of Editing style on SEEM_IT was tested across three types of routine actions, performed by a trained actor in front of cameras: (1) pouring some water into a glass and drinking it ("Drinking water"); (2) cutting a half-loaf of bread into two parts with a knife ("Cutting bread"); (3) repeatedly moving a glass and a loaf of bread on a table ("Moving objects"). In addition, the actor was asked to perform the action "Moving hands" (i.e., gently moving his hands upwards on the table in a circular motion; Action 0): this action was presented only in the (A) master shot (no editing) version at the beginning of the experiment as a control stimulus aimed at preventing a possible "novelty effect".

Actions (1), (2), and (3) differ in terms of intentionality/goal-orientation and in terms of linearity/non-iteration of sub-actions. More precisely, "Drinking water" (1) is an action clearly oriented both by local goals (sub-actions including grasping, lifting, tilting, putting down a bottle, grasping, lifting, holding a glass and bringing it to mouth, drinking, putting down the glass) and by a global agent's intention. Moreover, it is a completely linear action, without any element of iteration or repetition. "Cutting bread" (2) is an action with a clear intention, including evident goal-directed motor acts as subcomponents: grasping a bread knife, holding a loaf, cutting the loaf in two pieces, and placing them on a dish. Moreover, it implies the iteration of one of the sub-actions (the gesture of cutting the loaf is clearly repeated two times as the knife sinks in it). Finally, "Moving objects" (3) includes clear goal-directed motor components such as grasping, holding, and putting down different objects. The global intention, however, is not defined, and no final goal can be identified. Moreover, it presents a high degree of iteration, since the object displacement (two objects being moved two times each) can appear to be a slightly varied repetition of the same gesture.

As we said, the groups of three videos representing the same action had the same duration; moreover, all the clips had similar durations: 12" for "Moving Hands", 13.5" for "Drinking Water", 11" for "Cutting bread" and 11.8 for "Moving Objects".

A summary of the combination of Action types and Editing styles is shown in the following table:

Action types	Editing styles		
	A Master shot	B Slow-paced	C Fast-paced
0. Moving hands [control clip]	0A	–	–
1. Drinking water (*goal-directed, linear*)	1A	1B	1C
2. Cutting bread (*goal-directed, iterative*)	2A	2B	2C
3. Moving objects (*undefined goal, iterative*)	3A	3B	3C

16.3.2 Procedure and Measures

16.3.2.1 Participants and Tasks

The sample consisted of 76 undergraduate students, with normal visual acuity and unaware of the specific purposes of the study. The participants' mean age was 20.72 (DS = 3.26). Each participant watched all nine video clips, which were administered in randomised order. The additional control video clip 0A was presented at the beginning of the experimental session in order to control for a potential "novelty effect". Eye-movements were recorded while participants watched the video clips using a Tobii X120 eye-tracker, but these data are not reported in this article.

In order to prevent the participants from counting seconds in their minds, we invited them to provide a short oral description of the content immediately after watching each clip ("*Now please tell me what happened in this video clip*"). Then, participants were asked to report their Emotional involvement rating three adjectives on a 7-point Likert scale (i.e., boring, interesting, engaging; $\alpha = .82$); to express a Time passage judgement (on a 9-point Likert scale from "*time dragged*" to "*time flew*"), an Action speed judgement (from "*very slow*" to "*very fast*"), and finally to estimate the Duration of the clip in seconds (by indicating a numerical value between 1 and 30 s). Notably, following current literature (e.g. Droit-Volet and Wearden 2016; Droit-Volet et al. 2017; Wearden 2015; Wearden et al. 2014), we decided to keep the qualitative (judgement) and quantitative (estimation) aspects of time perception as separate variables, both in data collection and analysis.

At the end of each session, participants were required to complete two tasks assessing their individual estimation ability in order to control for individual differences in the ability to perform cognitive estimates.

16.3.2.2 Analysis

Repeated measures ANOVAs with Bonferroni pairwise comparisons (Editing style x Action type) were used for data analysis. For accuracy of duration estimates, Individual Time Estimation Ability was included as a covariate.

In addition, a repeated measures ANOVA was used to compare accuracy of duration estimates when including the 0A control video clip (master shot only).

16.4 An Experiment on SEEM_IT: Results

Overall, the results highlighted the prominent role of fast-paced editing (C) in affecting spectators' experience, since this Editing style showed an effect on each of the variables under observation. Specifically, in comparison with slow-paced editing (B) and no-editing (A), it was rated as more emotionally involving, and generated higher ratings of "time flying" and of action speed. Moreover, fast-paced editing led to significantly higher overestimations of durations (in particular compared to no-editing master shot A).

16.4.1 Emotional Involvement

Concerning emotional involvement, the analysis yielded a significant main effect of Editing style, $F(2150) = 13.02$, $p < .001$, $\eta 2 = .15$. The interaction between Editing style and Action type was also significant, $F(4300) = 2.53$, $p = .040$, $\eta 2 = .03$, while the main effect of Action type was not, $F(2150) = 2.75$, $p = .077$. Pairwise comparisons showed that the fast-paced editing was rated as more emotionally involving than the master shot ($p < .000$) and the slow-paced editing ($p < .01$), while no difference emerged between the slow-paced and the master shot editing. Significant pairwise comparisons are shown in Fig. 16.1.

16.4.2 Action Speed and Time Passage

Concerning Action speed, the analysis yielded a significant main effect of Editing style, $F(2150) = 15.73$, $p < .001$, $\eta 2 = .17$. The interaction between Editing style and Action type was also significant, $F(4300) = 4.02$, $p < .01$, $\eta 2 = .05$, while the main effect of Action type was not, $F(2150) = 1.25$, $p = .287$. Pairwise comparisons showed that the action was rated as faster when fast-paced editing was used compared to master shot ($p < .000$) and slow-paced editing ($p < .01$), while no difference emerged between slow-paced and master shot editing. When univariate ANOVAs were used to analyse the interaction effect, however, the results showed that Editing style had a significant effect (i.e., action was judged as faster) for "Drinking water", $F(2150) = 17.49$, $p < .001$, $\eta 2 = .19$, and "Cutting bread", $F(2150) = 6.35$, $p < .01$, $\eta 2 = .08$, but not for "Moving objects", $F(2150) = 2.52$, $p = .09$. Significant pairwise comparisons are shown in Fig. 16.2.

Similar results were obtained when Time passage was considered. The analysis yielded a significant main effect of Editing style, $F(2150) = 7.74$, $p < .01$, $\eta 2 = .09$. The interaction between Editing style and Action type was also significant, $F(4300)$

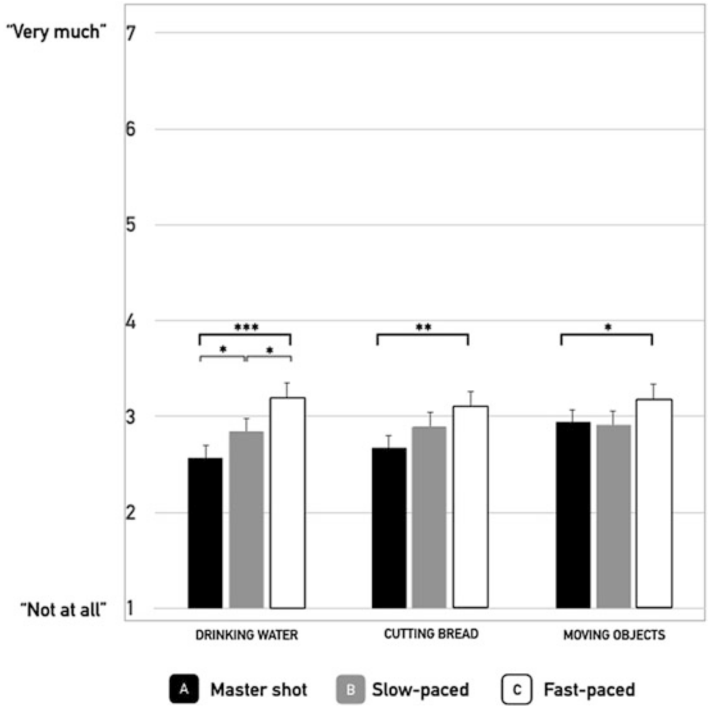


Fig. 16.1 Emotional involvement. *** p <.001; ** p <.01; * p <.05. Error bars represent standard error of the mean

= 3.39, $p < .05$, $\eta 2 = .04$, while the main effect of Action type was not, $F(2150) = .73$, $p = .486$. Pairwise comparisons showed that time was judged as "flying" rather than "dragging" when fast-paced editing was used compared to master shot ($p < .01$) and slow-paced editing ($p < .01$), while no difference emerged between slow-paced and master shot (no editing condition). When univariate ANOVAs were used to analyse the interaction effect, however, the results showed that Editing style had a significant effect (i.e., time flew) for "Drinking water", $F(2150) = 7.83$, $p < .01$, $\eta 2 = .10$, and "Cutting bread", $F(2150) = 6.69$, $p < .01$, $\eta 2 = .07$, but not for "Moving objects", $F(2150) = .93$, $p = .396$. Significant pairwise comparisons are shown in Fig. 16.3.

Overall, we can observe that time judgments depend not only on the Editing style, but also on the Action type. The fast-paced editing (C) influenced subjective time judgements when considering action 1 ("Drinking water"). When participants watched this action, their judgements about both Time passage and Action speed mirrored the stepwise distribution of the editing conditions (A), (B) and (C), with (C) inducing the sensation of the highest rate of both time flow and action.

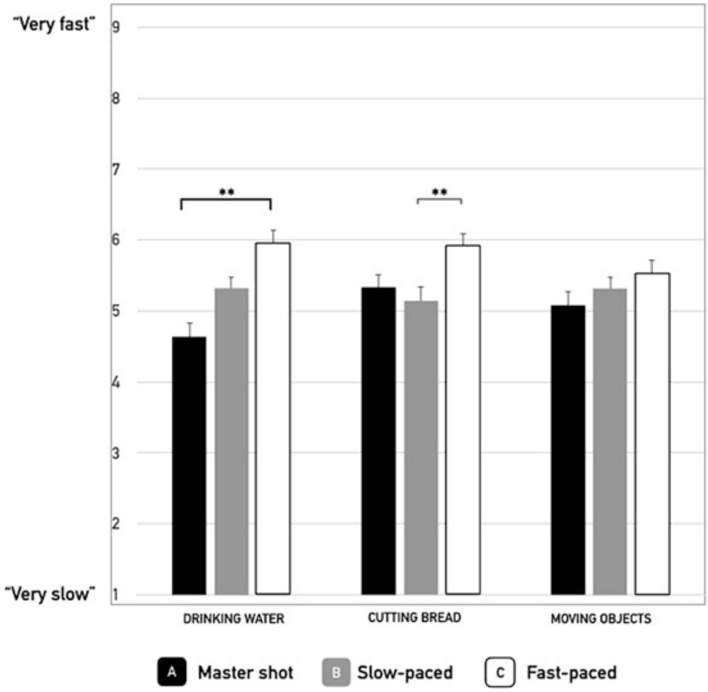


Fig. 16.2 Action speed. *** p <.001; ** p <.01; * p <.05. Error bars represent standard error of the mean

By contrast, in the case of "Cutting bread," the slow-paced editing did not produce a judgment of greater or faster Time passage with respect to the master shot (even though fast-paced editing C still triggered a judgement of higher speed), thus breaking the ascending order of the effects of the three editing conditions. Finally, when considering the action "Moving objects," neither the slow-paced nor the fast-paced editing affected Time passage or Action speed judgements significantly.

16.4.3 Duration Estimation

Concerning accuracy of Duration estimates, we first compared the participants' estimates of the duration of the control video clip (0A) to the duration estimates of the other Action types (Master shot only). The analysis yielded a significant effect, $F(3222) = 22.15, p < .001, \eta 2 = .23$. Pairwise comparisons showed that "Drinking

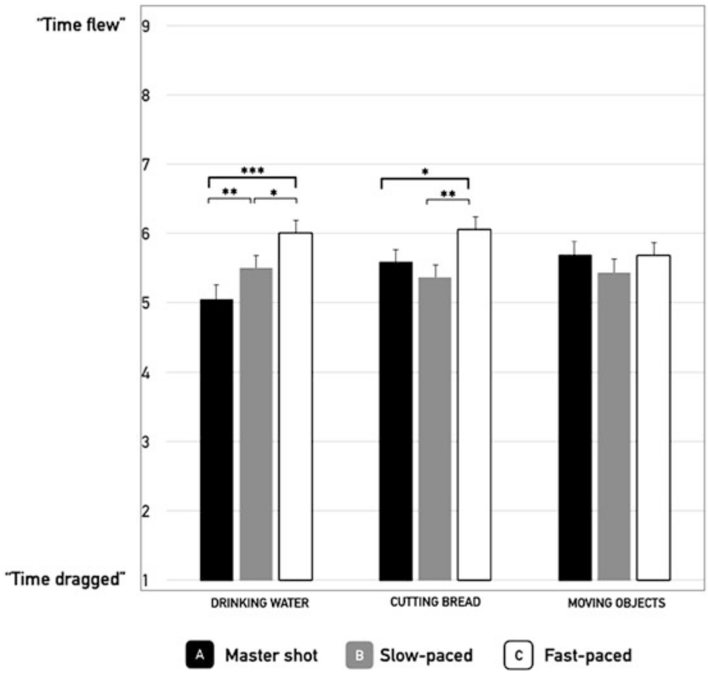


Fig. 16.3 Time passage. *** p <.001; ** p <.01; * p <.05. Error bars represent standard error of the mean

water" generated more accurate estimates than all the other Action types, followed by "Cutting bread", "Moving objects", and finally by the control action (0A).

We then conducted a 3 (Editing style) × 3 (Action types) repeated measures ANOVA. The analysis yielded a significant main effect of Editing style, $F(2150) = 5.13$, $p < .01$, $\eta 2 = .06$, and of Action type, $F(2150) = 32.23$, $p < .001$, $\eta 2 = .30$, while the interaction between Editing style and Action type was nonsignificant, $F(4300) = .83$, $p = .506$. Individual estimation ability (included as covariate) was also significant, $F(174) = 4.18$, $p < .05$, $\eta 2 = .05$. Bonferroni adjusted pairwise comparisons showed that duration was overestimated when fast-paced editing was used compared to the master shot ($p < .01$); moreover, "Drinking water" generated more accurate estimates than the two other Action types, with "Moving objects" producing the highest rate of overestimation. Significant pairwise comparisons are shown in Fig. 16.4.

In sum, when considering the results of the Duration estimation task, we found a significant effect of both Editing style and Action type. Although the duration of the videos was generally overestimated and the fast-paced condition (C) triggered on average the greatest overestimation, variations in the duration estimates were primarily determined by the Action type. More precisely, the duration of "Moving objects" was overestimated to a greater degree than that of "Cutting bread," and the

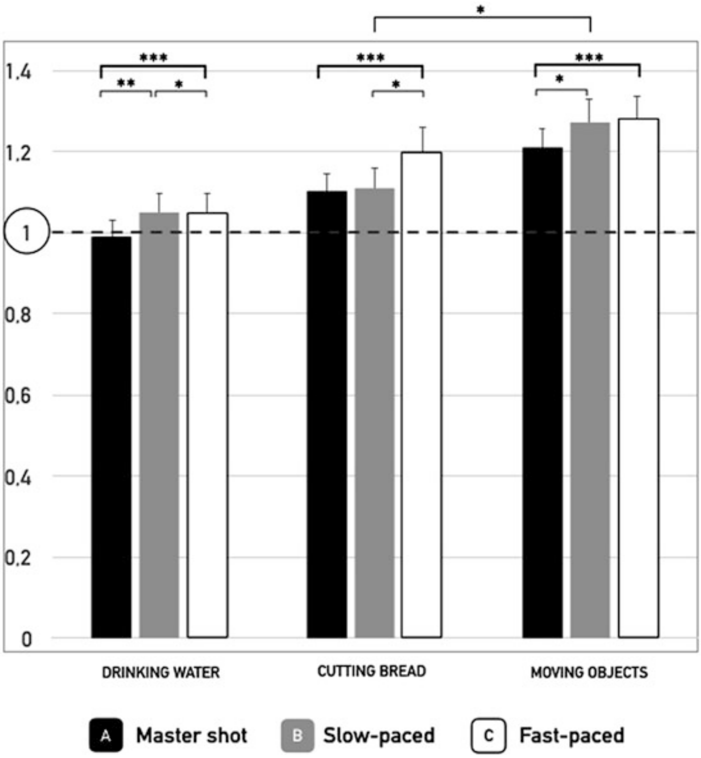


Fig. 16.4 Duration estimation accuracy. *** p <.001; ** p <.01; * p <.05. Error bars represent standard error of the mean

duration of the latter was overestimated to a greater degree than "Drinking water." As a consequence, the greatest degree of overestimation occured when combining "Moving objects" with fast-paced editing. These conclusions are confirmed by a comparison between the estimates of the master shots only (excluding any kind of editing) and the control video: the estimation of "Drinking water" was closer to the actual duration, while we found growing overestimations for "Cutting bread" and "Moving objects". These findings suggest that, when considering participants' Duration estimates, the effect of the Action type represented in the video clip overcame and evened out the effects of the Editing Style. At the same time, the fact that the greatest Duration evaluation was found when "Moving objects" was arranged according to the fast-paced editing seems to imply that the two variables may synergistically interact.

A final remark concerns the relationship between qualitative judgements (i.e., action speed and time passage) and Duration estimates. To examine this issue, we computed two-way correlations between participants' ratings and Duration estimates. Overall, no significant associations emerged (mean $r = -.08$, $p > .05$), with the exception of significant negative correlations between Duration estimates and Time passage (mean $r = -.26$, $p < .05$), as well as between Duration estimates and Action speed (mean $r = -.32$, $p < .01$) when fast-paced editing was used. Thus, for fast-paced edited videos, lower estimates of duration were associated with higher judgements of speed and time flowing quickly.

16.5 An Experiment On SEEM_IT: Discussion

16.5.1 The Role of Editing and the Body of the Film

In general, the findings clearly show that editing plays a role in determining the perception of time. In particular, fast-paced editing results in a judgement of acceleration of both the passage of time and the course of the action; moreover, it triggers an overestimation in the evaluations of durations. This first conclusion confirms the data in the literature regarding the influence of what we called "discourse movement" in the determination of temporal perception, in particular of durations (see Sect. 16.2.2) – on the condition, however, that we admit that *the editing introduces an additional kind of movement with respect to ordinary experience*.

Therefore, if we accept the hypothesis according to which the experience of viewing moving images consists in the extension within a technological apparatus of the ordinary experience of the embodied perception of time, we will have to admit that the embodied simulation of the movement in this case involves not only other subjects, but also a different kind of body, that is *the perceiving/expressing body of the film* (Sobchack 1992; Bellour 2009; Smith 2017). The movements of this body should be considered multiple yet connected (see our list in Sect. 16.2.2). In any case, the problem of a temporal relationship between the film viewer and the body of film still remains widely to be explored (for some attempts see Gallese and Guerra forthcoming).

16.5.2 Judgments and Estimations: Dancing with the Movies

However, we have also seen how editing interacts with the *type of represented action* in determining temporal perceptions. Regarding the Action speed judgments, slow and fast-paced Editing styles produce a clearly progressive acceleration only in the case of a linear and clearly goal-oriented action such as "Drinking water." On the contrary, the effect of editing becomes less certain in cases of a less clearly linear and goal-oriented action such as "Cutting bread," and ends up fading in cases of a repetitive and non-goal-oriented action such as "Moving objects." As for the estimation of durations, although the edited clips tend to produce a certain overestimation compared to the master shots, it is first and foremost the Action type that determines a substantial accuracy ("Drinking water"), a slight overestimation ("Cutting bread"), or a greater overestimation ("Moving objects"). These data confirm the results obtained by Manoudi (2015) (although the experimental conditions were slightly different from ours), according to which "the significant variability found in time estimation was due to the type of events presented in the stimuli (i.e., some events are by nature more dynamic than others) and the different proportion of static and dynamic shots in each scene" (30).

It is therefore necessary to ask why some Action types interact with Editing styles differently from others in determining temporal judgments and estimates. If we adopt the model of an embodied perception of time grounded in the observation of actions and movements of other subjects or objects in an embodied simulation mode, we can advance two hypotheses. The common premise of the two models is that *the body schemata of movement and action possess an intrinsic temporal dimension*, expressed both in terms of speed and duration, so that "the experience or the reactivation in memory of the dynamic of a previous action or event may ... influence a current time judgment" (Droit-Volet et al. 2013: 114). In other terms, body schemata represent typical forms of (procedural and temporalized) *body memory* (Koch et al. 2012).

The first model, which we will call DABS (Direct Application of Body Schemata), implies that body schemata that are well-defined in terms of linear ordering and clear goal-orientations of actions are also endowed with a "hard" temporality, which is recalled and superimposed upon the viewing moving images by the spectator. As a consequence, actions observed in moving images are exposed to regular acceleration according to the speed of editing; moreover, the "hard" temporality ensures in any case a realistic estimate of the durations. On the contrary, actions that are less linear and with less clear goal-orientations are endowed with a "soft" temporality: on the one hand, this "soft" time interacts with the Editing styles in such a way as to produce judgments of time and action speed that are in part independent from editing pace; on the other hand, it implies an overall overestimation of the durations.

The second model, which we will call CABS (Conjectural Application of Body Schemata), implies that the temporal determinations of the body schemata function as matrices for formulating hypotheses about movement and action timing: these hypotheses or expectancies are gradually tested during the spectator's online experiential processes (possibly together with other types of non-temporal determinations, such as spatial, narrative, etc.). In the case of a linear and clearly goal-oriented action, such as "Drinking water," the matrix foresees a (relatively) rigidly pre-established course of action, so that if the experiential data coming from the moving images regularly confirm such hypotheses, editing pace remains the only element determining a perception of higher speed. At the same time, this experiential process knows no contradiction of hypotheses and expectations, hence the absence of an overall overestimation of temporal durations. On the contrary, in the case of body schemata that are less or not at all linear and goal-oriented, the matrix of hypothesis is weaker, and therefore the activity consisting in advancing hypotheses, testing them, and reformulating them becomes more complex and intense. As a consequence, the influence of editing on the judgment of speed becomes more troubled, and the duration of the action as seen in the moving images tends to be overestimated.

The CABS model, implying a prevision or expectancy mechanism, would find some confirmations in the literature. First of all, it is consistent with the theoretical hypotheses and the more cautious experimental demonstrations by De Wied et al. (1992), despite the fact that these were advanced in a non-embodied theoretical context: according to the authors, time evaluation can be manipulated through the distortion of the spectator's temporal expectation systems, which in turn can be produced by film editing, mainly through ellipsis at the level of sub-actions. Second, the CABS model would resonate with more general theories that link temporal perception to the framework of the spectator's expectancies in relation to event coherence (e.g. the "expectancy/contrast model" by Jones and Boltz 1989, that De Wied et al. 1992 applied to film experience), duration (Boltz 1993), order (the "Memento effect" studied by Liverence and Scholl 2012; Meyerhoff et al. 2015), or even to action tasks (Boltz 1998). Third, and more specifically, a model implying a forecasting and adaptive component can link the experience of viewing moving images to the well-studied field of (embodied) joint and coordinate action and perception, such as that enacted by couples of dancers or piano players (see Sect. 16.2.2): in activities requiring sensorimotor coordination of two or more subjects, each of them hypothesizes a temporal development of the other's movements based on embodied simulations, checks their actual development, and adapts his or her movements to the shared action in progress, possibly reassessing his or her matrices of temporal expectancies. If applied to our object of study, these models seem to disclose the hypothesis that *the viewing of moving images does not entail simply "watching" a film, but rather consists in "playing" and "dancing" with it*.

The suggestion of this hypothesis does not in any case resolve many open questions: what exactly are the temporal qualities of a body schemata and how are they coded? How do non-transitive or reflexive actions behave in this regard? Is there a relationship between the hypothetical activity of the spectator and the segmentation of the action into sub-actions (according to the Event Segmentation Theory approach)? If so, does editing cause differences in the hypothesis process? Are both of the models presented here coexistent and working in synergy, or is the first one better suited to data related to speed judgment and the second to duration evaluations?

16.5.3 Limitations

Although the results of the current study are promising, several limitations bear noting. An important limitation concerns the operationalization of the independent variables. In defining the different Editing styles, number of cuts and shot angle were not manipulated independently, and for this reason it is not possible to disentangle their differential effects on the dependent variables. That is, the significant differences we found between the Editing styles may be due to either the number of cuts, the shot angle, or a combination of the two. Likewise, concerning Action types, the characteristics of goal orientation and linearity were not varied independently. This methodological limitation was mainly due to the explorative nature of this initial study, since a completely crossed design would have required a higher number of conditions, and would be better addressed in a set of multiple experiments. Future work could address these issues, examining the differential impact of shot angle/number of cuts, as well as of action properties on individuals' time perception. Third, the order of the self-report questions regarding subjective time judgements and duration estimate was not counterbalanced. Although we did not find significant correlations among these variables across all the videos, the negative correlations we found between duration estimates and time judgments when watching fast-paced videos may be due to the presentation order (i.e., participants estimated duration *after* judging Time passage and Action speed).

16.6 Concluding Remarks

In Sect. 16.2, we stressed that the pilot experiment illustrated in the central sections of this article is part of a broader framework of research on SEEM_IT: as we said, SEEM_IT represents a strategic object, since on the one hand it is connected to the semiotic forms and processes of the moving image, and on the other refers to the social forms and processes of the collective perception of time.

Regarding the first aspect, our experiment has highlighted a strong link between forms of editing in moving images, the narrative articulation of the represented action, and the temporal experience of the viewer. Even if further analysis and verification are necessary, it seems that the considerations advanced go in the direction of an embodied semiotics and pragmatics of the film text, and open the possibility of methodologically-updated close readings. Even if the experimental procedure focussed on the two dimensions of Speed of time/action passage and Duration evaluation in the subjective experience of time, it is possible to extend the analysis to other dimensions – for example by adopting micro-phenomenological methods (Petitmengin 2006).

The second aspect did not emerge directly in this experiment; more generally, the issue of the relationship between the specificity of temporal experience established and driven by the viewing of moving images, and the specificity of modern and contemporary forms of the experience of time remains open. One can ask for example how much and through which processes the massive diffusion of moving images has conditioned the modern and contemporary perception of social time as accelerated, compressed, dilated etc., noted by many observers (see Sect. 16.2.1). Although such work largely remains to be done, we can nevertheless observe that the embodied approach offers an interesting starting point: indeed, the embodied perception of time is a *relational* and *intersubjective* phenomenon, as it implies a deep relationship with the time lived and expressed by other bodies, even in the absence of pre-established common goals (Laroche et al. 2014; Gallotti et al. 2017; Schirmer et al. 2016). In the case of the moving image experience, bodies tend to multiply: here we find the represented ones, the body of the film, those of the viewers, and those of other spectators. The experience of viewing moving images is therefore in itself a *multibody* one, and it implies not just the *investment* of body schemata, but also (especially in the CABS hypothesis) their *manipulation* and *alteration* (Fingerhut and Heimann 2017), which would correspond, in turn, to a more or less deep and stable modification of the shared time experience.

Acknowledgements The research presented in this report took place within a PRIN (Research Project of National Interest) titled *Perception, Performativity and Cognitive Sciences* and funded by the Italian Government (2015, Grant number: 2015TM24JS - SH4; P.I. Antonio Pennisi, Università degli studi di Messina). The unit working team included Ruggero Eugeni (Università Cattolica del Sacro Cuore, Milan, *coordinator*), Riccardo Manzotti (IULM – International University of Languages and Media, Milan), Adriano D'Aloia (Università degli Studi della Campania "Luigi Vanvitelli"), Federica Cavaletti (Università Cattolica del Sacro Cuore), and Massimo Locatelli (Università Cattolica del Sacro Cuore). We conducted the experiment in collaboration with Maria Rita Ciceri's team, composed by Stefania Balzarotti and Elisa Cardani (Università Cattolica del Sacro Cuore, Milan). We thank Pia Tikka, Tim Smith, Patricia Pisters, Vinzenz Hediger, Maria Poulaki, Julian Hanich, Joerg Fingerhut, Francesco Sticchi, Alessandro Antonietti, Vittorio Gallese, Pietro Montani, Ninni Pennisi, and all the colleagues of the PRIN project for their useful suggestions. A special thanks to Ed Tan and Katrin Heimann for their careful reading of the paper and their comments and encouragements.

References

Adam, B. (2004). *Time: Key concepts*. Cambridge/Malden: Polity Press.

Aglioti, S.A., Cesari, P., Romani, M., & Urgesi, C. (2008). Action anticipation and motor resonance in elite basketball players. *Natural Neurosciences, 11*(9), 1109–1116.

Altshuler, R., & Sigrist, M.-J. (Eds.). (2016). *Time and the philosophy of action*. London/New York: Routledge.

Ames, M. (Ed.). (2012). *Time in television narrative. Exploring temporality in twenty-first-century programming*. Jackson: University Press of Mississippi.

Arstila, V., & Lloyd, D. (Eds.). (2014). *Subjective time. The philosophy, psychology, and neuroscience of temporality* Cambridge, MA/London: The MIT Press.

Bellour, R. (2009). *Le corps du cinéma. Hypnoses, émotions, animalités*. Paris: POL Traffic.

Benini, A. (2017). *Neurobiologia del tempo*. Milano: Cortina.

Berliner, T., & Cohen, D.J. (2011). The illusion of continuity: Active perception and the classical editing system. *Journal of Film and Video, 63*, 44–63.

Bettetini, G. (1979). *Tempo del senso. La logica temporale dei testi audiovisivi*. Milano: Bompiani.

Block, R., & Grondin, S. (2014). Timing and time perception: A selective review and commentary on recent reviews. *Frontiers in Psychology, 5*, 648.

Boltz, M.G. (1993). Time estimation and expectancies. *Memory and Cognition, 21*, 853–863.

Boltz, M.G. (1998). Task predictability and remembered duration. *Perception & Psychophysics, 60*, 768–784.

Bordwell, D. (2006). *The way Hollywood tells it*. Berkeley/Los Angeles: University of California Press.

Brown, S.W. (1995). Time, change, and motion: The effects of stimulus movement on temporal perception. *Perception & Psychophysics, 57*(I), 105–116.

Buonomano, D. (2017). *Your brain is a time machine. The neuroscience and physics of time*. New York: Norton.

Burdick, A. (2017). *Why time flies. A mostly scientific investigation*. New York/London: Simon & Schuster.

Burges, J., & Elias, A.J. (Eds.). (2016). *Time. A vocabulary of the present*. New York: New York University Press.

Carruthers, L. (2016). *Doing time. Temporality, hermeneutics, and contemporary cinema*. New York: State University of New York Press.

Chatman, S. (1978). *Story and discourse: Narrative structure in fiction and film*. Ithaca: Cornell University Press.

Cohen, S.S., Henin, S., & Parra, L.C. (2017). Engaging narratives evoke similar neural activity and lead to similar time perception. *Scientific Reports, 7*(4578), 1–10.

Colling, J.L., Thompson, W.F., & Sutton, J. (2014). The effect of movement kinematics on predicting the timing of observed actions. *Experimental Brain Research, 232*, 1193–1206.

Coull, J.T., Vidal, F., Burle, B. (2016). When to act, or not to act: that's the SMA's question. In W.H Meck, R.B. Ivry (Eds.), (pp. 14–21).

Crow, G., & Heath, S. (Eds.). (2002). *Social conceptions of time. Structure and process in work and everyday life*. Houndmills/New York: Palgrave Macmillan.

Currie, G. (1995). *Image and mind: Film, philosophy, and cognitive science*. Cambridge: Cambridge University Press.

Currie, G. (2004). Can there be a literary philosophy of time? In G. Currie (Ed.), *Arts and Minds* (pp. 84–104). Oxford: Oxford University Press.

Cutting, J.E. (2005). Perceiving scenes in film and in the world. In J.D. Anderson & B.F. Anderson (Eds.), *Moving image theory: Ecological considerations* (pp. 9–27). Carbondale: University of Southern Illinois Press.

Cutting, J.E., & Candan, A. (2013). Movies, evolution, and mind: From fragmentation to continuity. *The Evolutionary Review, 4*(3), 25–35.

Cutting, J.E., & Candan, A. (2015). Shot durations, shot classes, and the increased pace of popular movies. *Projections, 9*(2), 40–62.

D'Aloia, A., & Eugeni, R. (Eds.). (2014). *Neurofilmology. Audiovisual studies and the challenge of neurosciences*. [special issue] *Cinéma et Cie. International Film Studies Journal*, *XIV*, 22–23.

D'Ydewalle, G., & Vanderbeeken, M. (1990). Perceptual and cognitive processing of editing rules in film. In R. Groner, G. d'Ydewalle, & R. Parham (Eds.), *From eye to mind: Information acquisition in perception, search, and reading* (pp. 129–139). Amsterdam: Elsevier Science Publishers.

D'Ydewalle, G., Desmet, G., & Van Rensbergen, J. (1998). Film perception: The processing of film cuts. In G. Underwood (Ed.), *Eye guidance in reading and scene perception* (pp. 357–367). Oxford: Elsevier.

Damasio, A. (2002). Remembering when. *Scientific American, 287*(3. [Special issue] *A Matter of Time*), 66–73.

De Wied, M. (1994). The role of temporal expectancies in the production of film suspense. *Poetics, 23*, 107–123.

De Wied, M., Tan, E. S. H., Frijda N. H. (1992). Duration experience under conditions of suspense in films. In F. Macar, V. Pouthas, & W.J. Friedman (Eds.), *Time, Action and Cognition. Towards bridging the gap* (pp. 325–336). Dordrecht: Kluwer Academic Publishers.

Deleuze, G. (1986). *Cinema 1: The movement-image*. London: Athlone.

Deleuze, G. (1989). *Cinema 2: The time-image*. Minneapolis: University of Minnesota Press.

Doane, M.A. (2002). *The emergence of cinematic time*. Cambridge, MA: Harvard University Press.

Drayton, L., & Furman, M. (Eds.). (2018). Time in the brain, Special issues of *Trends in Cognitive Sciences, 22*(10), 84–952; and *Trends in Neurosciences*, 41(10), 641–762.

Droit-Volet, S. (2014). What emotions tell us about time.

Droit-Volet, S., & Wearden, J. (2016). Passage of time judgements are not time judgements: Evidence from a study using experience sampling methodology. *Frontiers in Psychology, 7*, 176.

Droit-Volet, S., Fayolle, S., Lamotte, M., & Gil, S. (2013). Time, emotion and the embodiment of timing. *Timing and Time Perception, 1*, 99–126.
Droit-Volet, S., Trahanias, P., & Maniadakis, M. (2017). Passage of time judgments in everyday life are not related to duration judgments except for long durations of several minutes. *Acta Psychologica, 173*, 116–121.
Ethis, E. (2006). *Les spectateurs du temps. Pour une sociologie de la réception du cinema*. Paris: L'Harmattan.
Fayolle, S., Droit-Volet, S., & Gil, S. (2014). Emotion and time perception: Effects of film-induced mood. In A. Vatakis (Ed.), *International conference on timing and time perception, 31 March – 3 April 2014*, *Corfu, Greece*, special issue of *Procedia – Social and Behavioral Sciences* (Vol. 126, pp. 251–252).
Ferrari, P.F., & Rizzolatti, G. (Eds.). (2015). *New frontiers in mirror neurons research*. Oxford/New York: Oxford University Press.
Fingerhut, J., & Heimann, K. (2017). Movies and the mind: On our filmic body. In C. Durt, T. Fuchs, & C. Tewes (Eds.), *Embodiment, Enaction, and culture. Investigating the constitution of the shared world* (pp. 353–377). Cambridge, MA/London: The MIT Press.
Flaherty, M.G. (2011). *The textures of time. Agency and temporal experience*. Philadelphia: Temple University Press.
Fraisse, P. (1964). *The psychology of time*. New York: Harper & Row.
Gallagher, S. (2011). *Time in action*. In C. Callender (Ed.), (pp. 493–515).
Gallese, V. (2005). Embodied simulation: From neurons to phenomenal experience. *Phenomenology and the Cognitive Sciences, 4*, 23–48.
Gallese, V., & Guerra, M. (forthcoming). *The empathic screen. Cinema and neuroscience*. Oxford/New York: Oxford University Press.
Gallotti, M., Fairhurst, M.T., & Frith, C.D. (2017). Alignment in social interactions. *Consciousness and Cognition, 48*, 253–261.
Genette, G. (1972). *Figures III*. Paris: Seuil.
Germeys, F., & D'Ydewalle, G. (2007). The psychology of film: Perceiving beyond the cut. *Psychological Research, 71*, 458–466.
Guyau, J.-M. (1890). *La genèse de l'idée de temps*. Paris: Alcan.
Hammond, C. (2012). *Time warped: Unlocking the mysteries of time perception*. Toronto: Anansi Press.
Jones, M.R., & Boltz, M. (1989). Dynamic attending and responses to time. *Psychological Review, 96*, 459–491.
Keightley, E. (Ed.). (2012). *Time, media and modernity*. Houndmills/New York: Palgrave MacMillan.
Klein, S. (2007). *The secret pulse of time. Making sense of life's scarcest commodity*. Cambridge, MA: Da Capo Press.
Koch, S. C., Fuchs, T., Summa, M., & Müller, C. (2012). *Body memory, metaphor, and movement*. Amsterdam/Philadelphia: John Benjamins Publishing Company.
Laroche, J., Berardi, A.M., & Brangier, E. (2014). Embodiment of intersubjective time: Relational dynamics as attractors in the temporal coordination of interpersonal behaviors and experiences. *Frontiers in Psychology, 5*, 1880.
Liverence, B. M., & Scholl, B. J. (2012). Discrete events as units of perceived time. *Journal of Experimental Psychology: Human Perception and Performance, 38*, 549–554.
Loftus, E.F., Schooler, J.W., Boone, S.M., & Kline, D. (1987). Time went by so slowly: Overestimation of event duration by males and females. *Applied Cognitive Psychology, 1*, 3–13.
Magliano, J.P., & Zacks, J.M. (2011). The impact of continuity editing in narrative film on event segmentation. *Cognitive Science, 8*, 1489–1517.
Manoudi, E. (2015). *Investigation of the effects of editing techniques for time manipulation and continuity editing rules in time estimation*. Master Thesis, National and Kapodistrian University of Athens.

Matthews, W.J., & Meck, W.H. (2014). Time perception: The bad news and the good. *WIREs Cogn Sci, 5*, 429–446.

McGowan, T. (2011). *Out of time: Desire in atemporal cinema*. Minneapolis: University of Minnesota Press.

Meck, W.H., & Ivry, R.B. (Eds.). (2016). *Time in perception and action*. [special issue]. *Current Opinion in Behavioral Sciences, 8*, 1–290.

Merchant, H., & De la Fuente, V. (Eds.). (2014). *Neurobiology of interval timing*. New York: Springer.

Merchant, H., Harrington, D.L., & Meck, W.H. (2013). Neural basis of the perception and estimation of time. *Annual Review of Neurosciences, 36*, 313–336.

Meyerhoff, H.F., Vanes, L.D., & Huff, M. (2015). Spatiotemporal predictability alters perceived duration of visual events: Memento effect revisited. *Journal of Experimental Psychology: Human Perception and Performance, 41*(3), 613–622.

Mittel, J. (2015). *Complex TV. The poetics of contemporary television storytelling*. New York/London: New York University Press.

Mölder, B., Arstila, V., & Øhrstrøm, P. (Eds.). (2016). *Philosophy and psychology of time*. Heidelberg/New York: Springer.

Mroz, M. (2012). *Temporality and film analysis*. Edinburgh: Edinburgh University Press.

Mulvey, L. (2006). *Death 24x a second: Stillness and the moving image*. London: Reaktion Books.

Nather, F.C., & Oliveira Bueno, J.L. (2012). Timing perception in paintings and sculptures of Edgar Degas. *KronoScope, 12*(1), 16–30.

Nather, F.C., Oliveira Bueno, J.L., Bigand, E., & Droit-Volet, S. (2011). Time changes with the embodiment of another's body posture. *PLoS One, 6*(5), e19818.

Nather, F.C., Alarcon, P., Fernandes, M., & Oliveira Bueno, J.L. (2014). Subjective time perception is affected by different durations of exposure to abstract paintings that represent human movement. *Psychology & Neuroscience, 7*(3), 381–392.

Petitmengin, C. (2006). Describing one's subjective experience in the second person: An interview method for the science of consciousness. *Phenomenology and the Cognitive Sciences, 5*, 229–269.

Phillips, I. (Ed.). (2017). *The Routledge handbook of philosophy of temporal experience*. London/New York: Routledge.

Piaget, J. (1969). *The child's conception of time*. London/New York: Routledge.

Poulaki, M. (2015). Brain science and film theory. Reassessing the place of cognitive discontinuity in cinema. *Projections, 9*(1), 23–42.

Powell, H. (2012). *Stop the clocks! Time and narrative in cinema*. London/New York: Tauris.

Radvansky, G.A., & Zacks, J.M. (2014). *Event Cognition*. Oxford/New York: Oxford University Press.

Ricoeur, P. (1984–1988). *Time and narrative* (Voll. 1–3 (1983–1985)). Chicago/London: The University of Chicago Press.

Rizzolatti, G., & Sinigaglia, C. (2007). *Mirrors in the brain. How our minds share actions and emotions. Oxford*. New York: Oxford University Press.

Rizzolatti, G., & Sinigaglia, C. (2016). The mirror mechanism: A basic principle of brain function. *Nature Reviews Neuroscience, 17*(12), 757–765.

Roenneberg, T. (2012). *Internal time. Chronotypes, social jet lag, and why you're so tired*. Cambridge, MA/London: Harvard University Press.

Schirmer, A., Meck, W.H., & Penney, T.B. (2016). The socio-temporal brain: Connecting people in time. *Trends in Cognitive Sciences, 20*(10), 760–772.

Sebanz, N., & Knoblich, G. (2009). Prediction in joint action: What, when, and where. *Topics in Cognitive Science, 1*, 353–367.

Sebanz, N., Bekkering, H., & Knoblich, G. (2006). Joint action: Bodies and minds moving together. *Trends in Cognitive Sciences, 10*(2), 70–76.

Shipley, T.F., & Zacks, J.M. (Eds.). (2008). *Understanding events from perception to action*. Oxford/New York: Oxford University Press.

Smith, T.J. (2012). The attentional theory of cinematic continuity. *Projections, 6*(1), 1–27.

Smith, T.J. (2013). Watching you watch movies: Using eye tracking to inform cognitive film theory. In: Shimamura (Ed.), (pp. 165–191).

Smith, M. (2017). *Film, art and the third culture. A naturalized aesthetics of film*. Oxford/New York: Oxford University Press.

Smith, T.J., & Henderson, J.M. (2008). Edit blindness: The relationship between attention and global change blindness in dynamic scenes. *Journal of Eye Movement Research, 2*(2), 1–17.

Sobchack, V. (1992). *The address of the eye. A phenomenology of film experience*. Princeton: Princeton University Press.

Sobchack, V. (2004). The scene of the screen. Envisioning photographic, cinematic, and electronic 'presence'. In V. Sobchack (Ed.), *Carnal thoughts. Embodiment and moving image culture* (pp. 135–162). Berkeley/Los Angeles/London: University of California Press.

Stewart, G. (2007). *Framed time. Toward a postfilmic cinema*. Chicago: University of Chicago Press.

Terrone, E. (2017). On time in cinema. In I. Phillips (Ed.), *The Routledge handbook of philosophy of temporal experience* (pp. 326–338). London/New York: Routledge.

Tikka, P., Kaipainen, M. (2014). Phenomenological considerations on time consciousness under neurocinematic search light. In D'Aloia, Eugeni (Eds.), (pp. 127–139).

Tikka, P., & Kaipainen, M. (2015). Embodied protonarratives embedded in systems of contexts. A neurocinematic approach. In M.J. Grabowski (Ed.), *Neuroscience and media: New understandings and representations* (pp. 76–88). London/New York: Routledge.

Trifonova, T. (2007). Imaginary time in contemporary cinema. In T. Trifonova (Ed.), *The image in French philosophy* (pp. 261–306). Amsterdam/New York: Rodopi.

Vatakis, A. et al. (2014). Time to act: New perspectives on embodiment and timing. In A. Vatakis (Ed.), *International Conference on Timing and Time Perception, 31 March – 3 April 2014, Corfu, Greece* [special issue] *Procedia – Social and Behavioral Sciences* (Vol. 126, pp. 16–20).

Vatakis, A., Balcı, F., Di Luca, M., & Correa, Á. (Eds.). (2018). *Timing and time perception: Procedures, measures, and applications*. Leiden/Boston: Brill.

Vesper, C., & Van Der Wel, R.P. (2013). Are you ready to jump? Predictive mechanisms in interpersonal coordination. *Journal of Experimental Psychology: Human Perception and Performance, 39*(1), 48–61.

Vesper, C., Schmitz, L., Safra, L., Sebanz, N., & Knoblich, G. (2016). The role of shared visual information for joint action coordination. *Cognition, 153*, 118–123.

Vicary, S., Sperling, M., Von Zimmermann, J., Richardson, D.C., & Orgs, G. (2017). Joint action aesthetics. *PLoS One, 12*(7), e0180101.

Wang, L., & Jiang, Y. (2012). Life motion signals lengthen perceived temporal duration. *PNAS Proceedings of the National Academy of Sciences. USA, 109*, E673–E677.

Wearden, J.H. (2005). The wrong tree: Time perception and time experience in the elderly. In J. Duncan, L. Phillips, & P. McLeod (Eds.), *Measuring the mind: Speed, age, and control* (pp. 137–158). Oxford/New York: Oxford University Press.

Wearden, J.H. (2008). The perception of time: Basic research and some potential links to the study of language. *Language Learning, 58 (Suppl. 1)*, 149–171.

Wearden, J.H. (2015). Passage of time judgments. *Consciousness and Cognition, 38*, 165–171.

Wearden, J.H. (2016). *The psychology of time perception*. London: Palgrave Macmillan.

Wearden, J.H., O'Donoghue, A., Ogden, R., & Montgomery, C. (2014). Subjective duration in the laboratory and the world outside. In V. Arstila, D. Lloyd (Eds.), (pp. 294–310).

Wittmann, M., & van Wassenhove, V. (Eds.). (2009). *The experience of time: Neural mechanisms and the interplay of emotion, cognition and embodiment* [Special Issue]. *Philosophical Transactions of the Royal Society, Series B, 364*, 1525.

Wittmann, M. (2016). *Felt time. The psychology of how we perceive time*. Cambridge, MA/London: The MIT Press.

Wittmann, M., van Wassenhove, V., Craig, A.D., & Paulus, M.P. (2010). The neural substrates of subjective time dilatation. *Frontiers in Human Neuroscience, 4*, 1–9.

Wolf, T., Sebanz, N., & Knoblich, G. (2018). Joint action coordination in expert-novice pairs: Can experts predict novices' suboptimal timing? *Cognition, 178*, 103–108.
Zacks, J.M. (2015). *Flicker: Your brain on movies*. Oxford/New York: Oxford University Press.
Zacks, J.M., & Magliano, J.P. (2011). Film understanding and cognitive neuroscience. In F. Bacci & D.P. Melcher (Eds.), *Art and the senses* (pp. 435–454). Oxford: Oxford University Press.

Chapter 17
Neuromodulation and Neural Circuit Performativity: Adequacy Conditions for Their Computational Modelling

Roberto Prevete and Guglielmo Tamburrini

Abstract An understanding of the functional repertoire of neural circuits and their plasticity requires knowledge of neural connectivity diagrams and their dynamical evolution. However, one must additionally take into account the *fast* and *reversible* functional effects induced by neuromodulatory mechanisms which do not alter neural circuit diagrams. Neuromodulators contribute crucially to determine the *performativity* of a neural circuit, that is, its ability to change behavior, and especially behavioral changes occurring under temporal constraints that are incompatible with the longer time scales of Hebbian learning and other forms of neural learning. This paper focuses on two properties of neuromodulatory action that have been relatively neglected so far. These properties are the *functional soundness* of neuromodulated circuits and the *robustness* of neuromodulatory action. Both properties are analyzed here as sources of functional specifications for the computational modeling of neural circuit performativity. In particular, taking dynamical systems that are based on CTRNNs (Continuous Time Recurrent Neural Networks) as an exemplary class of computational models, it is argued that robustness is suitably modeled there by means of a hysteresis process, and functional soundness by means of a multiplicity of stable fixed points.

Keywords Computational neurosciences · Performativity of neural circuits · Neuromodulation · Computational models of neuromodulation · Robustness of neuromodulatory action

R. Prevete (✉) · G. Tamburrini
DIETI – Dipartimento di Ingegneria Elettrica e Tecnologie dell'Informazione, Università degli Studi di Napoli Federico II, Naples, Italy
e-mail: rprevete@unina.it; tamburrini@unina.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_17

17.1 Introduction

In addition to being determined by classical inter-neuronal connectivity, the dynamics of neural circuits is strongly influenced by *neuromodulators.* These substances are typically located in the extracellular fluid, alter the dynamics of neural circuits by selectively changing their structural parameters (such as synaptic strengths and maximum capacity of ion channels), but usually leave unaltered inter-neuronal connectivity diagrams. Moreover, by inducing rapid and usually more easily reversible changes in the structural and functional characteristics of neural circuits, neuromodulating mechanisms differ significantly from neural learning mechanisms. Growing biological evidence about the multiple effects of neuromodulatory action conclusively shows that a satisfactory understanding of the functional and structural dynamics of neural circuits cannot be achieved by exclusively focusing on neural connectivity diagrams and their changes (Bargmann 2012; Marder 2012).

Here, we explore the computational modeling of neuromodulatory action from the perspective of a neural circuit's *performativity*. By performativity of a neural circuit we mean the capability of a neural circuit to actually switch between behavioral patterns in its repertoire, producing timely responses to internal and external stimuli. In particular, neuromodulation plays a central role to determine behavioral changes occurring under temporal constraints that are incompatible with the longer time scales of Hebbian learning and other forms of neural learning. Understanding the performativity of neural circuits is interesting both from the perspective of neural population dynamics, and from the broader perspective of the behavioral performativity of biological systems that are endowed with a nervous system. Indeed, the mechanisms underlying the performativity of neural circuits provide the neural basis for the capability of those biological organisms to change their sensory-motor patterns under time pressure.

Biological data show that neuromodulation affects neural circuits in many different ways: (1) a given neuron can be modulated by different types of neuromodulators (Flamm and Harris-Warrick 1986; Hooper and Marder 1987; Swensen and Marder 2000). (2) The same type of neuromodulator may not have the same effect on all neurons; and the same neurons can be modulated differently by different neuromodulators. (3) There are extrinsic and intrinsic neuromodulators (Fellous and Linster 1998; Marder 2012): some neuromodulatory signals may come from an area outside the neuromodulated circuit (extrinsic neuromodulators); in other cases, neuromodulators are produced by neurons of the affected circuit (intrinsic neuromodulators). (4) Neuromodulation acts on a wide variety of time scales. In particular, the temporal properties of neuromodulation differ significantly from the temporal properties of neural learning processes: neuromodulators may induce comparatively more rapid changes in the structural and functional characteristics of neural circuits, and these effects are usually more rapidly reversible. (5) The dynamics of a neural circuit can be modified either by a neuromodulator acting on few elements of the circuit or by a neuromodulator more widely acting on many elements of the circuit (Marder et al. 2014). (6) The effect of a neuromodulator may depend on the initial activity of the neuromodulated circuit (Nusbaum and Marder 1989; Weimann et al. 1997; Williams et al. 2013).

In the light of these findings, it is evident that neuromodulators act in a variety of ways, originate from different structures and have varied spatial distribution and time scales of action. Neuromodulatory features 1-6 raise many open modeling problems (Marder 2012; Marder et al. 2014). Here, we will selectively focus on some of these problems, examining in particular the *functional soundness* of neuromodulation circuits and the *robustness* of neuromodulatory action. After a brief review of relevant literature, we will discuss some key aspects of – and adequacy conditions for – computational models that aim to account for the functional soundness and robustness of neuromodulation.

17.2 Functional Soundness and Robustness

Functional Soundness Neuromodulatory actions produce rapid and usually reversible changes in structural parameters of a neural circuit, such as the synaptic strength or the maximum capacity of ion channels. The set of parameter values that are produced by neuromodulatory action have been usually found to correspond to appropriate functions of the neural circuit itself (Bargmann 2012; Marder 2012; Marder et al. 2014). In other words, a neuromodulated circuit is usually characterized by a *functionally appropriate* performativity, that is, by a repertoire of behavioural patterns and transitions between them that are suitable for "the good functioning" of the whole system. An open problem is therefore to explain how it is that extensive and heterogeneous neuromodulation regularly produces appropriate and significant functions of the neuromodulated circuits. This problem about the behaviour of biological neural circuits is akin, as pointed out in Marder (2012), to the problem of finding a set of parameters constraining an artificial neural network to produce the desired input-output relationships, while ruling out or reducing to some acceptable level the occurrence of undesired I/O behaviors.

The fact that neuromodulated neural circuits regularly exhibit suitable behavioural patterns despite the breadth and heterogeneity of neuromodulatory action is somewhat surprising. Indeed, one might have reasonably conjectured that the wide variety of observed neuromodulatory actions would often lead to "overmodulated" circuits, that is, to circuits whose dynamics corresponds to inappropriate and destructive functions for the whole system. But this is not the case: neuromodulation has been found to regularly produce circuit dynamics which is conducive to coherent and beneficial behaviors for the entire system. A significant case in point are neuromodulations underlying sleep and wakefulness transitions (McCormick 1989; McCormick and Bal 1997). It has been conjectured that these behavioural regularities are preserved by means of biological mechanisms counteracting "overmodulation" effects.

Although it is in principle possible that for each specific circuit there are specific mechanisms that counteract overmodulation, it has been hypothesized that some overarching mechanisms exist which counteract overmodulation across a wide variety of neural circuits (Marder 2012).

Robustness
Preliminarily, it is useful to distinguish between two types of robustness: (i) *switch robustness*, that is, robustness in moving from one behavior to another functionally, and (ii) *stability robustness*, that is, as the capability to preserve over time some given behavioral pattern. Switching robustness is brought out from both computational simulations and experimental data, which converge to show that the same circuit dynamics can be obtained in presence of similar neuromodulatory signals, when the system is prepared in a variety of initial conditions characterized by a wide range of values for the relevant structural parameters (Szücs and Selverston 2006; Marder et al. 2014). It hase been observed that a neural circuit can exhibit the same behavior even in presence of different structural parameters (Goldman et al. 2001; Taylor et al. 2009). Moreover, it has been observed that similar neuromodulatory actions lead to the same behavioral change.

The second type of robustness (stability robustness) is brought out by the observation of neuromodulated (or even non-modulated) behaviors that are preserved in the presence of small perturbations of neuromodulatory signals. Accordingly, the dynamics of a neuromodulated (or non-modulated) circuit is said to be stable in the sense of small perturbation tackling. Although stability robustness is not explicitly highlighted in the neuroscientific literature, it is clearly suggested, albeit only implicitly so, by some authors when they state that neuromodulated circuits stably implement a function (see, for example, (Bargmann 2012)).

17.3 Computational Models of Neuromodulation in Literature

A commonly used computational model of neuromodulation is *GasNet* (Husbands 1998). This model was mainly used in the context of the evolutionary learning of control systems (controllers) for robots that have to engage in a variety of tasks (see, for example, (McHale and Husbands 2004)). Although there are several variants of GasNet (see, for example, (Magg and Philippides 2006)), the model is basically given by a recurrent neural network with spatially distributed neurons and allowing for two different mechanisms for exchanging information between neurons: (i) the customary "wired" connection mechanism: each neuron is connected to other neurons by means of predefined connections (synaptic connections); (ii) a "gaseous" information exchange mechanism, inspired by the theory of nitric oxide gas diffusion in biological neural networks. In this way, the activity of a neuron can affect the activity of other neurons even in the absence of wired connections.

Each neuron can emit different sorts of "gas". These gases have modulating effects on the weights of the synaptic connections entering the neurons that are close to the gas emitting neurons. More in detail, the modulating effect is defined as a multiplicative factor applied to the weights of the wired connections. In many specific models of the GasNet family, this multiplicative factor can take on a value chosen into a finite set of predefined values. The type of gas that each node can emit, the conditions for gas emission from each node, the network topology and the gas diffusion properties (such as its decay rate) are determined on the basis of evolutionary learning (Zhang and Suganthan 2010)

Many other neuromodulation models have been proposed. However, one main profitably distinguish between two main types of approaches to neuromodulation modeling. The first and more general approach fits the framework of "enhanced" artificial neural networks, which are endowed with mechanisms that capture the broad functional role of neuromodulation in terms of some overarching "ability to change the structural parameters of the network" or "ability to change the dynamics of the network". The second and more specific approach leads to the development of models of given neural circuits subject to neuromodulation.

An approach of the first type is adopted, for example, in Ziemke (1999), Ziemke and Thieme (2002). There, a multilevel network is proposed (ESCN: Extended Sequential Cascaded Network), formed in its turn by two subnets, called *function network* and *context network*. The function network is a standard feed-forward network that binds inputs to two different types of units, *output units*, and *status units*, using a single layer of connection weights. The context network takes the values of the state units as input and dynamically updates the weights of the function network. Other systems that use two different levels of information processing have been developed, for example, in Meng et al. (2010) and Donnarumma et al. (2012). In Meng et al. (2010), the authors propose that weights, plasticity of weights, and meta-plasticity of a primary neural network are regulated by the output of an evolving Gene Regulatory Network (GRN). This last subnet, in turn, influences the dynamics of the primary network. This approach has been used to develop an application for recognizing human behaviors from video sequences. In Donnarumma et al. (2012, 2015) a recurrent continuous-time neural network with a hierarchical organization is proposed, where each hierarchical level receives inputs of two different types: a sensory input and a program input transmitted from the previous level in the hierarchy. The dynamics of each hierarchical level is defined by its program input, leaving the parameters of the network unchanged. This neural architecture has also been proposed as a model for prefrontal cognitive control (Donnarumma et al. 2016).

Another model fitting the first type of approach is the Dynamically-Rearranging Neural Network (DRNN) (Kondo et al. 1999; Ishiguro et al. 2003). In DRNNs, unlike conventional artificial neural networks, each neuron can spread specific neuromodulators and each connection can receive the neuromodulators that have been emitted. The weights of the connections are updated by a rule similar to Hebb's learning rule. This system was mostly used in robotic scenarios. The authors hypothesized that DRNNs can contribute to overcome difficulties that one encounters when artificial agents are evolved by interactions with the real world.

A neural network is described in Finnis and Neal (2016) that can assume qualitatively different types of behaviors using a fairly simple neuromodulation scheme. In this model, the weights of a classical feed-forward neural network are modulated by a parameter h, called “hormone”, in such a way that if $h = 0$ the connections are inhibited, and if $h>0$ the connections are excited. The network is trained, through a gradient rule, to learn two different target functions, setting $h = 0$ for one target function and $h = 1$ for the other one. The results obtained following this approach suggest that it is feasible to train explicitly a neural network to learn different functions.

The second approach, in which neuromodulation effects are designed to model specific biological systems subject to neuromodulation, was followed in Cox and Krichmar (2009) and Krichmar (2012). In Cox and Krichmar (2009) the authors propose a model of a specific neuromodulatory system to play the role of a robotic controller. The neural network model is a recurrent network where neuromodulatory activity acts as a multiplying factor on the synaptic weights. Furthermore, some synaptic weights are subject to plasticity following a Hebbian learning rule. In the classic Hodgkin-Huxley formalism, neuromodulation was often expressed as a change in the maximum conductance of some membrane currents. For example, in Butera et al. (1995) the authors proposed a scheme of interaction between dopamine and serotonin to modify maximum conductivity. In an associative learning model (Abbott 1990), the authors used neuromodulation as a mechanism to signal the start and end points of learning phases. Other models consider neuromodulation as a signal capable of modifying synaptic mechanisms. For example, in Montague et al. (1996) the authors proposed a reward-based mechanism regulating how weights are changed by the learning rule.

In conclusion, it is worth emphasizing that neither the neuromodulation models mentioned in this section nor other related models proposed in the literature explicitly address the modelling problems related to the functional soundness and robustness of modulatory effects. In particular, the “overmodulation” problem discussed above persists in many such models. For example, in cases where neuromodulation is functionally captured in terms of a multiplicative parameter, the modulated weights can assume an overly wide spectrum of values, making overmodulation a highly probable event.

17.4 Towards the Computational Modeling of Functional Soundness and Robustness

To develop more adequate computational models of neuromodulated neural circuits, satisfying the properties described in Sect. 17.2, one has to introduce constraints on both parameter space and the effects of neuromodulation. In particular, to capture the robustness and functional soundness of neural circuits exposed to neuromodulatory influences, a computational model should meet the following qualitative and heuristically motivated specifications:

1. a “small” amount of neuromodulatory substances should cause perturbations of the structural parameters that leave circuit behavior unaltered.
2. a “large” amount of neuromodulatory substances should cause a sudden change of neural parameters, which induces a qualitative change in circuit functionality, while preserving the soundness of the new function in the context of the whole system.
3. A neural circuit subject to neuromodulatory actions should preserve its behavior under “small” variations in the amount of neuromodulatory substances.
4. A neuromodulated circuit should go back to the non-modulated state when there is a “strong” decrease in the neuromodulatory substance.
5. Some possible values of the neural circuit structural parameters, sensitive to neuromodulation, should be inaccessible when the same parameters are modified by neuromodulatory substances. Only those values that allow the neural circuit to assume firing dynamics corresponding to functions that are appropriate for the whole system should be reachable, thus avoiding overmodulation.

Specifications 1–5 can be further elaborated on towards a computational model based on artificial neural networks:

(a) To satisfy qualitative specifications 2 and 3, a plausible hypothesis is that the effects of neuromodulation on a neural parameter depend on the value of the unmodified parameter. To clarify this statement, let us consider the case of two non-modulated neural circuits belonging to some region of parameters A. Region A functionally corresponds to one and the same behavior, and the two neural circuits are characterized by different values of the parameters in A. Suppose, moreover, that the two circuits both “move” from A to a new region B, corresponding to a new functional behavior, when they are influenced by the same concentration of some neuromodulating substance. Here the problem is to modify, by means of the same neuromodulatory action, the structural parameters of the two circuits in such a way that both circuits are regularly displaced in region B even though the values of their parameters are not the same. As suggested also in Marder et al. (2014), this result might be obtained assuming that the effects of the same neuromodulation on the two neural circuits are different and, in particular, that these effects depend on the values of the non-modulated parameters.

(b) To satisfy points 1 and 4, one may assume that there is some sort of threshold value on the neuromodulation concentration to allow the transition from the non-modulated state to the modulated state and vice versa. One might additionally assume that the threshold in the two states is different, so as to ensure that small perturbations of neuromodulation do not cause the system to exit from the neuromodulated state. More specifically, suppose that in the transition from unmodulated state to the modulated state there is an almost linear relationship between the concentration of neuromodulation and the change of neural parameters, until a “high” neuromodulation concentration (a TH1 threshold) is reached that allows the system to move to the modulated state. The new value of the structural parameter(s) should be kept unchanged under further small changes in neuromodulator concentration. Similarly, during the transition from the modulated to the non-modulated state there should still be an almost linear relationship between neuromodulation concentration and neural parameter(s), until a “low” neuromodulation concentration (a TH2 threshold) is reached. At that point, again, there should be a sharp change in the parameter to return to the original value. This value should be maintained even in the presence of a further decrease or small variation in the neuromodulator concentration. To avoid repeated switching from an unmodulated to a modulated state, and vice versa, under small variations in the concentration of neuromodulation, one may assume that the two thresholds are different and that in particular TH2 <TH1. This behavior has significant similarities with the phenomenon of hysteresis. Hysteretic systems are systems with memory, where the effect of an input depends on the chronology of the system itself. Figure 17.3 shows an example of the relationship between neuromodulator concentration and consequent effects on the parameter, in the form of a hysteresis phenomenon.

17.5 A Generalized GasNet Model of Neuromodulation Effects

Starting from GasNet models (Husbands 1998; Magg and Philippides 2006), we formulate now a generalization of such models so that new/different neuromodulation properties can be added to the model by specializing some functions/parameters of the general definition. In particular, we add some functional properties that are meant to fulfil the requirements discussed in points (a) and (b) in the previous section. Thus, we introduce a general rule for the neuromodulation mechanism as expressed in Eq. 17.1, which enables us to vary (introduce or eliminate) function properties/constraints from such mechanism to several levels of the interaction neural parameters (neuromodulators). More in detail, this general rule has been developed on the basis of the following considerations/hypotheses:

- Different types of neuromodulators can act in different ways on the same neural parameter. Moreover, different neural parameters can be influenced in different ways by the same type of neuromodulators;
- Two different aspects of a neuromodulation mechanisms can be isolated: (i) To what degree a neural parameter is neuromodulated by the concentration of some specific type of neuromodulator, and (ii) the effect of being neuromodulated on the value of the neural parameter. For example, a neural parameter can be neuromodulated to the maximum degree by two different neuromodulators.

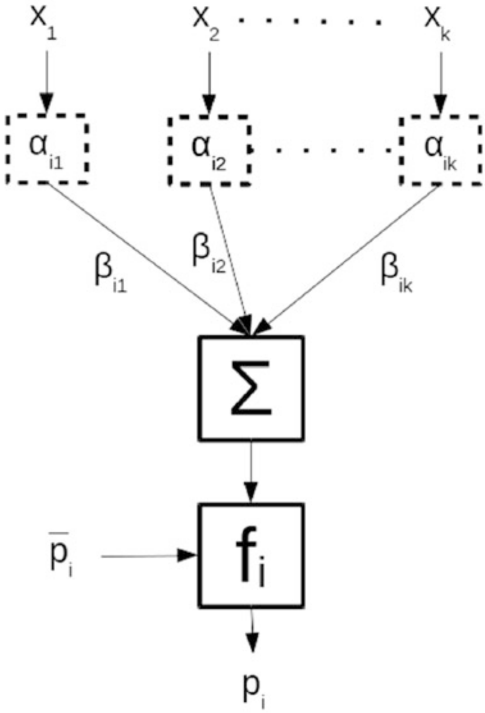


Fig. 17.1 *General neuromodulation mechanism*. In figure, $x_1, x_2, \ldots, x_k$ are the concentrations of k different types of neuromodulators which act on the value of a neural parameter i. $\bar{P}_i$ is the value of the parameter when it is unmodulated. p_i is its value when it is neuromodulated. α_{ih} is a value belonging to [0, 1]. The latter expresses how much the parameter i is neuromodulated by the concentration of neuromodulator h. β_{ih} expresses how the neuromodulator of type h acts on parameter i. $\beta_{ih} > 0$ increases the parameter, $\beta_{ih} < 0$ decreases it. $f_i(\cdot)$ is a functional mapping which returns the new value of the parameter on the basis of its own unmodulated value and the summation of neuromodulator effects

However, one of these neuromodulators decreases the value of the neural parameter, whereas the other one increases this value.

- The effects of different types of neuromodulators on neural parameters can be combined in a linear way.

Let us call p_i the value of a generic neural structural parameter i subject to neuromodulation. Then, in accordance with the above heuristic remarks, we suppose that the evolution of this parameter is regulated by a rule as expressed in Eq. 17.1 (see also Fig. 17.1).

$$p_i = f_i\left(\sum\nolimits_{h=1}^{k} \beta_{ih}\alpha_{ih}\left(x_h\right) + \theta_i, \overline{p_i}\right) \tag{17.1}$$

where:

- k is the number of types of neuromodulators,
- $\bar{P}_i$ is the unmodulated value of the parameter,
- β ih expresses how the neuromodulator of type h acts on the parameter p_i . β_{ih} > 0 increases the parameter, $\beta_{ih} < 0$ decreases it. A value equal to zero indicates

that the parameter p_i is not influenced by the neuromodulator of type h. β_{ih} is a constant value which depends on the unmodulated value of the parameter p_i.

- α_{ih} is a value belonging to [0, 1]. This value expresses how much the parameter i is neuromodulated by the the concentration of the neuromodulator h. $\alpha_{ih} = 0$ indicates that the neural parameter is completely in an unmodulated state, by contrast $\alpha_{ih} = 1$ indicates that p_i is totally neuromodulated.
- $f_i(\cdot)$ is a functional mapping which returns the new value of the parameter on the basis of its own unmodulated value and the summation of neuromodulator effects.
- θ_i is a bias.

Equation 17.1 can be interpreted as a generalization of the gasNet equation to regulate the network parameters by gas neuromdulations. In fact, this equation reduces to a gasNet equation if one stipulates that (1) $k = 2$, i.e., there are just two different types of neuromodulators, (2) $\alpha_{i1} = x_1$, $\alpha_{i2} = x_2$, $\beta_{i1} = (N - D_{i0})$ and $\beta_{i2} = -D_{i0}$, $\theta_i = D_{i0}$, (3) $f(a) = P(g(a))$ where P is a $1 \times N$ array and $g(a) = \text{floor}(a)$ if $a > 1$ and $a < N$, 1 if $a \leq 1$, N otherwise. D_{i0} is a value belonging to the discrete set $\{1, 2, \ldots, N\}$.

In order to fulfil the requirements discussed in points (a) and (b) of Sect. 17.4 above, we introduce two possible functional constraints/properties of the

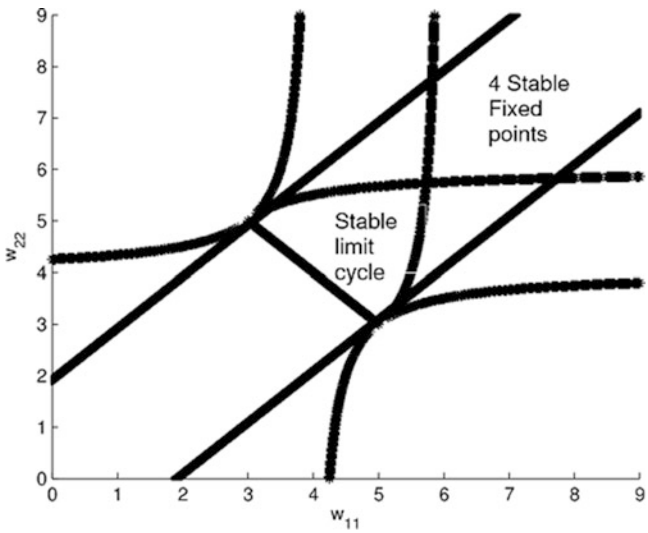


Fig. 17.2 *Bifurcation map of a two-neuron network*. In figure is reported the bifurcation map of a two-neuron CTRNN by varying the weight of the auto-connections and leaving unchanged $w_{12} = 1$ and $w_{21} = -1$. Bold continuos lines delimit regions in the weight space where the two-neuron CTRNN exhibits qualitatively different behaviours. In figure are evidenced the weight regions where a *stable cycle limit* and *four stable fixed points* exist. From a biological point of view, the first case (stable cycle limit) can be interpreted as *bursting* activity, the second case as *tonic* activity. See text for further details

neuromodulation mechanism and suggest how one may embed these properties into the general rule expressed in Eq. 17.1.

- As discussed above, a plausible hypothesis is that the effects of neuromodulations on a neural parameter depend on the value of the unmodulated parameter. For example, consider the case of two unmodulated neural circuits belonging to some parameter region R_i, but with different values of the parameters, that are both "shifted" towards a new region R_j when influenced by a same neuromodulation concentration. As suggested in Marder et al. (2014), a possible explanation of this behaviour is that neuromodulation effects on the two neural circuits are different. Accordingly, we suppose that these effects depend on the values of the unmodulated parameters, choosing f in Eq. 17.1 as a multiplicative function between the summation and the unmodulated parameter.
- Moreover, we hypothesize that the temporal evolution of the neural parameter is regulated by some sort of hysteresis loop. To this end, we define the temporal evolution of α_{ih} as regulated by a hysteresis loop. Several hysteresis models have been proposed in the literature (for a review, see (Hassani et al. 2014)). Here, we use the Coleman-Hodgdon hysteresis model which is described by a first-order nonlinear differential equation as expressed in Eq. 17.2

$$\dot{\alpha} = a\,(f(x) - \alpha)\,|\dot{x}| + g(x)\dot{x} \tag{17.2}$$

where $a > 0$ is a real number, $f(\cdot)$ and $g(\cdot)$ are real-valued functions which have to fulfil some specific constrains (see (Voros 2009)). This model can be used for a broad class of hysteretic systems by an appropriate choice of functions $f(\cdot)$ and $g(\cdot)$. In the simpler cases these functions can be chosen by setting: $f(x) = m_1\, x[1 - h(|x| - D_1)] + D_1\, m_1\, h(|x| - D_1)\,\mathrm{sign}(x)$ and $g(x) = b[1 - h(|x| - D\ 1)]$, where $h(\cdot)$ is the Heaviside step function, and D_1 , m_1, b are parameters which regulate the hysteresis phenomenon. We chose parameters a, D_1, m_1, b such that points (b) in Sect. 17.4 is fulfilled. In particular, parameter α follows two sigmoid-like curves: in the phase going from the unmodulated to modulated state, α follows a sigmoid-like function which is centred on *high values* of the neuromodulation concentration x; in the phase going from the modulated to unmodulated state α follows a sigmoid-like function which is centred on *lower values* of x. In Fig. 17.3 an example of such behaviour is reported.

17.6 An Artificial Neural Network Model and Its Experimental Framework

In the construction of a computational model shedding light on the properties of robustness and functional soundness of neuromodulatory action, a fundamental choice concerns the model of artificial neurons to operate with. This choice

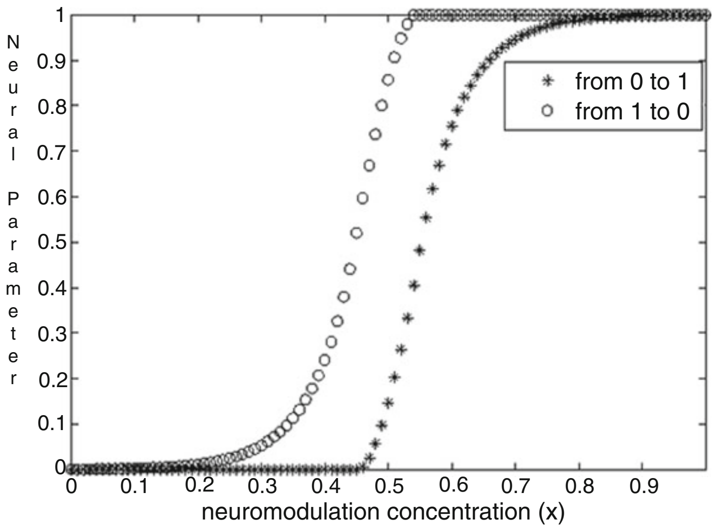
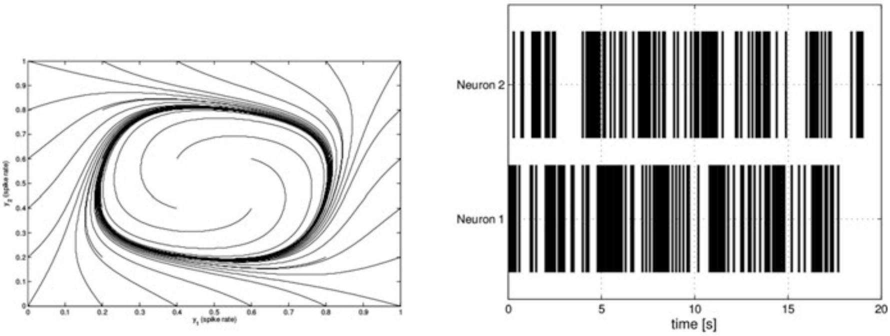


Fig. 17.3 *Hysteresisis*. Example of the relationship between the value of a structural parameter of a neural circuit and the neuromodulation concentration in terms of hysteresis

must clearly take into account the direct biological interpretability of artificial neurons. However, this property must be balanced with the desiderata of "cheap" computational costs and mathematical tractability for implementation purposes. A computational model striking a reasonable balance among these various constraints are Continuous Time Recurrent Neural Networks (CTRNN): not expensive from an implementation viewpoint, mathematically tractable, usable as universal approximators of dynamic systems and, last but not least, directly interpretable in terms of typical behaviors of biological neural networks (Kier et al. 2006). Let us consider the latter property in relation to the spike frequency of a biological neuron, which one may distinguish into "tonic" spike frequency (basic activity with constant firing frequency) and "bursting" (spike trains including different frequencies). In the context of CTRNN, these two activities correspond to fixed points and limit cycles, respectively. In Fig. 17.4, for example, we have the phase portrait of a small CTRNN with two neurons, which has a limit cycle (Fig. 17.4a) and the corresponding spike raster (Fig. 17.4b). In Fig. Fig. 17.4b, one can see that the two neurons show a bursting activity. Fig. 17.5 shows the phase portrait of a two-neuron CTRNN exhibiting 4 stable fixed points and the corresponding spike raster. In Figs. 17.5b–e fixed points correspond to tonic type activities.

Interestingly, the behaviour of center-crossing two-neuron CTRNNs was extensively studied in Beer (1995). In particular, if one considers networks with $w_{21} = -w_{12} = 1$ and external input $I_1 = I_2 = 0$, a bifurcation map as reported in Fig. 17.2 is obtained. In this case, one obtains several qualitatively different network behaviours. Nevertheless, it is possible to identify a specific parameter region, say region R_C,



(a) Limit Cycle (b) Bursting

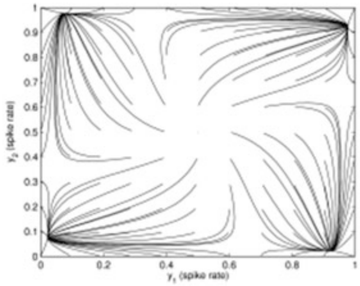
Fig. 17.4 *Activity of a 2-neuron CTRNN network interpreted in terms of the activity of biological neurons*. In subfigure (**a**) is reported a limit cycle of the network, in subfigure (**b**) the corresponding activity of the two neurons in terms of raster plot

where a stable cycle limit exists, and another region, say R_4, where the network exhibits 4 stable fixed points. Thus, one may interpret a two-neuron CTRNN as an unmodulated circuit, if it is into the region R_C, and as a modulated circuit fulfilling the *soundness requirement* if it happens to be into the region R_4. Every other value of parameters w_{11} and w_{22} will be considered as cases of "over-modulation".

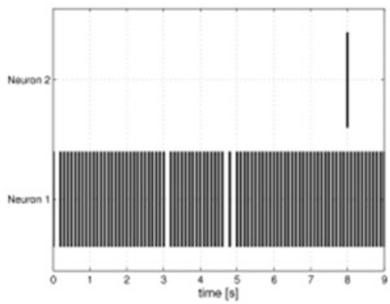
Thus, one can set up an experimental simulation framework to explore the behavior of a large number of two-neuron CTRNNs, provided with a neuromodulation mechanism as discussed in Sect. 17.5, and subject to different sorts of neuromodulatory action.

17.7 Concluding Remarks

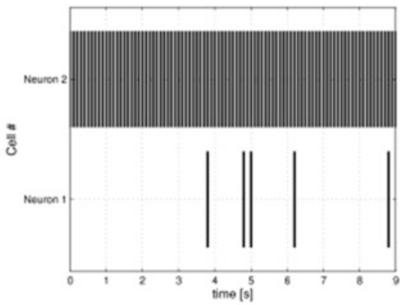
In this paper we have highlighted how the action of neuromodulators is crucial to determine the functional repertoire of a neural circuit and its behavioral plasticity. Neuromodulators contribute crucially to determine the performativity of a neural circuit, that is, its ability to change behavior, and especially so by inducing behavioral changes occurring under temporal constraints that are incompatible with the longer time scales that are often involved in both biological artificial neural network learning. Two key properties of the action of neuromodulators that allow neuromodulated systems to regularly produce circuit dynamics that are consistent with the behavior of the whole system are the functional soundness of the circuits subjected to neuromodulation and the robustness of neuromodulatory action. We have shown that these two properties are not explicitly thematized and investigated in major computational models of neuromodulation proposed in literature. Moreover, some plausible hypotheses were identified and discussed



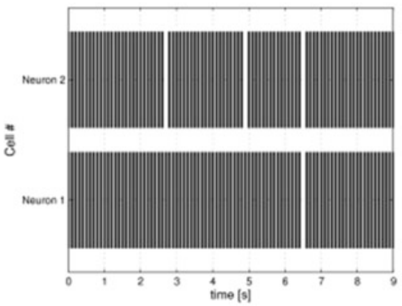
(a) 4 stable fixed points



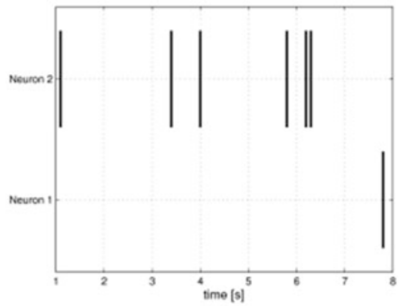
(b) Tonic firing: Neuron 1 with high spike frequency



(c) Tonic firing:Neuron 2 with high spike frequency



(d) Tonic firing: both neurons with high spike frequency



(e) Tonic firing: both neurons with low spike frequency

Fig. 17.5 Activity of a 2-neuron CTRNN network interpreted in terms of the activity of biological neurons. In subfigure (**a**) a 2-neuron CTRNN network with 4 different stable fixed points (**a**). Each fixed point can be interpreted in terms of the activity of biological neurons (**b**), (**c**), (**d**) and (**e**)

towards the design of computational models of neuromodulation taking into account both the functional soundness and the robustness of neuromodulatory actions. In particular, we have highlighted how the back-and-forth transition of a neural circuit between a non-modulated state and a modulated one might be adequately captured by some sort of hysteresis phenomenon. Finally, if one wants to allow for some possible values of the neuromodulation-sensitive structural parameters to be inaccessible when one or more neuromodulators act on the circuit (point 5 in Sect. 17.4), this condition could be satisfied by assuming that all the neuromodulation-sensitive structural parameters interact with each other. Thus, these parameters can be described as a single dynamic system with more stable fixed points (and therefore different regions of attraction) in which the action of the neuromodulators consists in letting the system "jump" from one fixed point to another one. In this way, these parameters are allowed to assume a finite set of values corresponding to appropriate behaviors (functional soundness). One should be careful to note, however, that in the context of neuromodulation studies this modeling hypothesis has no clear supporting evidence and stands in need of further empirical control. However, a similar behavior has been reported and investigated in some different contexts, for example in connection with multistable perception in Sterzer et al. (2009).

Acknowledgments Research work on which this article is based was partially supported by grant 2015TM24JS in the framework of the PRIN 2015 program of MIUR (Italian Ministry of University, Research and Education).

References

Abbott, L.F. (1990). Modulation of function and gated learning in a network memory. *Proceedings of the National Academy of Sciences of the United States of America, 87*(23), 9241–9245.

Bargmann, C.I. (2012). Beyond the connectome: How neuromodulators shape neural circuits. *BioEssays, 34*, 458–465.

Beer, R.D. (1995). On the dynamics of small continuous-time recurrent neural networks. *Adaptive Behavior, 3*, 469–509.

Butera, R.J., Clark, J.W., Canavier, C.C., Baxter, D.A., & Byrne, J.H. (1995). Analysis of the effects of modulatory agents on a modeled bursting neuron: Dynamic interactions between voltage and calcium dependent systems. *Journal of Computational Neuroscience, 2*(1), 19–44.

Cox, B.R., & Krichmar, J.L. (2009). Neuromodulation as a robot controller: A brain-inspired strategy for controlling autonomous robots. *IEEE Robotics and Automation Magazine, 16*, 1115–1129.

Donnarumma, F., Prevete, R., & Trautteur, G. (2012). Programming in the brain: A neural network theoretical framework. *Connection Science, 24*(2–3), 71–90.

Donnarumma, F., Prevete, R., Chersi, F., & Pezzulo, G. (2015). A programmer–interpreter neural network architecture for prefrontal cognitive control. *International Journal of Neural Systems, 25*(06), 1550017.

Donnarumma, F., Prevete, R., de Giorgio, A., Montone, G., & Pezzulo, G. (2016). Learning programs is better than learning dynamics: A programmable neural network hierarchical architecture in a multi-task scenario. *Adaptive Behavior, 24*(1), 27–51.

Fellous, J.M., & Linster, C. (1998). Computational models of neuromodulation. *Neural Computation, 10*(4), 771–805.

Finnis, J.C., & Neal, M. (2016, August). UESMANN: A feed-forward network capable of learning multiple functions. In *International conference on simulation of adaptive behavior* (pp. 101–112). Cham: Springer.

Flamm, R.E., & Harris-Warrick, R.M. (1986). *Journal of Neurophysiology, 55*, 866–881.
Goldman, M.S., Golowasch, J., Marder, E., & Abbott, L.F. (2001). Global structure, robustness, and modulation of neuronal models. *The Journal of Neuroscience, 21*, 5229–5238.
Hassani, V., Jahjowidodo, T.T., & Do, T.N. (2014). A survey on hysteresis modeling, identification and control. *Mechanical Systems and Signal Processing, 49*, 209–233.
Hooper, S.L., & Marder, E. (1987). *The Journal of Neuroscience, 7*, 2097–2112.
Husbands, P. (1998). Evolving robot behaviours with diffusing gas networks. In P. Husbands & J.-A. Meyer (Eds.), *Evolutionary robotics: Proc. EvoRob'98, LNCS 1468* (pp. 71–86). Springer.
Ishiguro, A., Fujii, A., & Eggenberger, P. (2003). Neuromodulated control of bipedal locomotion using a polymorphic CPG circuit. *Adaptive Behavior, 11*, 7–17.
Kier, R.J., Ames, J.C., Beer, R.D., & Harrison, R.R. (2006). Design and implementation of multipattern generators in analog VLSI. *IEEE Transactions on Neural Networks, 17*, 1025–1038.
Kondo, T., Ishiguro, A., Tokura, S., Uchikawa, Y., & Eggenberger, P. (1999). Realization of robust controllers in evolutionary robotics: A dynamically-rearranging neural network approach. In *Proceedings of the 1999 congress of evolutionary computation* (Vol. 1, pp. 366–373).
Krichmar, J.L. (2012, June). A biologically inspired action selection algorithm based on principles of neuromodulation. In *Neural Networks (IJCNN), The 2012 International Joint Conference on* (pp. 1–8). IEEE.
Magg, S., & Philippides, A. (2006, September). GasNets and CTRNNs–a comparison in terms of evolvability. In *International conference on simulation of adaptive behavior* (pp. 461–472). Berlin/Heidelberg: Springer.
Marder, E. (2012). Neuromodulation of neuronal circuits: Back to the future. *Neuron, 76*, 1–11.
Marder, E., O'Leary, T., & Shruti, S. (2014). Neuromodulation of circuits with variable parameters: Single neurons and small circuits reveal principles of state-dependent and robust neuromodulation. *Annual Review of Neuroscience, 37*, 329–346.
McCormick, D.A. (1989). Cholinergic and noradrenergic modulation of thalamocortical processing. *Trends in Neuroscience, 12*(6), 215–221.
McCormick, D.A., & Bal, T. (1997). Sleep and arousal: Thalamocortical mechanisms. *Annual Review of Neuroscience, 20*(1), 185–215.
McHale, G., & Husbands, P. (2004). GasNets and other evolvable neural networks applied to bipedal locomotion. In S. Schaal et al. (Eds.), *From animals to Animats 8: Proceedings of the eighth international conference on simulation of adaptive behaviour (SAB'2004)* (pp. 163–172). MIT Press.
Meng, Y., Jin, Y., Yin, J., & Conforth, M. (2010). Human activity detection using spiking neural networks regulated by a gene regulatory network. In IEEE international joint conference on neural networks (IJCNN 2010).
Montague, P.R., Dayan, P., & Sejnowski, T.J. (1996). A framework for mesencephalic dopamine systems based on predictive Hebbian learning. *The Journal of Neuroscience, 16*(5), 1936–1947.
Nusbaum, M.P., & Marder, E. (1989). *The Journal of Neuroscience, 9*, 1591–1599.
Sterzer, P., Kleinschmidt, A., & Rees, G. (2009). The neural bases of multistable perception. *Trends in Cognitive Sciences, 13*(7), 310–318.
Swensen, A.M., & Marder, E. (2000). *The Journal of Neuroscience, 20*, 6752–6759.
Szücs, A., & Selverston, A.I. (2006). Consistent dynamics suggests tight regulation of biophysical parameters in a small network of bursting neurons. *Journal of Neurobiology, 66*, 1584–1601.
Taylor, A.L., Goaillard, J.M., & Marder, E. (2009). How multiple conductances determine electrophysiological properties in a multicompartment model. *The Journal of Neuroscience, 29*, 5573–5586.
Weimann, J.M., Skiebe, P., Heinzel, H.G., Soto, C., Kopell, N., et al. (1997). Modulation of oscillator interactions in the crab stomatogastric ganglion by crustacean cardioactive peptide. *The Journal of Neuroscience, 17*, 1748–1760.

Williams, A.H., Calkins, A., O'Leary, T., Symonds, R., Marder, E., & Dickinson, P.S. (2013). The neuromuscular transform of the lobster cardiac system explains the opposing effects of a neuromodulator on muscle output. *The Journal of Neuroscience, 33*, 16565–16575.

Zhang, L., & Suganthan, P.N. (2016). A survey of randomized algorithms for training neural networks. *Information Sciences, 364*, 146–155.

Ziemke, T. (1999). Remembering how to behave: Recurrent neural networks for adaptive robot behavior. In L.R. Medsker & L.C. Jain (Eds.), *Recurrent neural networks: Design and applications* (pp. 359–389). Boca Raton: CRC Press.

Ziemke, T., & Thieme, M. (2002). Neuromodulation of reactive sensorimotor mappings as a short-term memory mechanism in delayed response tasks. *Adaptive Behavior, 10*, 185–198.

Chapter 18
Neural Representations in Context

Alessio Plebe and Vivian M. De La Cruz

Abstract In recent years, a number of different disciplines have begun to investigate the fundamental role context appears to play in a number of cognitive phenomena. Traditionally, linguistics, and the fields of communication and pragmatics in particular, have been the areas that have focused the most on contextual effects. Context has increasingly been studied for its role in influencing mental concepts, for some scholars being considered constitutive for most – if not all – concepts. Cognitive neuroscience is now starting to consider in a systematic way how context interacts with neural responses, although this research is still scattered and concentrated in a small number of specific cases only. In this chapter, we attempt to tie these three levels together, since only from their integration can a comprehensive explanation of how context affects cognition be constructed. The way context drives language comprehension depends on the effects of context on the conceptual scaffolding of the listener, which in turn, is the result of his neural responses in combination to context. These neural responses derive from learning throughout the history of experiences of the individual, and the association between possible contexts and heard utterances. The road we take to accomplishing the multi-level integration between what appear to be distant domains, is a computational one. This approach meets with the mechanistic framework of explanation, which is currently held as the most appropriate way of approaching cognitive phenomena that is often characterized by a multiplicity of levels, as is the case with context. The core underlying concept of the neurocomputational framework here proposed,

Authors equally contribute to this work.

A. Plebe (✉)
Department of Cognitive Science, University of Messina, Messina, Italy
e-mail: aplebe@unime.it

V. M. De La Cruz
Department of Educational Sciences, University of Catania, Catania, Italy
e-mail: vmdelacr@unict.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*,
Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_18

is an account of neural representation, based on structural similarity. Structural representations are still the best option on the market in cognitive science, but in their traditional form, derived from classical measurement theory, are affected by a number of serious drawbacks, including not being able to account for context. We suggest a different account of structural similarity, one informed by current neuroscience, where the homomorphic relations required for structural similarity are derived from neural population coding. In a preliminary mathematical sketch, we indicate how this approach can construct neural aggegations that are sensitive to context.

Keywords Neural representations · Linguistic context · Cognitive context · Language development · Population coding

18.1 Introduction

There is a growing awareness of the important role contextual effects play in a wide range of cognitive phenomena. Linguistic communication has been the area of study that has traditionally explored these issues, but in the last 20 years or so they have also begun to be considered in regards to the nature of mental concepts. Cognitive neuroscience has also recently begun to consider how context influences and or interacts with neural responses, though this research is still limited to a small amount of restricted cases. A certain amount of independence exists in these three different areas of investigation, especially in regards to what takes place at the neural level. What we propose here is an approach to contextual effects that instead intersects all three levels, using as the starting point a computational model that is able to grasp the basic mechanisms of a generic response to context. We do this in adherence to a mechanistic multilevel explanation, recently defended as the most suitable one on the market in cognitive science (Miłkowski 2013; Boone and Piccinini 2016).

What we sustain, in particular, is that the most fertile direction to take is that of recuperating the standard formalization of structural representation derived from classical measurement theory (Swoyer 1991). What we do however, is express it in biologically plausible terms, linked to one of the basic mechanisms of the cerebral cortex, known as population coding. In a preliminary mathematical sketch, we indicate how this approach can construct neural aggegations that are sensitive to and can account for context.

18.2 A Plurality of Contexts

Context is an important notion in a variety of fields, and in linguistic research in particular. Though many scholars agree that it is crucial to the understanding and production of language, it is difficult to come up with a clear and undisputed definition of what it is. The Oxford dictionary defines the term as: “The circumstances that form the setting for an event, statement, or idea, and in terms of which it can be fully understood.”

For the purposes at hand it is convenient to simplify the variety of accepted uses of the word context in three main areas:

- linguistic context
- cognitive context
- neural context

Without a doubt, the first has the most consolidated tradition and is still today, unless otherwise specified, assumed to be the one most proper to the philosophical debate. Its main element has roots that reach back to the past, and regards the degree to which truth-functional semantics depends on context. Gottlob Frege raised the point in his uncompleted 1897 volume *Logik*, and though not explicitly using the term *context*, underlined how for many expressions, fixing their truth value requires supplemental information, coming from the circumstances, in which such expressions are pronounced. The first clear elucidation of the dependance of language on context was proposed by John Searle (1978), with his characteristic flair for provocation. His provocatory style also partly accounts for the lasting impression of his work, so much so as to have induced François Recanati (2004), in more recent times, to use the same title – *Literal meaning* – for his book on linguistic context. Whether literal meaning, truly exists, is exactly what is contested by these authors. Of course, opposite arguments also exist, which defend the possibility of constructing truth-functional semantics starting from statements, abstracting them from context. Among these, one of the fiercest arguments is represented by that of Cappelen and Lepore (2005), whose book has an unequivocal title: *Insensitive Semantics*, or a semantics, in which context has barely any influence at all.

18.2.1 Context and Language Development

In reference to linguistic context as seen from a developmental psychology perspective, recent language acquisition research has contributed insights to how very young children’s sensitivity to contextual factors, and in particular, to both same and varied contexts, act as support to the early learning of new words and their subsequent generalization (Goldenberg 2015; Goldenberg and Sandhofer 2013).

In these studies the contexts were the spatial location of the child and the speakers the child interacted with. In addition, Goldenberg (2015) reports how the number of naturally occurring variations in contexts, in which children are exposed to nouns, for example, influences the nouns they use and their frequency of use. What the authors suggest is that not only is contextual variation present in the exposure children have to nouns (speaker context), it in turn leads to the higher likelihood of children producing these nouns in a variety of contexts themselves. In addition, and quite interestingly, the more varied the spatial locations the children's exposure to nouns is, the more likely they are to use these nouns in a variety of spatial locations.

In a statistical learning investigation of early word learning using the CHILDES database (Hills et al. 2010), had already explored how contextual diversity in the learning environment might be influencing the order (or age of acquisition), in which young children learn particular classes of words. In this case, the contextual diversity was defined as the "number of unique word types a word co-ocurrs with in care-giver speech". What these researchers found was that not only did this contextual diversity predict the order, in which certain classes of words were produced by children (nouns, verbs, adjectives and function words), it was also highly correlated with "adult generated free associates" (i.e., words that adults are more likely to associate with other words), taken as an index of the adults' semantic networks. The strength of correlation, however depended on the word class (e.g. for function words no strong positive correlation was found). The authors find their results in keeping with the hypothesis that the contextual nature of the learning environment plays an important role in children's early learning of particular word classes, and nouns in particular.

18.2.2 Concepts and Context

At a cognitive level, the issue instead regards concepts and the degree to which, they are dependent on context. It must be said, that all the principle theories cognitive science has proposed regarding the nature of concepts, such as Eleonor Rosch's prototypes, Medin and Schaffer's exemplars, and Susan Cary's theory, have simply never taken context into consideration. Moving therefore, in contrast with the prevalent view on concepts, Lawrence Barsalou (1983) has been one of the first to underline how difficult it is to conceive them as stable subjective entities, while it appears more appropriate to think of categories as dynamically constructed and tailored to specific contexts, or as *Ad hoc categories*. Just like Searle with his 1978 book, Barsalou's 1983 book has left a lasting mark, influencing a number of subsequent investigations, including those that have even more radically hypothesized that it is not only certain types of concepts that are constructed ad hoc, but that this is an intrinsic characteristic of them all (Casasanto and Lupyan 2015).

In recent decades, the issue of context has become increasingly more important, and as a result a number of investigations have been done, in which the linguistic and cognitive views converge and intersect, such as in Relevance Theory (Sperber and Wilson 1995) and in the work of Robyn Carston (2002). A recent review of studies of the cognitive perspective on the linguistic issue of context can be found in Airenti and Plebe (2017). Just as in the strictly linguistic domain, we find in the wider cognitive view a variety of positions, some that minimize the destabilizing effect context has on concepts, such as that of Edouard Machery (2015), or others that assume a more intermediate position such as that of Mazzone and Lalumera (2009), that while acknowledging the fundamental role context might play in concepts, sustain that a characterizing stable nucleus of mental concepts is also a part.

18.2.3 Context at the Neural Level

The topic of context is beginning to gain a certain relevance in the neuroscientific domain as well, in terms that at first glance might appear to be somewhat distant from the two domains of research briefly discussed above. The issue regards whether the activation of neurons, in response to the same stimuli, can significantly change due to contextual factors. An area traditionally considered as being a site of contextual effects processing is the hippocampus. In particular, signs of environmental context are represented in the *place cell*, and can influence discrimination decisions between visual stimuli and emotional fear responses. Neurons in area CA1 (primary area of the *cornu ammonis*) instead codify contextual overlap of a temporal nature, so that memories of events taking place in brief temporal sequences subsequently have facilitated reciprocal re-activation. Recently, the picture has widened, going way beyond the hippocampus, with evidence of conspicuous contextual effects also in perception areas. The fields of spectro-temporal response in the primary auditory cortex of ferrets modify themselves plastically according to the context of action, although the latter is independent from the auditory stimulus itself. Similarly, in mice, a remodelling of the topographic maps of primary sensorimotor cortex corresponding to the cushions found in the back paws of the animals has been found, which seems to depend on the type of floor pavement the animals are on. Neural context, thus, appears to be a widespread phenomenon, but one that is still waiting to be explored. For a recent review the reader is invited to see Stark et al. (2018).

18.3 Structural Representations

The idea that mental representations should bear similarity with the structural properties of their referents is not a recent one. In fact, according to Hume (1748, ch.IX):

> All our reasoning concerning matter of fact are founded on a species of analogy, which leads us to expect from any cause the same events, which we have observed to result from similar causes. [...] But where the objects have not so exact a similarity, the analogy is less perfect, and the inference is less conclusive; though still it has some force, in proportion to the degree of similarity and resemblance.

The idea of similarity also satisfies our own intuitions regarding representations, namely that there should be some sort of similarity between a representation and what it represents. The challenge has been that of establishing a theory of what this similarity should be.

18.3.1 Traditional Accounts of Structural Representations

The first attempt to formalize similarity in terms of structural relations, whose influence is still felt today, can be traced back to Russell (1927), who introduced *relation-number* defined as the class of all set-theoretical relations similar to a given relation. Russell derived several mathematical properties of the "relation-number", showing that they satisfied all the formal laws satisfied by transfinite ordinal numbers. An important aspect in Russel's book was a theory of how the physical world become related to our own sensations. Therefore, his account of similarity in terms of relation-number was an abstract theory of representations.

In the 1970s, a new mathematical domain, began to be developed that followed in the footsteps of Russell's foundational work on structural representations. That domain was measurement, by Krantz et al. (1971). It was an unprecedented attempt to unify all the systems that numerically represent any attribute of objects, substances, or events in the world.

The basic formulation of any measurement representation is in terms of a homomorphism between the two domains. If A is an empirical system, and B a numerical system, then B represents when there exist n-place relations R^A and R^B, and a homomorphism $\phi : A \rightarrow B$ can be established, such that:

$$\forall a_i \in A \left(R^A(a_1, \cdots, a_n) \Leftrightarrow R^B(\phi(a_1), \cdots, \phi(a_n)) \right). \tag{18.1}$$

This general formulation is just the basis of the effective development of various bodies of theories, each one for a specific case of measure. For each specific system further effort is required in proving the existence of the representation in Eq. (18.1) for the two chosen relations, and in proving a uniqueness theorem that guarantees that all possible homomorphisms satisfying (18.1) will map onto the same numerical structure.

Years later Swoyer (1991) returned to Russell's original aim, by trying to widen the scope of measurement theory to the domain of mental representations. He adapted Eq. (18.1) for kinds of domains he called *intensional relational systems*, in practice a system that allows first-order relations between individual elements, and second-order relations between first-order relations. Swoyer deliberately refrained from developing a representation and uniqueness theorem for examples of mental representations, but described four illustrative examples of what his notion of intentional relational systems and related representation could encompass.

18.3.2 Neural Structural Representations

Structural representations are still the best option in cognitive science (Ramsey 2007), even if they are subject to a number of serious drawbacks, especially due to the weak distinction between genuine and trivial representational systems, allowed by traditional accounts. A survey of drawbacks and possible ways out are found in Plebe and De La Cruz (2018). For our purposes, let it suffice to say that traditional accounts of structural representations simply ignore context. Let us have an empirical domain A and the corresponding mental domain B, as in Fig. 18.1. In the upper drawing, two different environmental contexts, c' and c'', cause two different entities of the world, a_2 and a_3, to be mapped into the same concept b_1. For example b_1 is the concept CHAIR, and a_3 is actually a chair in the environmental context c' OFFICE, while a_2 is a rock in a peculiar perspective context c'' that cause a_2 to appear as a chair. In the lower drawing, the rock a_2 maps to the concept b_2 ROCK when the mental inner context c' is that of HIKING, while is mapped to b_1, CHAIR, when associated with the mental inner context c'' TIRED. Both cases violate the homomorphic mapping.

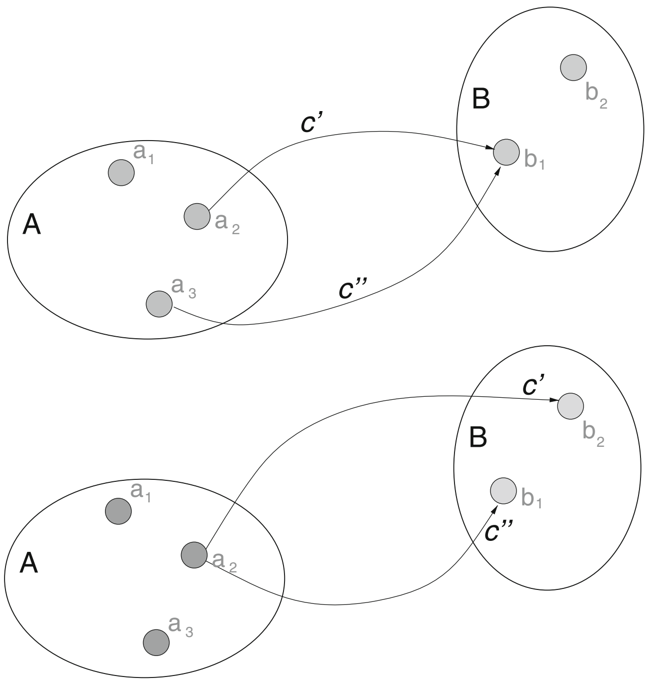


Fig. 18.1 Examples of how easily the traditional accounts of structural representations are defeated by contextual effects. In both cases A is the empirical domain and B is the mental domain, c are contexts affecting the mapping

For the purpose of representation, one of the most promising concepts drawn from neuroscience is that the power of coding information in neural circuits lies in the combined activities of many neurons. This idea comes under a variety of almost equivalent names, such as "distributed coding" (Hinton et al. 1986), "population vector coding" (Churchland and Sejnowski 1994) and most frequently known as just, "population coding" (Zemel et al. 1998; Quian Quiroga and Panzeri 2013). Scholars such as Yuste (2015) regard the concepts of coding by combined neural activities as a major paradigm shift in neuroscience.

The coding by distributed populations has been extensively studied in the cerebral cortex, especially in regards to visual stimuli (Pasupathy and Connor 2002) and objects (Sakai et al. 1994), but it has been observed for a wide variety of other representations, including: movement direction in the motor cortex (Georgopoulos et al. 1986); sound localization in the auditory system (Fitzpatrick et al. 1997); odors in the anterior piriform cortex (Miura et al. 2012); and task-dependent behavioral decisions in prefrontal cortex (Stokes et al. 2013). Several authors (Fusi et al. 2016; Lehky and Tanaka 2016) have used concepts of vector space to show how neural population coding allows the management of a very high number of dimensions in the represented features, in a compact way.

By using population coding, the structural representation of concepts in the cortex can be formalized in a more precise way than with the general use of isomorphism and homomorphism. In the next section we will provide a sketch, concise yet adequate for showing the inclusion of contextual effects.

18.4 Context Sensitive Coding

We will now sketch out a possible way of formalizing neural population coding as the representing structure of a domain in the external world. We will start with the most general formulation, without assumptions regarding the part of the brain, to which the population belongs, or the specific perceptual modalities involved. We then specialize the basic formulation to the case where the stimulus, at least in part, conveys linguistic information. Finally, we extend the formulation by explicitly including the context.

18.4.1 Basic Population Coding Formulation

Let us take a population $\mathscr{X}$ of neurons that responds to an empirical domain $\mathscr{G}$. Let us assume this domain is structured in categories, by an equivalence relation $\stackrel{R}{\sim}$, so that $\mathscr{G}$ is partitioned in the set $\mathscr{S}$ of equivalence classes S. Note that we are not making ontological assumptions about the real organization of natural domains into equivalence classes. Our aim is to derive a formal account of how a population of neurons can establish a structural representation of an empirical domain $\mathscr{G}$, *provided* it is structured in categories by an equivalence relation. This structure could just be normative, for example given by names of objects in a certain language. This assumption provides the advantage of a fairly simple mathematical formulation. We will discuss later how this basic formulation might be extended when abandoning equivalence classes for categorization theories with non exact membership. Let $s \in \mathscr{G}$ be an instance of the empirical domain, and x_i a measure of the activity of a generic neural unit i in $\mathscr{X}$. The activity can be any relevant numerical measure, such as firing rate. We can write the following basic equation for the response of unit i to the presentation of the stimulus s:

$$x_i(s) : S \in \mathscr{S} \to \mathbb{R}^+; \quad s \in S \in \mathscr{S}, \tag{18.2}$$

and its vectorial extension:

$$\mathbf{x}(s) : S \in \mathscr{S} \to \mathbb{R}^{|\mathscr{X}|} \tag{18.3}$$

collecting all responses $x_i(s)$ of neurons in $\mathscr{X}$. The stimulus s is an instance of a possible sensorial experience given by an item in category S, which in turn belongs to the set of all relevant categories $\mathscr{S}$. For a class $S \in \mathscr{S}$ we can define the two sets:

$$X_{S,i} = \left\{x_i(s_j) : s_j \in S\right\}; \quad \overline{X}_{S,i} = \left\{x_i(s_j) : s_j \in S' \neq S \in \mathscr{S}\right\}. \tag{18.4}$$

We can then associate with class S a set of units in the map, by ranking it with the following function:

$$r(S,i) = \frac{\mu_{X_{S,i}} - \mu_{\overline{X_{S,i}}}}{\sqrt{\frac{\sigma_{X_{S,i}}}{|X_{S,i}|} + \frac{\sigma_{\overline{X_{S,i}}}}{|\overline{X}_{S,i}|}}}, \tag{18.5}$$

where μ is the average and σ the standard deviation of the values in the two sets, and $|\cdot|$ is the cardinality of a set. Now the following relation can be established as the population code of a class S in $\mathscr{X}$:

$$p_{\mathscr{X}}(S) : \mathscr{S} \to \{\langle i_1, i_2, \cdots, i_M\rangle : r(S,i_1) > r(S,i_2) > \cdots > r(S,i_M)\}, \tag{18.6}$$

where M is a given constant, with order of magnitude smaller than the number of units in the map. The population code $p_{\mathscr{X}}(S)$ computed with (18.6) can be used to classify a stimulus s in an expected category:

$$c_{\mathscr{X}}(s) = \arg\max_{S \in \mathscr{S}} \left\{ \sum_{j=1\cdots M} \alpha^j x_{p_{\mathscr{X}}(S)_j}(s) \right\}, \tag{18.7}$$

where $p_{\mathscr{X}}(S)_j$ denotes the j-th element in the ordered set $p_{\mathscr{X}}(S)$, and α is a constant that is close to one.

The settlement of a semantic representation in a map of the model can be established by testing the discriminatory power of its population coding:

$$a_{\mathscr{X}}(S) = \frac{|\{s : s \in S \wedge c_{\mathscr{X}}(s) = S\}|}{|S|}. \tag{18.8}$$

Equation (18.7) provides the mapping between the categorial structure established by population coding in the cortex, and the categorial structure of the represented system $\mathscr{S}$, like, for example, a categorial domain in the world, as organized in a given language. Equation (18.8) gives the amount of potential correctness of the representation system, note that, conversely, $1 - a_{\mathscr{X}}(S)$ is the potential amount of misrepresentation of the representation system: the probability that a stimulus s_i will be taken as caused by an entity that is different from the category it actually belongs to. In Plebe and De La Cruz (2018) demonstrations are provided on formal properties of (18.7), including the support for homomorphic mapping.

18.4.2 Development of Representations

As seen in Sect. 18.2.1 there is a close relationship between the context influencing lexical understanding in adults, and the effect of context in the early learning of the same word. This relationship is well reflected at the neural level in our account of structural representations. A crucial point regarding neural representations is that responses x_i as those in Eq. (18.2) become meaningful by virtue of a developmental process, in which neural populations responsive to attributes of the entities in $\mathscr{G}$ gradually learn regularities between perceived attributes and categories S. Let $m \in \mathscr{M}$ be the attributes of entities in $\mathscr{G}$ that can be perceived in a stimulus s. In order to couple attributes with neural activation we should provide a generic expansion of the activation functions x_i of neurons in $\mathscr{X}$:

$$\begin{aligned} x_i(s) = f\Bigg(&\sum_{m \in \mathscr{M}} \mathbf{a}_{m,i} \cdot \mathbf{v}_{m,i}(s) + \\ &\mathbf{e}_i \cdot \mathbf{x}_{\mathrm{E},i}(s) - \mathbf{i}_i \cdot \mathbf{x}_{\mathrm{I},i}(s) + \mathbf{b}_i \cdot \mathbf{y}_i(s) \Bigg). \end{aligned} \tag{18.9}$$

The activation of neuron i derives from the summation of four distinct components. The vector $\mathbf{v}_{m,i}(s)$ is composed by afferents to unit i in lower brain areas, which respond to sensorial features associated with attribute m, vector $\mathbf{a}_{m,i}$ is composed by all synaptic strengths of the afferents $\mathbf{v}_{m,i}(s)$. Not every unit i will receive afferents from areas sensitive to all attributes $m \in \mathscr{M}$, in these cases the synaptic vector $\mathbf{a}_{m,i}$ will have null values. The vectors $\mathbf{x}_{\mathrm{E},i(s)}$ and $\mathbf{x}_{\mathrm{I},i(s)}$ are the activation of all neurons in the population $\mathscr{X}$, where a lateral connection exists with neuron i of an excitatory or inhibitory type, respectively. Vectors $\mathbf{e}_i$ and $\mathbf{i}_i$ are composed by all connection strengths of the excitatory or inhibitory neurons projecting to i. The vector $\mathbf{y}_i(s)$ is composed by backprojections from higher brain areas to i, with synaptic strengths in vector $\mathbf{b}_i$. The function f expresses the nonlinearity of the activation of neurons with respect to the summation of input contributions, typically a monotonic continuous growing function limited between 0 and 1.

Equation (18.9) reflects the typical arrangements of connections in the cortex, characterized by afferents, backprojections, and intracortical lateral connections of excitatory and inhibitory types (Grinvald et al. 1994; Cerreira-Perpiñán and Goodhill 2004). This equation, abstracted from details that are not relevant here, is equivalent to that used in neurocomputational models such as LISSOM (*Laterally Interconnected Synergetically Self-Organizing Map*) (Sirosh and Miikkulainen 1997; Miikkulainen et al. 2005) and Topographica (Bednar 2009).

In Eq. (18.9) describing the activation of neuron i all connections can be regarded as plastic, as is the case in a large part of the brain (Bermúdez-Rattoni 2007), and in the cortex especially (Buonomano and Merzenich 1998; Feldman 2009). The development of representations can be accomplished through the exposure of the neural system that includes the population $\mathscr{X}$, and is described by Eq. (18.9), to experiences with all instances in $\mathscr{G}$, while modifying the synaptic weights following a plausible modification of the classical Hebbian law:

$$\Delta \mathbf{a}_{r_\mathrm{A},i} = \frac{\mathbf{a}_{r_\mathrm{A},i} + \eta_\mathrm{A} x_i \mathbf{v}_{r_\mathrm{A},i}}{\left\| \mathbf{a}_{r_\mathrm{A},i} + \eta_\mathrm{A} x_i \mathbf{v}_{r_\mathrm{A},i} \right\|} - \mathbf{a}_{r_\mathrm{A},i}, \tag{18.10}$$

$$\Delta \mathbf{e}_{r_\mathrm{E},i} = \frac{\mathbf{e}_{r_\mathrm{E},i} + \eta_\mathrm{E} x_i \mathbf{x}_{r_\mathrm{E},i}}{\left\| \mathbf{e}_{r_\mathrm{E},i} + \eta_\mathrm{E} x_i \mathbf{x}_{r_\mathrm{E},i} \right\|} - \mathbf{e}_{r_\mathrm{E},i}, \tag{18.11}$$

$$\Delta \mathbf{i}_{r_\mathrm{I},i} = \frac{\mathbf{i}_{r_\mathrm{I},i} + \eta_\mathrm{I} x_i \mathbf{x}_{r_\mathrm{I},i}}{\left\| \mathbf{i}_{r_\mathrm{I},i} + \eta_\mathrm{I} x_i \mathbf{x}_{r_\mathrm{I},i} \right\|} - \mathbf{i}_{r_\mathrm{I},i}, \tag{18.12}$$

where $\eta_{\{\mathrm{A,E,I}\}}$ are the learning rates for the afferent, excitatory, and inhibitory weights, and $\|\cdot\|$ is the L^1-norm. In all equations the numerator represents the Hebbian increase of synaptic efficiency due to coincidental activation of presynaptic and postsynaptic units. The denominator acts as a homeostatic compensation, that tends to keep the average excitability of the neuron constant, in the long term. It implements the mechanism known as homeostatic plasticity (Turrigiano 2011), that counterbalances Hebbian potentiation of synapses. Equations of this kind are used in neurocomputational models of the emergence of representation in the cerebral cortex (Miikkulainen et al. 2005; Plebe and Domenella 2007; Bednar 2012).

Let $x_i^{(0)}$ be the activation of units i in the cortical map before any developmental process, and $x_i^{(D)}$ the activation in the same map after development, for example ruled by equations (18.10), (18.11), (18.12) if units x_i follow a LISSOM formulation. The development of the structural representation over the domain $\mathscr{S}$ here formalized can be assessed by the following constraint:

$$a^{(0)}(S) \approx \frac{1}{|\mathscr{S}|}, \forall S \in \mathscr{S}, \tag{18.13}$$

$$a^{(D)}(S) \approx 1 \gg a^{(0)}(S), \forall S \in \mathscr{S}, \tag{18.14}$$

where $a(S)$ is the function in Eq. (18.8). The accuracy of categorization in a map before development approximates chance probability, after development approximates one, and should be well larger than the undeveloped categorization.

18.4.3 Extension to Linguistic Input

Let us suppose $\mathscr{X}$ is a population of neurons in a higher cortical area integrating multimodal information and internally generated signals, such as the prefrontal cortex.

We can extend the equation to account for linguistic entities as follows:

$$\begin{aligned} x_i(j) : J_{\in \mathscr{J}} \to \mathbb{R}; \quad j = \langle s, n \rangle_{\in J} = \\ \left(\{\epsilon\} \cup \bigcup_{S \in \mathscr{S}} S \right) \times \left(\{\epsilon\} \cup \bigcup_{S \in \mathscr{S}} N_S \right), \end{aligned} \tag{18.15}$$

where s is the perceptual stimulus as in (18.2) and n is an afferent to x_i that provides reference to the concept S. For example, n can be the sound heard in coincidence with the visual stimulus s of a named object, and N_S is the set of utterances naming the category S. But n can be an internal signal from other areas, coding the linguistic form of the name of the category S. The population coding of categories $p(S)$ can be computed with the same procedure described by Eqs. (18.4), (18.5), (18.6), applied now to the activation given by Eq. (18.15). Note that the empty sample ϵ is included, so that stimuli of the form $j = \langle \epsilon, n \rangle$ may elicit in the system $\mathscr{X}$ the representation of the category referred to by n, without the perceptual stimulus s *in presentia*. Conversely, a stimulus of the form $j = \langle s, \epsilon \rangle$ may elicit in the system $\mathscr{X}$ the linguistic form of the word mostly related to the visual object in s.

18.4.4 Contextual Effects

We can now extend the given framework of structural representation to include context. Let s be a stimulus related with the empirical domain $\mathscr{G}$, and c the contribution of the context, not directly part of $\mathscr{G}$, but influencing its interpretation in categories $\mathscr{S}$, we can write:

$$x_i(t): T \in \mathscr{T} \to \mathbb{R}; \quad t = \langle s, c\rangle \in T = \left(\{\epsilon\} \cup \bigcup_{S\in\mathscr{S}} S\right) \times \left(\{\epsilon\} \cup \bigcup_{S\in\mathscr{S}} C_S\right), \tag{18.16}$$

where C_S is the set of all contextual stimuli c that are mostly associated with category $S \in \mathscr{S}$ of the empirical domain at hand. Note that both s and c can be, in turn, split into a perceptual and a linguistic component, as done in Eq. (18.15).

In detailing the response x_i to t we can distinguish two main different contextual effects. In the first one, Eq. (18.9) takes the following form:

$$x_i(t) = f\Bigg(\sum_{m\in\mathscr{M}} \mathbf{a}_{m,i} \cdot \mathbf{v}_{m,i}(s) + \sum_{m_\mathscr{C}\in\mathscr{M}_\mathscr{C}} \mathbf{a}_{m_\mathscr{C},i} \cdot \mathbf{v}_{m_\mathscr{C},i}(c) + \mathbf{e}_i \cdot \mathbf{x}_{\mathrm{E},i}(s) - \mathbf{i}_i \cdot \mathbf{x}_{\mathrm{I},i}(s) + \mathbf{b}_i \cdot \mathbf{y}_i(s)\Bigg), \tag{18.17}$$

where the context exposes, directly or indirectly, some feature as afferent stimulus to the neural population $\mathscr{X}$, accounted in Eq. (18.17) by the terms $\mathbf{a}_{m_\mathscr{C},i} \cdot \mathbf{v}_{m_\mathscr{C},i}(c)$, in which attributes $m_\mathscr{C}, i$ are proper of the context, and in general different to the attributes $m \in \mathscr{M}$ pertaining to the empirical domain $\mathscr{G}$. Both kinds of attributes, however, share a modality that is perceived by the neural population $\mathscr{X}$. An example can be when s is composed by an utterance and a visual object, whose attributes are captured by the term $\mathbf{a}_{m,i} \cdot \mathbf{v}_{m,i}(s)$, and the context is given by the visual appearance of the face of the speaking person, including her gaze towards the named object. It is actually the case of visual cues that affect the auditory speech pathway (Calvert et al. 1997; Bernstein and Liebenthal 2014).

A second kind of contextual effect can be described by the following equation:

$$x_i(t) = f\Bigg(\sum_{m\in\mathscr{M}} \mathbf{a}_{m,i} \cdot \mathbf{v}_{m,i}(s) + \mathbf{e}_i \cdot \mathbf{x}_{\mathrm{E},i}(s) - \mathbf{i}_i \cdot \mathbf{x}_{\mathrm{I},i}(s) + \mathbf{b}_i \cdot \mathbf{y}_i(s) + \mathbf{b}_{c,i} \cdot \mathbf{z}_i(c)\Bigg) \tag{18.18}$$

In this case the context does not expose attributes that are perceived, either directly or indirectly, by the neural population $\mathscr{X}$, rather derives by backprojection from higher cortical areas. It is included in Eq. (18.18) by the term $\mathbf{b}_{c,i} \cdot \mathbf{z}_i(c)$. Typical examples are all the cases when the flow of thought influences the current interpretation of linguistic or perceptual stimuli. The context may concern previous portions of an ongoing conversation affecting the interpretation of the empirical domain $\mathscr{G}$, or mental associations performed by the subject.

18.5 Conclusions

In the present work we have considered a series of research areas, in which context is increasingly being taken into consideration for the important role it plays in different aspects of cognition. These areas are no longer limited to linguistics, or philosophy of language, but now also include cognitive neuroscience. In an effort to bridge these three approaches, we propose a neuroscience inspired concept, neural population coding, as the foundation of structural representations that are able to explain contextual effects, across multiple levels, from neurons to concepts to language. While a detailed unpacking of the proposed framework is certainly beyond the scope of this work, we nevertheless provided a formal description consistent with both the classical cognitive structural representation theory, and with general formulations of neural population coding. Furthermore, we detailed how our representation scheme can develop from experience, taking into account context in a way that parallels contextual effects in early language learning in young children.

References

Airenti, G., & Plebe, A. (2017). Editorial: Context in communication: A cognitive view. *Frontiers in Psychology, 8*, 115.

Barsalou, L.W. (1983). Ad hoc concepts. *Memory and Cognition, 11*, 211–217.

Bednar, J.A. (2009). Topographica: Building and analyzing map-level simulations from Python, C/C++, MATLAB, NEST, or NEURON components. *Frontiers in Neuroinformatics, 3*, 8.

Bednar, J.A. (2012). Building a mechanistic model of the development and function of the primary visual cortex. *Journal of Physiology – Paris, 106*, 194–211.

Bermúdez-Rattoni, F. (ed) (2007). *Neural plasticity and memory: From genes to brain imaging*. Boca Raton (FL): CRC Press.

Bernstein, L.E., & Liebenthal, E. (2014). Neural pathways for visual speech perception. *Frontiers in Neuroscience, 8*, 386.

Boone, W., & Piccinini, G. (2016). The cognitive neuroscience revolution. *Synthese, 193*, 1509–1534.

Buonomano, D.V., & Merzenich, MM (1998) Cortical plasticity: From synapses to maps. *Annual Review of Neuroscience, 21*, 149–186.

Calvert, G.A., Bullmore, E.T., Brammer, M.J., Campbell, R., Williams, S.C.R., & McGuire, P.K., et al. (1997). Activation of auditory cortex during silent lipreading. *Science, 276*, 593–596.

Cappelen, H., & Lepore, E. (2005). *Insensitive semantics*. Oxford (UK): Basil Blackwell.

Carston, R. (2002). *Thoughts and utterances: The pragmatics of explicit communication*. Malden (MA): Blackwell Publishing.

Casasanto, D., & Lupyan, G. (2015). All concepts are ad hoc concepts. In S. Laurence & E. Margolis (Eds.), *The conceptual mind: New directions in the study of concepts*. Cambridge, MA: MIT Press.

Cerreira-Perpiñán, M., & Goodhill, G.J. (2004). Influence of lateral connections on the structure of cortical maps. *Journal of Neurophysiology, 92*, 2947–2959.

Churchland, P.S., & Sejnowski, T. (1994). *The computational brain*. Cambridge (MA): MIT Press.

Feldman, D.E. (2009). Synaptic mechanisms for plasticity in neocortex. *Annual Review of Neuroscience, 32*, 33–55.

Fitzpatrick, D.C., Batra, R., Stanford, T.R., & Kuwada, S. (1997). A neuronal population code for sound localization. *Nature, 388*, 871–874.

Fusi, S., Miller, E.K., & Rigotti, M. (2016). Why neurons mix: High dimensionality for higher cognition. *Current Opinion in Neurobiology, 37*, 66–74.

Georgopoulos, A.P., Schwartz, A.B., & Kettner, R.E. (1986). Neuronal population coding of movement direction. *Science, 233*, 1416–1419.

Goldenberg, E.R. (2015). The role of context in early language development. PhD thesis, UCLA

Goldenberg, E.R., & Sandhofer, C.M. (2013). Same, varied or both? Contextual support aids yound children in genaralizing category labels. *Journal of Experimental Child Psychology, 115*, 150–162.

Grinvald, A., Lieke, E.E., Frostig, R.D., & Hildesheim, R. (1994). Cortical point-spread function and long-range lateral interactions revealed by real-time optical imaging of macaque monkey primary visual cortex. *Journal of Neuroscience, 14*, 2545–2568.

Hills, T.T., Maouene, J., Riordan, B., & Smith, L.B. (2010). The associative structure of language: Contextual diversity in early word learning. *Journal of Memory and Language, 63*, 259–273.

Hinton, G.E., McClelland, J.L., & Rumelhart, D.E. (1986). Distributed representations. In: D.E. Rumelhart & J.L. McClelland (Eds.), *Parallel distributed processing: Explorations in the microstructure of cognition* (Vol. 1, pp. 77–109) Cambridge (MA): MIT Press.

Hume, D. (1748). *An enquiry concerning human understanding*. London: A. Millar.

Krantz, D., Luce, D., Suppes, P., & Tversky, A. (1971). *Foundations of measurement – Volume I Additive and polynomial representations*. New York: Academic Press.

Lehky, S.R., & Tanaka, K. (2016). Neural representation for object recognition in inferotemporal cortex. *Current Opinion in Neurobiology, 37*, 23–35.

Machery, E. (2015). By default: Concepts are accessed in a context-independent manner. In: S. Laurence & E. Margolis (Eds.), *The conceptual mind: New directions in the study of concepts*. Cambridge, MA: MIT Press.

Mazzone, M., & Lalumera, E. (2009). Concepts: Stored or created? *Minds and Machines, 20*, 47–68.

Miikkulainen, R., Bednar, J., Choe, Y., & Sirosh, J. (2005). *Computational maps in the visual cortex*. New York: Springer-Science.

Miłkowski, M. (2013). *Explaining the computational mind*. Cambridge (MA): MIT Press.

Miura, K., Mainen, Z.F., & Uchida, N. (2012). Odor representations in olfactory cortex: Distributed rate coding and decorrelated population activity. *Neuron, 74*, 1087–1098.

Pasupathy, A., & Connor, C.E. (2002). Population coding of shape in area v4. *Nature Neuroscience, 5*, 1332–1338.

Plebe, A., & De La Cruz, V.M. (2018). Neural representations beyond “plus X”. *Minds and Machines, 28*, 93–117.

Plebe, A., & Domenella, R.G. (2007). Object recognition by artificial cortical maps. *Neural Networks, 20*, 763–780.

Quian Quiroga, R., & Panzeri, S. (Eds.) (2013). *Principles of neural coding*. Boca Raton (FL): CRC Press.

Ramsey, W.M. (2007). *Representation reconsidered*. Cambridge (UK): Cambridge University Press.

Recanati, F. (2004). *Literal meaning*. Cambridge (UK): Cambridge University Press.

Russell, B. (1927). *The analysis of matter*. London: Harcourt.

Sakai, K., Naya, Y., & Miyashita, Y. (1994). Neuronal tuning and associative mechanisms in form representation. *Learning and Menory, 1*, 83–105.

Searle, J.R. (1978). Literal meaning. *Erkenntnis, 13*, 207–224.

Sirosh, J., & Miikkulainen, R. (1997). Topographic receptive fields and patterned lateral interaction in a self-organizing model of the primary visual cortex. *Neural Computation, 9*, 577–594.

Sperber, D., & Wilson, D. (1995). *Relevance: Communication and cognition*. New York: John Wiley.

Stark, S.M., Reagh, Z.M., Yassa, M.A., & Stark, C.E. (2018). What's in a context? Cautions, limitations, and potential paths forward. *Neuroscience Letters*. https:doi.org/10.1016/j.neulet.2017.05.022.

Stokes, M.G., Kusunoki, M., Sigala, N., Nili, H., Gaffan, D., & Duncan, J. (2013). Dynamic coding for cognitive control in prefrontal cortex. *Neuron, 78*, 364–375.

Swoyer, C. (1991). Structural representation and surrogative reasoning. *Synthese, 87*, 449–508.

Turrigiano, G.G. (2011). Too many cooks? Intrinsic and synaptic homeostatic mechanisms in cortical circuit refinement. *Annual Review of Neuroscience, 34*, 89–103.

Yuste, R. (2015). From the neuron doctrine to neural networks. *Nature Reviews Neuroscience, 16*, 1–11.

Zemel, R.S., Dayan, P., & Pouget, A. (1998). Probabilistic interpretation of population codes. *Neural Computation, 10*, 403–430.

Part VII
Linguistics Approaches

Chapter 19
First Person Implicit Indirect Reports in Disguise

Alessandro Capone

19.1 Introduction

In this paper, I deal with implicit indirect reports. First of all, I discuss implicit indirect reports involving the first person. Then, I prove that in some cases second person reports are implicit indirect reports involving a *de se* attribution. Next, I draw analogies with implicit indirect reports involving the third person. I establish some similarities at the level of free enrichment through which the explicature is obtained and I propose that the explicature is syntactically active, given that it sanctions anaphora.

An implicit indirect report is a report which does not explicitly display features of indirect reports (e.g. the verb 'say' or the presence of a reported speaker), but implies an evidential base requiring the structure of an indirect report. Most importantly, in this paper I demonstrate that such structural elements are active from a syntactic point of view in that they allow anaphora under certain conditions. Although it is the speaker's meaning that matters in these cases, insofar as it intrudes into the explicature and it requires a certain (compulsory) logical form, the elements of the logical form implied at the level of the explicature are syntactically active. Furthermore, they sometimes require syntactic slots such as the experiencer and,

I first considered the issue of implicit indirect reports when reading a paper by Elizabeth Holt that was submitted for my collection on indirect reports and pragmatics (Springer 2016). There was little discussion about implicit indirect reports because the focus was on indirect reports in general, but there was sufficient to allow me to give some consideration to this topic in Capone (2016) (implicit embeddings), and now in the present paper.

A. Capone (✉)
University of Messina, Messina, Italy
e-mail: acapone@unime.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_19

furthermore, and somewhat surprisingly, in the case of second person reports what is being implied is a structure hosting a *de se* implicit attribution which allows an internal perspective. Such implicit indirect reports with *de se* ramifications are to be considered as logophoric structures that present the perspective of a particular person, and in general the experience is linked to a time which is posterior to the event being narrated in the indirect report.

The issues addressed by this paper go beyond the topic being explicitly discussed, as issues are raised on the nature of the explicature involved in semantic/pragmatic analysis and the possibility that elements of the explicature are syntactically active. Such considerations can also be extended to other types of explicatures and have to be pursued in due course.

I also find it rather surprising that from a speaker's intentions we can go on to reconstruct the explicature and its syntactic configuration, an aspect which is not normally discussed in the literature. That the explicature should have a compulsory syntactic configuration as a result of the speaker's intentions is somewhat novel in the literature.

For example, when I discussed belief reports and their opacity (Capone 2008), I found it useful to explain the explicature by pointing to a syntactic configuration, which would solve lots of problems arising from the introduction of modes of presentation. I proposed to analyse an utterance such as "John believes that Mary is clever" as consisting of an articulated sentence and an appositive sentence conjoined to it. The appositive sentence merely expresses a concatenation of modes of presentation, while the simple sentence only represents referential interpretation of an articulated sentence. Anaphoric links between elements of the appositive sentence and nodes of the simple sentence would allow us to reconstruct pragmatic opacity. This resolves the thorny problems of the logical form of belief reports, because the pragmatics of the utterance is helped by the reconstructed syntactic analysis of the actual sentence uttered and the sentence which is in the air, an unarticulated sentence rather than an unarticulated constituent.

Concerning indirect reports in disguise, we can say that a syntactic analysis is coupled with a certain semantic-pragmatic interpretation and helps guide the interpretation. That syntactic analysis is conducive to meaning, but the syntax is not at the level of the articulated sentence but is part of a pragmatically reconstructed sentence. The fact that unarticulated pragmatically reconstructed constituents should have some syntax is not surprising, though some may be prepared to deny this. If an unarticulated constituent is a sentence, it must have some syntax, but this does not come from the explicit logical form but from the mind of the reader who reconstructs the interpretation.

We assume that more examples than are under discussion in this paper can be subjected to a similar analysis, as most cases in which one cannot directly know another person's mind but gets to know it through what a speaker has said, potentially constitute cases that can be analysed as implicit indirect reports. Even innocent remarks such as, *John has a pain in his stomach*, can be analyzed as implicit indirect reports, given that the question arises as to how we know what is happening in John's mind or body if he has never told us what has happened to him. Since we cannot know what he feels like telepathically, it must be reasonable to assume that we know this by some other means and, presumably, through what John has said to us about his corporeal sensations. A speaker's intentions prevail and a deeper logical form has to be reconstructed. The Wittgensteinian idea that at least a number of utterances must have a logical form that is different from what is superficially testified by the utterance is, therefore, vindicated.

I received a stimulating comment by one of the reviewers of this paper, which runs like this:

The idea is very stimulating and interesting, but perhaps the author extends a little too much the possibility of considering statements, for example in the first person, as "implicit indirect reports." In fact, if we consider the author's example "John has a pain in the stomach" it can be considered as an indirect report because, as maintained by the author, "John could have told me he had a stomachache." And therefore the expression is correctly understood as an implicit indirect report. Although this could be true in many cases, I do not think that I can state that this kind of sentence is always an implicit indirect report. For example, I can say that "John has pain ... " because I saw john contorting like when people have stomach ache, or because I know he has ingested a poison. Further, how do we know that a person feels depressed? Canonical evidence is provided by the person's utterance which expresses feelings and state of depression. Thus, 'You feel depressed' is pragmatically equivalent to 'You say you feel depressed', which is an indirect report. Thus, utterances such as (5) can be considered indirect reports in disguise. This is true but only if we consider the sentence "You are depressed" based on the previous utterance "I feel depressed." But what if just you look depressed?

I have great respect for this position. However, it actually helps build up the case that the inferences I am talking about are pragmatic, since they are defeasible in certain contexts, or because they are sensitive to contextual information, which plays some role in promoting them or in demoting them. I suspect, nevertheless, that the reviewers have somehow interpreted me as saying or proposing that these are default inferences, in which case they would be right that at least in certain cases they would not arise. However, I suspect that these are genuinely contextual inferential phenomena, where the context plays a role not only in cancelling an inference but also in promoting it. Needless to say, I agree with the reviewer that there are contexts in which we look at someone and know that she is depressed, without waiting to hear her utterance. But in some cases (e.g. telephone conversations), linguistic information is essential and in reconstructing the inferential layers of the response we see that some pragmatics is required to make a report an indirect report in disguise. All in all, I agree with the reviewer that here there may be different cases to note and discuss.

19.2 The Scope of Pragmatics

Semantics deals with aspects of meaning that are independent of context.[1] These are relatively stable and provide a structure upon which further meanings can accrue to the utterance.[2] Normally, semantics is fueled by words and the syntactic glue that combines them. Scholars in pragmatics believe that semantics is underdetermined, which means that even if we know the semantics of a certain expression, we do not know enough to know what the world is like (exactly). We more or less know what the world must be like, but this may not be enough for the purpose of knowledge. Capone (2016) has expressed the view that there may be a certain degree of exaggeration in this under-determinacy claim. At least certain words have stable meanings. If we know, for example, that there is a rose in Capone's house, we know what kind of flower we can expect there to be in that house. However, I admit that many examples are unlike this simple one and may advance the view that there are pragmatic increments to utterance interpretation which are fuelled through explicatures – that is, inferential enrichments are often of the free type (see cases of belief reports, knowing how attributions, indirect reports, attributive/referential attributions, *de se* attributions, etc.). I also agree that enrichments processes may go beyond reference assignment and ambiguity reduction. My view is that rationality can provide suitable expansions to sentential meanings.[3] When one takes into account what the speaker can rationally mean, we can reconstruct what s/he says. Very often such expansions serve to enrich the lexicon or the syntax. In other words, they are powerful ways of maximizing the linguistic resources of a language. Pragmatics is like a set of tools that can amplify the power of the language user. But, of course, this is no more than a metaphor, albeit a useful one, particularly for those languages such as pidgins which are impoverished and are stripped of semantic and grammatical resources. Thus, pragmatic enrichments range from reference fixing (saturation processes) and ambiguity resolution to free enrichments of the expansive type, (often) aimed at resolving logical problems such as blatant falsehood, contradiction and absurdity. These increments are the pragmatic components of explicatures. There has been a debate within the literature about

[1] Although, in some cases, semantics appears to be like an instruction which takes context as input, in a particular way, and gives a specific truth-evaluable content as output.

[2] Semantics provides a platform on which further meanings can be constructed. Most importantly, the unenriched logical form is capable of working as a premise in an act of reasoning which is conducive to fuller interpretation, provided that basic operations such as reference fixing and disambiguation have occurred.

[3] Synthetically, rationality is what leads to processes of reflective and unreflective inference in which a number of premises, including the literal meaning and the disseminated contextual clues, are put together (combined) in an argument that leads to a full interpreted proposition. The Gricean maxims or suitable equivalents (in expanded or compressed form) also work as premises in the argument. Since in an argument, we normally need something that leads from a set of premises to a conclusion, that is, a warrant, we can assume that in pragmatic inference the role of the warrant is played by the necessity of having speakers' intentions that obey canons of informativity.

whether these increments are cancellable or not. Pragmatists (notably Carston 2002) believe that pragmatic inferences, explicatures included, ought to be cancellable, with cancellability being the hallmark of pragmatic inference. Other scholars, for example, Capone (2003, 2006, 2009, 2013) proposed that the pragmatic components of explicatures ought not to be cancellable due to strong intentionality and to the fact that they are expected to resolve logical problems, which would remain if the explicature was cancelled (Jaszczolt (2016) writes about entrenched meanings, while she is not particularly explicit about the cancellability of explicatures). Thus, explicature cancellation would result in anomalies at the discourse level, in the cases of explicatures dealt with by Capone. (Of course, if the notion of explicature is extended, as proposed by relevance theorists, to cases of conversational implicatures (e.g. the quantifier 'some'), then Capone's considerations are not immediately applicable). Capone's considerations make sense if a strong notion of explicature is considered and if attention is confined to cases like those originally discussed in Carston's work.

In this paper, I am going to discuss the issue of implicit indirect reports. Thus, I need to provide some useful background that will enable the reader to make progress in the understanding of what is to follow. Indirect reports are usually micro-narrations relating utterances (an utterance is surely an event from a Davidsonian perspective) without doing so *verbatim*, that is, by reporting the exact words proffered by the original speaker.[4] They are usually summaries of stories, in which small details can be omitted, although the reporter is not allowed to offer a perspective that is totally removed from the perspective of the original speaker. Indirect reports are implicitly logophoric, in that they must be aimed at reproducing the perspective of the original speaker – at least they should not alter it too much and they should not present a self that is drastically different from the self of the original speaker. For example, it is not usually licit to replace some words with epithets or slurring expressions, even if the denotation is the same, because doing so would amount to representing the original speaker as someone who would use epithets or slurs, which is not (or need not be) the case. The perspective should not be altered – thus, indirect reports could be considered implicitly logophoric. Indirect reports are usually employed when the hearer is removed in space and time from the event of the utterance being reported. The context that facilitates the understanding of the pronominals contained in the indirect report is usually (with some exceptions) the context of the hearer, since the hearer has to have access to referents and the best way to have such access is to situate pronominals in a context which is accessible to the hearer. The original context of the utterance, being removed in time and space from the hearer, cannot be useful for the purpose of constructing reference. Furthermore, presuppositions need to be satisfied and they have to be satisfied in a context that is accessible to the hearer, not in one that is only accessible to the reporter or to the

[4] Some believe that verbatim direct reports are a fiction, given that due to memory limitations we always make changes in the reported utterance. However, it should be taken for granted that, at least in the written medium, verbatim quotation does makes sense.

original speaker. For the time being, these considerations may suffice to allow the hearer to proceed with reading the presentation of the topics being discussed in this paper. Finally, indirect reports can either be explicit or implicit. If they are implicit, one usually has to reconstruct who the reporter is and when the report was proffered. Usually, one has to first of all resort to some contextual clues to understand that an implicit indirect report is needed and, secondly, in order to reconstruct the structure of the indirect report. Implicit indirect reports are more common than imagined, even though one can find very little in the literature by which to construct a theory of implicit indirect reports. Some clues can be found in Holt (2016) and in Capone (2016), who devotes a chapter to simple sentences, substitution failure and implicit indirect reports. The present paper is also a small step in the direction of the theory of implicit indirect reports.

19.3 First Person Implicit Indirect Reports

Suppose A says:

(1) I am depressed.

This may overlap, or otherwise be very different in content from (2)

(2) I feel depressed.

If it does not overlap with (2), it can be said to be uttered on the basis of a warrant provided by some other speaker's utterance, such as 'You look depressed/You are depressed'.

Something very similar can happen in the second person. A can say:

(3) You are depressed.

This may overlap with either (4) or (5):

(4) You look depressed.
(5) You feel depressed.

If it overlaps with (5), (3) (You are depressed) is an implicit indirect report, something said on the basis of the warrant given by an utterance of (5) by the person whose state of mind is being described by (3). How do we know that a person feels depressed? Canonical evidence is provided by the person's utterance which expresses her feelings and state of depression. Thus, 'You feel depressed' is pragmatically equivalent to 'You say you feel depressed', which is an indirect report. Thus, utterances such as (5) can be considered to be indirect reports in disguise. An utterance is an indirect report in disguise when accepting it amounts to accepting an utterance on which it can be based, and without which there would be no evidence for the utterance in question. An indirect report normally has an implicit base, which is the explicit direct report on which it is based. Without such an implicit base, the utterance makes no sense, it has no evidential support, and amounts to an admission that the speaker is saying something without an evidential base.

The considerations above can be taken to introduce the issue of implicit indirect reports, but also the issue of the specularity relationship between the first and the second person (singular). In a dialogue, the addressee can act as a mirror and can be a source of self-knowledge for the first person subject. Anything that is first person can be referred to as second person, and anything that is second person can be referred to as first person. In this kind of game, anyone who uses the third person (e.g. 'He is depressed'), can be seen as speaking and acting from outside the game. Normally, a subject who uses the first person does not refer to himself by name; and a subject who uses the second person to refer to the addressee does not use a name, but prefers to use a pronominal. (The reason why we use pronominals for ourselves, rather than names, is possibly linguistic economy, given that a name needs a different kind of contextualization and can potentially pick up many referents, while the pronominal 'I' can, at most, pick up one referent in the context of the utterance, relative to the utterance). Someone who is outside the game can use either a pronominal or a name to refer to the participants in the I-you language game. A dialogical game involves the use of pronominals by the actors in order to refer to the actors who are playing the game. Anyone outside the dialogic game can use a name for the actors in the game. It is as if the use of pronominals vs. names marks an imaginary boundary between the I/you and the they, i.e. those who are inside the game and those who are outside.

Now, consider the following utterance:

(6) I never wanted to jump off the swing.

The speaker was 3 years old at the time of the event. He has pictures of that event, but he does not remember the event through memories from the inside (he does not have memories of himself being on the swing and not wanting to jump off when his sister wanted to join in the game).[5] As Higginbotham (2003) states, he has external memories that he was on the swing, because his mother and father told him about that event (alternatively he has some pictures as evidence of that event), he remembers the event from the outside, but he does not remember it from the inside. According to Higginbotham (2003) and Capone (2010), there is a difference between (7) and (8)

(7) I remember that I was on the swing
(8) I remember being on the swing.

The control construction [I remember PRO being on the swing] is even more first-personal than the one with the first-person construction, as it involves a genuine

[5]Interesting interpretative issues emerge. Is (6) equivalent to 'I remember I never wanted to jump off the swing'? The other interpretative possibility is: 'I remember never wanting to jump off the swing', which is even more first-personal than the former interpretation. As Higginbotham (2003) would state, the latter interpretation is more logophoric in that it involves the internal perspective of the speaker qua the experience and subject of the act of remembering.

self-based perspective which allows remembering from the inside. If the memory is linked with joy (or, alternatively, with pain), one should remember the joy or the pain if one has remembered it from the inside. But if one remembers the event because someone has told one about it, and that person forgot to describe the associated sensations (experienced from the outside), one would not be able to remember them.

Returning to (6), given that the speaker was 3 years old (as attested by the pictures that he still owns), he could not (normally) remember the event from the inside and, thus, the recipient of the utterance will reason that the event is a memory based on someone else's recollections. Thus, it is not a direct report, but must be an implicit indirect report. This means that (6) must be embedded in something like (9),

(9) [I was told (by my mother) that] I never wanted to jump off the swing.

The sentential fragment flanked by the square brackets has been reconstructed. It is not part of the logical form of the sentence, but it is part of the explicature through which the utterance is understood. We may well, at this point, ask ourselves how active these components of the explicature can be. We may want to know if something like the following, which allows explicit anaphora, is licit.

(10) [I was told (by my mother) that] I never wanted to jump off the swing; thus, at one point, I started asking her whether my sister was unhappy about that.[6]

As far as we are aware, a structure like (10) involving an anaphoric link between 'her' and 'my mother' does not seem to be licit. The use of 'her' must be sanctioned either by an anaphoric site ('my mother') or by a referent salient in context. If neither of the two cases materializes, the utterance is uninterpretable and, thus, fails to be licit. However, it is possible that the explicature should be minimal and, thus, we should have (11) rather than (10):

(11) [I was told (by someone) that] I never wanted to jump off the swing; thus, at one point, I started asking her whether my sister was unhappy about that.

Utterance (11) does not appear to be much better than (10), but this may be due to the fact that 'her' has specific features while 'someone' has non-specific features. In fact, (12) appears to be much better than (11) because the null pronominal 0 in the object position with respect to 'ask' has unspecific features.

(12) [I was told (by someone) that] I never wanted to jump off the swing; thus, at one point, I started asking 0 whether my sister was unhappy about that.

[6] *Vividness* should be taken to be an inferential syntactic structure which is associated with past tense reports (especially second person reports) requiring a logophoric interpretation. The structure is hosted through the syntactic device of a relative clause construction in an event which is implicit in the semantic/syntactic analysis of the main verb expressing the substance of the report, while we can say that the implicit event of the semantic analysis (a Davidsonian event structure) potentially hosts the syntactic construction that expresses vividness. A vividness implicit structure must be triggered by a number of contextual clues that say something about the participation of the speaker in the reported event.

It is true that we have now reached a dilemma. How can we know if 0 has independent reference or whether it is anaphorically linked with ‘someone’? They may happen to have the same reference by pure chance. Yet it cannot be as a result of pure chance, as demonstrated by the following more specific interpretative act:

(13) [I was told (by someone (who knew the event in that he participated in it)) that] I never wanted to jump off the swing; thus, at one point, I started asking 0 (who knew the event in that he participated in it) whether my sister was unhappy about that.

The conclusion we have reached is fairly important, provided no flaws can be found in the argument, because it demonstrates that the explicated part of the explicature, that is the implicit component of the indirect report, is syntactically active at the level of anaphoric connections. Of course, the price we had to pay in order to reach this conclusion was to resort to minimality. We saw that, by choosing a more explicit (and specific) explicature, we could not obtain the same result.

Clearly, for (13) to make sense, ‘someone’ and 0 must be restricted in the same way, because someone who was not present at the event (someone selected at random in an arbitrary way) could not necessarily be able to reply to the question being asked. This does not mean that, in deriving the explicature, we cannot further enrich the minimal explicature through further expansion. We can indeed, but we have to be careful to maintain the minimal explicature in the expanded construction so that anaphoric phenomena can still be licensed.

19.4 Second Person Indirect Reports and Implicit ‘de se’ Attributions

Now consider a variation on (6) (I never wanted to jump off the swing):

(14) You never wanted to jump off the swing.

The person who utters (14) can be my father (or mother) who has vivid memories of the events in question (sitting on the swing, not wanting to jump off the swing, etc.). However, if my sister says (14) (or something like (14)), given that she (my sister) was also too young to remember, it is likely that spoken by my sister, (14) is a sort of echo of what my father or my mother used to say in their narrations of the past (I remember this story recurred several times in my life). Thus, spoken by my sister, the utterance should be seen as having an implicit base, which is an indirect report like:

(15) I was told (several times) that you never wanted to jump off the swing

or

(16) Dad used to tell us that you never wanted to jump off the swing.

Our readers may now become impatient and begin to ask why we are making such a fuss about (14), which is a report, and possibly an indirect report in disguise. The fuss we are making about (14) is justified, because if (14) is merely based on an indirect report (and thus is an indirect report in disguise) its vividness is taken away. *Vividness* is like the direct participation in an event and is the recording of sensations linked to that event and experienced in that event. Thus, if (14) were not an indirect report, it would have a vividness that (14) qua an indirect report lacks: the sensations associated with the event and experienced from the inside. My sister, seeing that I never wanted to jump off the swing, may have experienced sensations of envy. Now, while the report may be not explicit about these experiences of envy, unless it is based on an indirect report, it should have a structure that reserves a slot for the experience at the syntactic level. Thus, our claim is that the implicit indirect report (14) would be different, syntactically, from the report (14) which is not based on an implicit indirect report. Thus, (14) which is interpreted as being something different from an indirect report, would have the following structure:

(17) You never wanted to jump off the swing in event e experienced by myself.

Adopting logical notation:

There is an e, e < utterance U (You never wanted to jump off the swing) and you never wanted to jump off the swing in e and e has at least two participants (you, I) and e was experienced from the inside by myself.

If (14) is interpreted as being an implicit indirect report, it should have a different structure along the lines of (18)

(18) There is an event e, and e < U (e is in the past with respect to U) and e has at least two participants (You, the indirect reporter) and e is the event of your not wanting to jump off the swing (at any of times t.....tn of interval T) and U was reported to me by the indirect reporter in event e', such that e < e' < U.

Now, although the event is narrated from an external point of view being based on someone's else's narration, it is not to be excluded that there may be further structure to this utterance, given that the speaker, in reporting what was reported to her, may be an experiencer with respect to the event of the indirect report through which she knew the reconstructed event. In fact, in listening to the report, she may experience envy. Now, if I am correct, there should be a syntactic slot for the experiencer attached to the indirect report, along the following lines:

There is an event e, and e < U (e is in the past with respect to U) and e has at least two participants (You, the indirect reporter) and e is the event of your not wanting to jump off the swing (at any of times t.....tn of interval T) and U was reported to me by the indirect reporter in event e', such that e < e' < U and I was the experiencer with respect to the indirect report of U.

Could there be a syntactic motivation for this analysis? Perhaps data like the following will provide a syntactic motivation:

(19) You never wanted to jump off the swing and I resented that.

In (19), the pronominal 'that' is surely anaphoric, but anaphoric to what? The utterance could be ambiguous in two ways:

(20) You never wanted to jump off the swing and I resented that (the fact that you never wanted to jump off the swing).

This is a double implicit indirect report, as the feeling of resentment may have been reconstructed through the memory provided by the indirect reporter, who did not restrict herself to telling a story of an external event but also gave expression to feelings which were expressed at those times by one of the participants. Thus, (20) should be pragmatically equivalent to

(21) You never wanted to jump off the swing and I resented that (the fact that you never wanted to jump off the swing), as my mother told me.

Thus, in (21) there are two indirect reports and the events reported may belong more or less to the same period (or they may be part of a sequence in the same period in the past).

A different interpretation of (19) would be the following:

(22) You never wanted to jump off the swing (mum used to tell us) and I resented that.

Could 'that' be now anaphorically linked to 'Mum used to tell us?'. This is not very plausible, although we are not sure whether it is possible or impossible. But (22) appears to be different from (21), due to the temporal specification of the event of resenting. While in (21) the event of resenting is located in the past with respect to the indirect report (my mother told me), in (22) it seems to be in the future with respect to the event of mum's telling of the story. Now it ought to be clear that (22) has further structure:

(23) You never wanted to jump off the swing (mum used to tell us and I was the experiencer in the event of her telling us and I experienced x during and after her telling us) and I resented that.

It is clear at this point that the resentment concerns the experience x and not the real event, because the speaker cannot remember the event of resenting S's not wanting to jump off the swing, from the inside. Instead, the speaker can experience the event of resentment from inside by hearing the indirect report, and only after hearing the indirect report. What is being resented is not the fact but the experience of the fact experienced through the indirect report.

When we look at all this, we clearly see that, after all, (14) is not only an indirect report in disguise and not only a case of a double indirect report, but it is also a case of a 'de se' indirect report (in disguise). Reference to participation or experience of an event from the inside takes us back to Higginbotham's (2003) view of *de se* reports. De se reports with PRO, according to Higginbotham, involved direct participation and experience of an event from the inside. Now, if this is the case, we can propose a minor, but not negligible or insignificant, modification of (23):

(24) You never wanted to jump off the swing (mum used to tell us) and I remember experiencing x, I was the experiencer in the event of her telling us and I experienced x during/after her telling us and I resented that.

Now, it seems to me that (24) has the structure of a *de se* report and, thus, satisfies certain desiderata of *de se* reports with respect to internal participation and from experiencing a memory from the inside.[7]

We have seen that by reasoning on the utterance and on what the evidential base for it ought to be, we have reconstructed an explicature which has a relatively complex logical form. Could this explicature be cancelled? Now, while Capone believes that explicatures are not cancellable for certain motivations, such as with issues of strong intentionality and logical well-formedness, we have specific reasons here to maintain that the explicature is not cancellable. In fact, cancelling the explicature means proceeding backwards in the enrichment process. But we should remember why we needed the enrichment process: we reconstructed an evidential base and a reasonable way to do so was to reconstruct the discourse that preceded the utterance (14). Unless an evidential base is reconstructed, the utterance remains up in the air. How does the speaker know that X never wanted to jump off the swing? The event being referred to belongs to a time in the past during which the speaker was too young to remember what happened. Thus, she has to rely on her mother's memories and the narrations available to her memory. Reconstructing the evidential base is not easy. An objection we may receive is that a hearer may not be interested in the evidential base for the utterance. When a speaker speaks, we trust him and accept what he says, unless there are reasons for not doing so. Why should we care about his evidence? We may believe that the issue of evidence is negligible, particularly if the events in question do not involve a substantial modification of our habits, attitudes or actions. Why should we care how one knows a fact? That he indeed narrates a fact is sufficient warrant for believing that the fact is to be considered. But this is like admitting that, if someone were to be challenged by the question "How did you come to know this?", he would not be able to reply. But this is not what is involved in the praxis of asserting things, narrating stories or facts. The evidential base may be implicit, but we should always be able to make it explicit, should it be required.

[7]It is most interesting that these considerations conform with Jaszczolt's (2016) view that "both I and you can be regarded as pertaining to modes of reference *de se* or self- ascription" (her argument is that when one attributes a quality (or predicate) to the second person, the attribution must be recovered by the addressee by using the first person).

19.5 Operation Cases

Now, consider the following utterance.

(25) When I was operated on, the surgeons had to use a special tube so that I could breathe.

By the standards established by the previous examples, this can also be considered as an implicit indirect report. As everyone knows, when one is being operated on, one is unconscious and, thus, cannot be aware of the techniques or instruments being used. The speaker was himself told by his doctors (after the operation was over) that they had to use a special tube so that he could breathe, because a normal tube was too thick. All he remembers is the preparations for the operation and the moment he was given an injection of narcotic – he slept and did not see any of the events happening to him. Given that this is a stereotypical situation, the recipient of (25) is able to assess that the speaker does not know this fact first-hand, but that he has second-hand knowledge and, thus, his report is based on another person's report (the surgeon's). Therefore, the recipient is able to reconstruct the utterance (26):

(26) (I was told by one of the surgeons that) When I was operated on, the surgeons had to use a special tube so that I could breathe.

Now, suppose that the recipient replies:

(27) This happened to me too.

An opponent of the explicature view might respond that such a reply will be anaphoric to only one portion of the utterance – that is, the explicit part, but cannot be anaphoric to the implicit part. In other words, 'This' is anaphoric to the fact 'that the surgeons used a special tube so that I could breathe', except for the reference of 'I', which should be switched to the current speaker and the reference of 'the surgeons', which has to refer to the surgeons in a different context (the context of the recipient's memories). The form of anaphora being used here is quite sloppy. It is not the specific fact that is being taken up anaphorically, but the general structure of the fact, while the references of certain NPs are to be anchored in a new context. However, the opponent of the explicature view may maintain that even this kind of sloppy anaphora cannot be applied to the implicit component of the explicature. Thus, 'This' cannot refer to the whole utterance 'I was told by the surgeons that when I was operated on, a special tube was used so that I could breathe'. But are we sure that this must be the case? Consider the following case:

(28) A: (I was told by one of the surgeons that) when I was operated on, the surgeons had to use a special tube so that I could breathe.
B: This happened to me too. My surgeon told me the same story.

(28B) can be interpretatively ambiguous. It can either mean 'This fact (the surgeons used a special tube) happened to me too' or 'This fact (I was told that the surgeons used a special tube) happened to me too'. In the case in which 'This' refers to the story by the surgeons, anaphora must be said to be sanctioned by an implicit component of the explicature. B's utterance simply makes the explicature explicit and disambiguates that section of the utterance which is being referred to anaphorically.

We have made enough progress in showing that the explicature is syntactically active in sanctioning anaphora, either through a part of it (a nominal) or through the whole utterance as reconstructed through the explicature.

19.6 Extending the Analysis

The story we have told so far is similar to that proposed by Capone (2016), a propos of simple sentences and substitution failure. The Fregean apparatus has so far been applied to belief reports and verbs that introduce intensional contexts. We would normally expect replacements of NPs to be licit in simple sentences (*salva veritate*), but not in intensional contexts, such as 'Mario believes that Elizabeth is in Rome'. Given that Mario does not believe that Elizabeth is Queen Elizabeth in disguise, even if we know this identity we cannot freely replace 'Elizabeth' with 'the Queen of England', because Mario would never give his assent to that substitution, given what he knows and believes.

However, Saul (2007) discusses various cases in which even in (apparently) simple sentences Leibniz's Law does not work and substitutions are not licit, as they result in sentences having different truth conditions. One such case is:

(29) Clark Kent went into the phone booth and Superman came out.

If we replaced 'Superman' with 'Clark Kent' we would obtain, according to Saul, a statement having different truth-conditions.

How can this be? We do not need to invoke universal opacity, as Saka p.c. does, to explain cases like these. Capone's solution (in Capone 2016) was to posit that an intensional context is created through an explicature, as in the following case:

(30) (The story says that/we are told that) Clark Kent went into the phone booth and Superman came out.

In other words, (29) is an implicit indirect report. Capone (2016) invoked the machinery of explicatures and, in particular, free enrichments to explain this example (and similar ones). Given the implicit indirect report in which there is a verb of saying, we now have an intensional context, and this suffices to explain why substitutions of coextensive NPs cannot occur (*salva veritate*). Now, given that this case, even if it does not involve the first person, reminds us of those cases which were previously discussed concerning the first person, we want to establish whether the explicated (implicit) parts of the explicature in (30) are also syntactically active. This would be a positive step towards demonstrating that a case can indeed be made for the presence of an explicature.

Certainly, it only takes a small stretch of the imagination for us to conceive examples like the following:

(31) Clark Kent went into the phone booth and Superman came out and a similar story can be said of Spiderman.

The reconstructed explicature in (31) is spelled out in (32).

(32) (The story says that/we are told that) Clark Kent went into the phone booth and Superman came out and a similar story can be said of Spiderman.

Now, while we have made some progress in demonstrating that the explicature is syntactically active because it is a site for anaphoric uptake (similar), we should reply to the skeptic's objection that in this case 'story' can be taken in a (more) factual sense. We do not need to presuppose that the story we are talking about is a fictional one, as it may be a story about real world facts. We can accept that there may be an ambiguity of this sort. But the purpose of explicatures is also to settle ambiguities and to select one reading out of possible number. Thus, in one reading, the story is not a factual one, but a fictional one. And this is all that is required to explain that substitution of an NP with a coextensive one (*salva veritate*), in such an *ad hoc* intensional context, is not licit.

19.7 Conclusion

This paper shows us how we should deal with explicatures. It is not sufficient to state that there is an explicature. We would have to extend such a story by demonstrating that the explicature has certain logical properties and is syntactically active. One way of showing that an explicature is syntactically active is to demonstrate that it can sanction anaphora. Possibly, we need to further discuss this important topic, but at least we have shown that we need to create a new chapter on the theory of explicatures. Most importantly, we have noticed that a large gap may exist between what is said and what is intended, and that superficial syntax is a poor guide to the complex logical form of the utterance. When we talk about the logical form of the utterance, we are referring to the explicature and its syntactic configuration. After all, even if explicatures are pragmatic devices (consisting of a sentence and a pragmatic component that can be added to the sentence or can supersede the sentence altogether), they need to have a syntactic structure, and we have proven that speakers' intentions can help shape the syntactic structure of an explicature.

References

Capone, A. (2003). On Grice's circle. *RASK: International Journal of Language and Communication, 19*, 3–32.

Capone, A. (2006). On Grice's circle. *Journal of Pragmatics, 38*, 645–669.

Capone, A. (2008). Belief reports and pragmatic intrusion. The case of null appositives. *Journal of Pragmatics, 40*(6), 1019–1040.

Capone, A. (2009). Are explicatures cancellable? Towards a theory of the speaker's intentionality. *Intercultural Pragmatics, 6*(1), 55–83.

Capone, A. (2010). "Between Scylla and Charibdis": The semantics and pragmatics of attitudes 'de se'. *Journal of Intercultural Pragmatics, 7*(3), 471–503.

Capone, A. (2016). *The pragmatics of indirect reports. Socio-philosophical considerations*. Cham: Springer.

Capone, A., Kiefer, F., & Lo Piparo, F. (Eds.). (2016). *Indirect reports and pragmatics*. Cham: Springer.

Carston, R. (2002). *Thoughts and utterances. The pragmatics of explicit communication*. Oxford: Blackwell.

Higginbotham, J. (2003). Remembering, imagining and the first person. In A. Barber (Ed.), *Epistemology of language* (pp. 496–533). Oxford: OUP.

Holt, E. (2016). Indirect Reported Speech in Interaction. In A. Capone, F. Kiefer, & F. Lo Piparo (Eds.), *Indirect reports and pragmatics: Interdisciplinary studies* (pp. 167–187). Cham: Springer. 21 p. (Perspectives in Pragmatics, Philosophy & Psychology; vol. 5).

Jaszczolt, K. (2016). Meaning in linguistic interaction. In *Semantics, Metasemantics, philosophy of language*. Oxford: OUP.

Peacocke, C. (2014). *Subject, consciousness and self-consciousness*. Oxford: OUP.

Saul, J. (2007). *Simple sentences, substitution and intuitions*. Oxford: OUP.

Chapter 20
Performance of Understanding: Pragmatics and Fast and Frugal Heuristics

Marco Carapezza

Abstract What determines the meaning of an utterance is a logical matter and as such must be treated independently of the bio-cognitive constraints that operate in our bodies. This thesis, whose great supporter was Frege, implies a clear notion of rationality that seems not to bear comparison with what we know on the limits of our rationality. Various theories (Kahneman and Tversky 1983; Gigerenzer et al., 1999), thematizing the need to consider our rationality beginning from the bio-cognitive constraints that our body imposes on a mass of information, can be of great utility for facing the problem of what type of rationality operates in phenomena of linguistic understanding (Ferreira and Patson 2007; Christiansen and Chater, 2016). From this picture it will clearly emerge that understanding is a performance of human organisms that cannot be described without considering the effective bio-cognitive constraints at work in our actions.

20.1 Rationality and Language

The dominant paradigm of philosophy of language, still represented by a line linking Frege to Chomsky, has treated the theme of linguistic meaning and its understanding as if it were a problem independent of the real *performances* of the speakers that live in languages. Even when it has considered the performances of speakers, as in the case of pragmatics, it has done it, – from Grice (1957) down to Sperber and Wilson (1995) – furnishing an idealized version of their computational ability, necessary, for example, for the construction of *implicatures.*

M. Carapezza (✉)
University of Palermo, Palermo, Italy
e-mail: marco.carapezza@unipa.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_20

In other words, it has treated speakers as if they were computational tools endowed with extraordinary cognitive abilities and not as *embodied* subjects (Gallese 2008; Pennisi and Falzone 2016) endowed *with* particular bio-cognitive constraints that actively operate in the phenomena of processing of information that are at the basis of phenomena of understanding (Carapezza and Cuccio 2018). In a framework of this type, understanding of the linguistic utterance seems to be seen as a mental event, something that happens to be or not be, and not as the result of certain abilities each time brought into play in performative activity, taking place within certain limits, involving different cognitive abilities. For an ample treatment in the evolutionary key of the performative dimension also seen in relationship to the bodily structures that in effect put them in place, the reader is referred to Pennisi and Falzone (2016). Here I will focus on some characteristics that emerge when we consider phenomena related to understanding as *performance* whose results can be very different, just as the criteria are different that we use for attributing understanding to our interlocutor or not (Wittgenstein 1953). It must immediately be clarified, to avoid misunderstandings, that by understanding here we essentially mean the performative ability of a speaker-listener to follow on from the linguistic stimulus provided by another speaker-listener or, in other words, to follow on from the movements of the linguistic game involving speakers-listeners.

A theory that wants to focus on real interactions among speakers should consider their real abilities and, therefore, their real cognitive limitations, beginning from the choice of the models of rationality most suited to describing our behaviours. In this connection, it does not seem that models based on classical rationality are able to describe what truly happens when we perform a linguistic expression; indeed, they seem to consider a sort of disembodied rationality that fits demoniac beings more than humans (Gigerenzer and Todd 2000, 728). Instead we need an embodied rationality, a rationality, that is, that truly keeps in mind the biological constraints of speakers. Traditional descriptions based on those models, as a rule, do not keep in mind, for example, the intrinsic biases of human knowledge and the heuristic that derives from them. To grasp the scope of the problem, it is enough to think of the mass of perceptive information that in a single speech act, as in any perceptive act, involves speaker and listener. Both in the perceptive sphere, and in the linguistic sphere, our cognitive system is forced to limit the flow of information through attentional filters, the so-called *bottleneck* (Broadbent 1958; Sperber and Wilson 1995). For this filter in the linguistic sphere therefore have to rely on heuristic strategies able to guarantee anyway the possibility of understanding. It is beginning from these issues that Christiansen (2016) has extended the metaphor of the attentional *bottleneck* to linguistic phenomena, focusing attention on the constraints within which understanding cannot avoid moving. Not bearing in mind these characteristics of our knowledge leads formats for representations used to describe linguistic phenomena to furnish an idealized or angelic image of our linguistic *performances.*

20.2 Language and the Bounded Rationality

Starting from the work of Herbert Simon (1957) in the 1950s on limited rationality, there are a lot of evidences which show that rational choices are subject to limitations of knowledge and cognitive ability. The sphere of *decision making*, until then dominated by an assumption of the abstract rationality of the agent of his or her own economic theories, has been revolutionized by these studies. In very famous papers Kahneman and Tversky (1979, 1983) describe a series of cognitive biases that operate when we take a decision. The two psycolinguists brought to light some systematic infringements of the predictions given by the classical paradigms on decision making. Such deviations from purely rational behaviour are attributable, according to the two psychologists, to the involvement of some normative and heuristic principles. I think that if we want to describe in a more realistic way how linguistic expressions are understood, it is important to take this into account.

20.2.1 The Frame Effect

A famous experiment by Kahneman and Tversky (1983), known as the problem of the Asian illness, describes this scenario:

The United States are about to face an epidemic that is expected to cause 600 deaths. To face the phenomenon two different action plans are proposed (A and B).

If programme A is adopted, 200 people are saved.

If the programme B is adopted, there will be a 1/3 chance of saving everyone and a 2/3 chance of saving no one.

Of the 152 people involved in the experiment, 72% preferred programme A and 28% programme B.

Another group of people, equivalent in size, was instead submitted to another test that was very similar to the first one.

Same scenario, an epidemic to be faced, but different frames, programmes C and D:

If programme C is adopted, 400 people die.

If programme D is adopted, there is a 1/3 chance that nobody will die and a 2/3 chance that everybody will die.

78% of the people preferred programme D to programme C.

It is quite evident that in both cases the same situations are described: the certain death of 200 people versus the 1/3 probability of saving 600 of them. Yet the results of the experiment are very different. In the literature these experiments are discussed with reference to propensity to risk: lesser, when the options are described in positive terms (saving people's lives); greater, when the options are described in negative terms (people's deaths).

In any case it is evident that the way of posing the questions seems to change the data of the problem, thus violating the axiom of invariance (Von Neumann and

Morgenstern 1947), which seems to be one of the cornerstones of the theory of rational decision. According to this axiom, the order of preference among options does not depend on the way in which they are described (Kahneman and Tversky 1983). And evidently it is not a question of familiarity with the theory of probability, as the two authors are careful to specify that among the subjects of the experiment many had competences of a probabilistic type. The issue goes much deeper. Indeed, when it is pointed out to the subjects that the answers given conflict with one another, they are perplexed and are not sure what to answer (Kahneman 2011, 359). As Kahneman and Tversky (1983, 436) write:

> Respondents confronted with their conflicting answers are typically puzzled. Even after rereading the problems, they still wish to be risk averse in the "lives saved" version; they wish to be risk seeking in the "lives lost" version; and they also wish to obey invariance and give consistent answers in the two versions. In their stubborn appeal, framing effects resemble perceptual illusions more than computational errors.

According to the two authors, we use two different modalities of thought, traditionally called system 1 and system 2, which have a complex relationship with one another. System 1 is characterized by greater speed, and automaticity that is well suited to adaptive demands; system 2 is characterized by a slower and more analytical modality, but often, as in the case of the epidemic, rationalizes ideas and feelings produced by system 1, which in this case focuses on the positive note of saving 200 lives rather than on losing 400. Linguistic phenomena seem indeed to belong to system 1 when they are very simple and, instead, to system 2 when they require in-depth analysis.

According to these authors, some decisional errors are induced by system 1, which however is the only one that can guide us in situations of uncertainty, for instance concerning moral choices, whereas system 2 would have more difficulty about making some choices.

Nevertheless, in the reflections of Kahneman and Tversky, the issue of framing is set in terms of a problem of cognitive perspective, entirely independent of issues of a linguistic nature. In other words, the cognitive issue is seen as independent of the fact that framing is in actual fact intimately interconnected with problems of understanding: nevertheless, it seems reasonable to hypothesize that the difference in the decisional result that corresponds to problems set in different terms goes first of all through a different way of *understanding* the problem. It is true that in one case "loss" is placed in the foreground but it is precisely understanding of the issue together with our cognitive biases that creates the problem.

Tversky and Kahneman (1974) seem to believe that cognitive biases orient our decisions but deform their outcomes. An observation that can be made in relation to this perspective is that it does not challenge the assumptions of classical rationality but the fact that we use it in many contexts. Probably, in order to describe phenomena of linguistic performances we can go further, challenging not only the idea that classical rationality informs a large part of our linguistic performances but also the idea that using rationality would at any rate have some advantages in terms of a better performance. In other words, linguistic performance is not concerned with processing all the information contained in the utterance, but only as much as is needed in order to move ahead. Perhaps it is for this reason that various research currents like the *Relevance theory* (Sperber and Wilson 1995) and the *Good-enough Approach* (Ferreira and Patson 2007) have looked more to another approach developed within the paradigm of the theory of limited rationalities, the *Fast and Frugal Heuristics* by Gerd Gigerenzer and his group (Gigerenzer et al. 1999). It seems indeed that this approach can be used better to describe how, above all in some cases, bad processing of information does not make performance less effective.

20.3 Relevance Theory and Ecological Rationality

The *ecological rationality* proposed by Gigerenzer and Todds (2000, p. 736) arises from the intuition that we make use of *fast and frugal* heuristics that differ from one another and, above all, are linked to circumstances and environmental conditions, which each time determine our behaviour. Unlike the cognitive bases of which Kahneman and Tversky speak, these heuristics often also work very well in cases in which they conflict with the results we would arrive at if we used the classical models of rationality. We are talking about heuristics adapted to different environmental situations, which take into account the biological constraints of our cognitive system and their adaptive nature in a very complex way.

Although they came into being in the sphere of decision psychology, fast and frugal heuristics have been given various applications within studies on language, particularly in approaches aiming to describe the real performances of individuals involved in linguistic interactions.

20.3.1 Relevance Theory

Within pragmatic theories, the theorists of the *Relevance theory* explicitly hark back to *fast and frugal* heuristics (Cf. Wilson and Sperber 2004; Carston 2012). To give just one example, Carston (2012) writes:

> Given its cognitive-scientific orientation, relevance theory pragmatics is concerned with the on-line processes of utterance interpretation and the nature of the mental system(s) responsible for them (Sperber and Wilson 1986/1995; Wilson and Sperber 2004). [. . .]

And it seems that, in solving a wide variety of everyday problems, we employ rather simple, albeit ecologically rational, heuristics rather than foolproof algorithms or explicit reasoning processes (Gigerenzer et al. 1999).

But starting from the first texts to the most recent ones, (Sperber and Wilson (1986, 2002; Mercier and Sperber 2017) focus precisely on the impossibility for a speaker to govern all the information and the possible inferences that can be made beginning from an utterance. But certainly the encounter with fast and frugal heuristics is extremely productive. For example the "procedure of understanding of relevance" [. . .]: it applies the most famous of *Fast and Frugal* heuristics*,* the one that Gigerenzer and Goldstein (1996) have called *Take the best.* Contrary to what could be imagined in many contexts, we draw our inferences, without taking into account the different possibilities that every characteristic offers, but singly considering these possibilities and stopping when one of these proves to be satisfied, so as to ensure the smallest cognitive effort and an outcome that is at any rate satisfactory.

Sperber and Wilson (2002) seem to adopt precisely this procedure:

(a) Follow the pathway of least effort in calculating the cognitive effects. Test the interpretative hypotheses in order of accessibility.
(b) Stop when your expectations are satisfied.

To clarify with an example:

> If we are discussing the result of the competitive examination of a friend and one of us affirms: "Franco is a professor", I understand this utterance making reference to the relevant characteristics of the concept of PROFESSOR, which is modulated in one of its possible meanings (Barsalou 1983, 1991):
>
> – *He knows the subject;*
> – *He is a man of power;*
> – *He knows how to expound things well;*
> – *He has this role in the Italian university;*
> *And so forth.*

All the main hypotheses are pre-activated and they are processed in order of accessibility. Having found the satisfactory one we stop. In this way a description is furnished of the phenomena of understanding that takes into account some cognitive constraints, which render wholly inadequate a model based on the assumption that we can effectively weigh up all the hypotheses of meaning and subsequently choose the most correct one. In this sense, the theory of relevance emphasizes that linguistic understanding is played out in that zone of equilibrium that is determined by cognitive constraints on one side, and on contextual constraints (and resources) on the other.

Nevertheless, although the relevance theory focuses precisely on our ability to select the relevant items of information in relation to an extraordinarily rich context and to consider them as stimuli for building an inference, Sperber and Wilson (1995) maintain a sort of idealization of *communicators*, of speakers-listeners. Indeed, the theorists of pertinence do not set sufficient store by the extent to which partial use of the available information leaves room for errors that systematically arise during our inferential activity (Sperber and Wilson 1995). This is not a reference to the errors of a speaking individual, but to cognitive *tendencies* that act, like the biases in the decisional processes brought to light by Kahnemann and Tversky, which systematically lead speakers to commit certain types of error. An analysis of the regularity underlying such systematic errors is outside the horizon of investigation of the Relevance Theory, inside which inferential errors are considered an effect of contingent situations, linked for example to situations of carelessness, and therefore non-systematic and unpredictable phenomena.

There is another aspect that in the relevance theory still makes communicators over-idealized subjects. They base their inferential activity on a pragmatic modulation (Recanati 2004) of the communicative stimulus that must lead to an expression endowed with truth value (explicatures), to be able to be further processed. But it is not sure that the utterances with which we operate do not always have a clear truth value (Travis 1989) and inferential errors are not always linked to contingent situations (Christianson 2016).

20.4 Ambiguity and Garden Path Sentences

The aspiration to work out a more cognitively reasonable model of our way of understanding a linguistic utterance is at the centre of the *Good Enough approach* to linguistic understanding, a research programme that, on the basis of experimental evidences, tries to examine the regularity and the heuristics that systematically act at the basis of apparent *failures* of linguistic understanding. According to these theorists (Ferreira et al. 2002, Ferreira and Patson 2007; Christianson 2016) linguistic processing of perceptive inputs takes place according to heuristics aiming to offer a *good enough* representation of the linguistic utterance, which by and large allows us to take part in the linguistic game or the conversational exchange, but not to have an accurate representation of what is said by others.

The *Good Enough Approach* is a theoretical proposal that focuses on how little information is exploited by the "understanding system" when it comes to deriving an interpretation [of a sentence], and how superficial (and sometimes wrong) interpretation of it can sometimes prove. These are examples, often banal ones, of misunderstandings that rarely interfere with the capacity to participate in the linguistic game, and yet bring to light some basic principles of perceptive-performative activity in which we are engaged in linguistic exchanges.

Through experimental analysis of the understanding of expressions that present ambiguity, like *garden-paths sentences*, (cf. Frazier et al. 1999; Christiansen 2016), passive utterances or, again disfluencies, revealed by the use of interjections during the conversations, Ferreira and his group show that representations of linguistic utterances are not so complete and accurate as we would expect.

Let us consider some examples:

20.4.1 Phenomena of Ambiguity

Consider the expression "The singer saw the audience with binoculars." This expression has often been used as an emblematic case of ambiguous expression, and certainly it is an expression that admits of at least two different interpretations. One is that the binoculars are used by the actor, the other that the audience or a large part of it watched the show with binoculars. It is evident that this ambiguity is present if considered abstractly but in a discourse context it is likely that this expression will lose its ambiguity. According to some authors, (cf. Spivey and Tanenhaus 1998), we can make reference to any encyclopaedic notion to resolve the ambiguity: as a rule in the theatre binoculars are used by the audience and not by performers.

It is not difficult, however, to imagine a conversation where the ambiguity is not solved, at the same time allowing a fluid conversational interaction.

Two friends:
One: "You know, Giovanni told me that the singer saw the audience with binoculars".
The other: "So you saw Giovanni and what did he say about me?"

How could we consider an exchange of this type?

Is it clear that the ambiguity is not resolved, but can we state that *The other* has not understood the utterance? Frazier et al. 1999 in similar expressions notice with experimental evidences that often people are not worried about disambiguating utterances if the information is not truly necessary.

20.4.2 Garden Path Sentences

Let us consider some examples of expressions that show particular syntactic structures, known as *garden-path* sentences:

(a) *While Mary bathed the baby played in the crib*,
(b) *The horse raced past the barn fell.*

These are linguistic structures that express levels of phrasal ambiguity in which the syntactic elements can have various grammatical functions and logics, thus giving rise to phenomena of ambiguity or disfluency. They prove difficult to analyze because they force us to go back in the analysis of the linguistic expression. During their processing we notice, for example through techniques of *eye tracking*, a jam in understanding, a decidedly longer processing time than similar expressions that do not show bifurcation, but these are not expressions that create particular problems for speakers.

It's interesting that (Ferreira et al. 2002) is that often, at any rate with higher percentages than one might imagine, the people interviewed, though not showing particular difficulties about understanding these expressions, appropriately questioned on the meaning of this utterance affirmatively answer both the question:

Did Maria bath the baby?
and the question
Did the baby play in the crib?

They ignore the fact that the two possibilities contradict one another. The same sentence cannot evidently affirm at the same time that “While Maria baths, her child plays in the crib” and “Maria baths her child, who plays in the crib.” In fact we have to choose: either the verb *to bath* is used in a reflexive way or in an active way, but it cannot simultaneously be used in both ways.

So one can imagine that what is at play is a heuristic that leads the listener to assume that the first name of the sentence is the agent of the action and the second name instead that related to the object on which an action is carried out. And this heuristic is responsible for errors related to understanding this expression.

20.4.3 Disfluencies

Perhaps even more interesting is the case of expressions in which there are indicators of self-corrections (Ferreira and Patson 2007). Let us consider the following expressions:

1. *I want you to drop the ball*
2. *I want you to put uh drop the ball*
3. *I want you to drop uh put the ball*
4. *I want to you to put the ball*

The first expression is the correct expression devoid of any obstacle (*disfluency*) made evident by the interjection *Uh.* The other expressions all present one obstacle or, like no. 4, an error. To understand the experiment well, it must be borne in mind that in English the verb *to put* needs a preposition in order correctly to fulfil its function, unlike the verb *drop*, which instead requires a proposition.

Expression no. 2 is considered grammatically correct by fewer people than no. 1: although the self-correction should amend the error, the presence of the interjection *Uh* suggests an error. The problem, however, is not caused by the disfluency. Indeed, if we consider expressions 3 and 4 we see very different results. People tended to consider no. 3 more correct than no. 4, precisely because of the obstacle. Therefore, the interjection that signals the obstacle does not constitute a problem.

Hence a more reasonable explanation would lead us to maintain that in the judgment on the grammatical correctness of an expression, the term that results from the self-correction is not seen separately from the term that precedes it and because of which the self-correction is made necessary. Indeed, expression no. 3 proves more correct than expression no. 4, because the term that precedes *put* is the verb *to drop*, which would have resulted in a correct expression.

In this case too we can say that the mechanisms of understanding prove to work effectively, for example optimizing the processing times for an utterance, furnishing a result that is *good enough* even if not really perfect.

Often, in fact, we construct local meanings that can conflict with the overall meaning of the utterance, (a phenomenon that is reminiscent of blindness to visual change: for an ample review cf. Jensen et al. 2011) but this does not always constitute a big problem, at least for many linguistic interactions. Indeed, revision of what has been rapidly perceived requires a quantity of time that is not available during a common dialogue situation. This does not alter the fact that there are different conversational situations, for example questioning in courts of justice (cf. Mosegaard Hansen 2008), where the type of conversation required particular attention to what is said during the debate and efforts are made to cover as far as possible the available information. As a rule, however, revision of what is perceived is a resource that the listener does not put in place unless the meaning conflicts with expectations or with the general coherence of the discourse. We never reflect enough on the fact that the success of our conversational exchanges is often accompanied by phenomena of wrong or partial understanding of what is said (Christianson 2016) but, nevertheless, we understand one another well enough.

20.5 The Cognitive Bottleneck

The reasons for these cognitive *biases* that are at work in phenomena of understanding probably lie in the cognitive constraints that operate in the creation of linguistic representations. These are constraints due, for example, to the phenomenon known as *bottleneck*. The richness and complexity of the linguistic and social information contained in a simple utterance makes it impossible to analyze it in its complexity while it is being expressed. At the same time there is a tendency to underestimate the fact that short-term memory is by its nature ephemeral and therefore if an acoustic stimulus is not rapidly processed it tends to decay and to be lost forever. Christiansen and Chater (2016), on the basis of various psycholinguistic data, have shown that the decay times of sound stimuli are a great deal shorter than those of semantic information. Normally, in fact, the time for which we remember a series of linguistic sounds is very much shorter than that for which we remember a given sentence. Therefore, our system has to process stimuli as they arrive.

Thus, in normal conversational exchanges we find ourselves having to process linguistic stimuli quickly as soon as they arrive, knowing that this processing can only be immediate: *now or never.* Otherwise information is lost. Then we can imagine that in conversational exchanges we use a *chunk and pass* modality (Christiansen and Chater 2016) according to which we sequentially analyze chunks of information as quickly as possible to move on to the following chunks and we use the available information predictively, to process the inputs that are arriving: “during understanding, the linguistic system has to continue to chop up the information that is arriving, in higher and higher levels of representative abstraction, to avoid being overwhelmed by the stimuli.”

It is a system that works along two different lines, one bottom-up that proceeds quickly, processing the acoustic stimuli, and one top-down, which instead quickly processes these stimuli and generates predictions on the continuation of the stimuli that we will receive. This second mechanism, which always acts parallel to the first one, allows us to go ahead quickly, leaving the role of confirmation of our prediction to the rest of the information (cf. Hohwy 2013; Clark 2013).

20.6 Instead of a Conclusion

The phenomena of understanding and communicative exchanges are performances that involve our whole body and cannot be correctly understood without considering the bio-cognitive constraints that inform them. These constraints are responsible for some modalities of our understanding, including limited but sufficient understanding of the meaning of the utterance. Many psycholinguistic evidences suggest considering the classical models of rationality as inadequate to describe linguistic performances and explain how limited understanding can be sufficient, passing through problematization of the type of rationality that is at work in these performances. We are aided by research projects that look to limited rationality and propose accurate descriptions of psychological phenomena responsible for significant *cognitive biases* (Tversky and Kahneman 1974), like the effect of the context (*framing*) that seems to be intimately connected with phenomena of linguistic understanding. Likewise, also in attempts to describe linguistic phenomena resorting to the *Fast and Frugal* heuristics identified by Gigerenzer, as do Sperber and Wilson (1995), it does not seem that this intimate dependence between understanding and cognitive biases is correctly focused. But these approaches seem unable to account for how little information is actually analyzed in our most common linguistic performances. This theme is currently central to research projects like the hypotheses of the *Good Enough Approach* and above all the *now or never* one of Christiansen and Chater (2016) highlight how little information is used in common conversational exchanges and furnish a reasonable model of how our cognitive constraints can avoid deterioration of linguistic stimuli. At the same time, however, they seem to be tilted too much towards a bottom-up consideration of phenomena of linguistic understanding. If, on the one hand, this approach takes into account the performative dimension, it gives little importance to the variety of ways in which we govern the complexity of the linguistic interactions in which we take part. We are still a long way from a theory that can account for the basic activities that act bottom-up and at the same time for the top-down phenomena that also characterize phenomena of linguistic understanding. We need much more research, but only by blending data and theories can we try to better describe the performance of understanding.

References

Barsalou, L.W. (1983). Ad hoc categories. *Memory and Cognition, 11*(3), 211–227.

Barsalou, L.W. (1991). Deriving categories to achieve goals. In H. Bower Gordon (a cura di), *The psychology of learning and motivation: Advances in research and theory* (pp. 1–64). San Diego: Academic.

Broadbent, D. (1958). *Perception and communication*. London: Pergamon Press.

Carapezza, M., & Cuccio, V. (2018). Abductive inferences in pragmatic processes. In A. Capone, M. Carapezza, & F. Lo Piparo (Eds.), *Further advances in pragmatics and philosophy* (pp. 221–242). New York/Francoforte: Springer.

Carston, R. (2012). Relevance theory. In G. Russell & D. Graff Fara (Eds.), *Routledge companion to philosophy of language* (pp. 163–176). New York/London: Routledge.

Christiansen, M.H. (2016). *Creating language*. Boston: MIT Press.

Christiansen, M.H., & Chater, N. (2016). The now-or-never bottleneck: A fundamental constraint of language. *Behavioral and Brain Sciences, 39*, 1–72.

Christianson, K. (2016). When language comprehension goes wrong for the right reasons: Good enough, underspecified, or shallow language processing. *Quarterly Journal of Experimental Psychology, 69*, 817–828.

Clark, A. (2013). Whatever next? Predictive brains, situated agents, and the future of cognitive science. *Behavioral and Brain Sciences, 36*, 181–204.

Ferreira, F., & Patson, N. (2007). The 'good enough' approach to language comprehension. *Language and Linguistic Compass, 1*(1–2), 71–83.

Ferreira, F., Ferraro, V., & Bailey, K.D. (2002). Good enough representations in language comprehension. *Current Directions in Psychological Sciences, 11*, 11–15.

Frazier, L., Pacht, J. M., & Rayner, K. (1999). Taking on semantic commitments, II: Collective versus distributive readings. *Cognition, 70*, 87–104.

Gallese, V. (2008). Mirror neurons and the social nature of language: The neural exploitation hypothesis. *Social Neuroscience, 3*, 317–333.

Gigerenzer, G., & Goldstein, D. (1996). Reasoning the fast and frugal way: Models of bounded rationality. *Psychological Review, 103*, 650–699.

Gigerenzer, G., & Todd, P. (2000). Précis of simple heuristic that make us smart. *Behevioral and Brain Sciences, 23*, 727–778.

Gigerenzer, G., Todd, P., & The ABC Group. (1999). *Simple heuristic that make us smart*. Oxford: Oxford University Press.

Grice, H.P. (1957). Meaning. *The Philosophical Review, 66*, 377–388, in *Studied in the way of word*s, Cambridge, MA: Harvard University Press, 1989.

Hohwy, J. (2013). *The predictive mind*. Oxford: Oxford University Press.

Jensen, M.W., Yao, R., Street, W.N., & Simons, D.J. (2011). Change blindness and inattentional blindness. *WIREs Cognitive Science, 2*, 529–546.

Kahneman, D. (2011). *Thinking, fast and slow*. London: Macmillan.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometria, 47*, 263–291.

Kahneman, D., & Tversky, A. (1983). Choice, values and frames. *American Psychologist, 39*, 341–350.

Mercier, H., & Sperber, D. (2017). *The enigma of reason. A new theory of human understanding*. Boston: Harvard University Press.

Mosegaard Hansen, M.B. (2008). On the availability of 'literal' meaning: Evidence from courtroom interaction. *Journal of Pragmatics, 40*, 1392–1410.

Pennisi, A., & Falzone, A. (2016). *Darwinian biolinguistics. Theory and history of a naturalistic philosophy of language and pragmatics*. New York/Francoforte: Springer.

Recanati, F. (2004). *Literal meaning*. Cambridge: Cambridge University Press.

Simon, H. (1957). A behavioral model of rational choice. In *Models of man, social and rational*. New York: Wiley.

Sperber, D., & Wilson, D. (1986/1995). *Relevance theory. Communication and cognition*. Oxford: Blackwell.
Sperber, D., & Wilson, D. (2002). Pragmatics modularity and mind-reading. *Mind and Language, 17*, 3–23.
Sperber, D., Cara, F., & Girotto, V. (1995). Relevance theory explains the selection task. *Cognition, 57*, 31–95.
Spivey, M., & Tanenhaus, M. (1998). *Sentence comprehension: The integration of habits and rules*. Boston: MIT Press.
Travis, C. (1989). *The uses of language*. Oxford: Oxford University Press.
Tversky, A., & Kahneman, A. (1974). Judgment under uncertainty: Heuristics and biases. *Science, 185*, 1124–1131.
von Neumann, J., & Morgenstern, O. (1947). *Theory of games and economic behaviour* (2nd ed.). Princeton: Princeton University Press.
Wilson, D., & Sperber, D. (2004). Relevance theory. In L.R. Horn & G. Ward (Eds.), *The handbook of pragmatics* (pp. 607–632). Oxford: Blackwell.
Wittgenstein, L. (1953). *Philosophical investigations*. Oxford, Blackwell, 2009.

Chapter 21
Happiness and Unhappiness of Performative Acts: Acquisition of L2 and Psychopathological Behaviors

Paola Pennisi

Abstract In this paper I will discuss a key concept in philosophy of language, the one of *performativity*, which has evolved accordingly to the process of change that cognitive science went through over the last decades due to the influence of the embodied approaches to cognition. The discussion starts with a summary of the many definitions of performativity (Sect. 21.1) and goes on with the analysis of the consequences that such differences had on the characterization of "happiness" and "unhappiness" of performative acts (Sect. 21.2). Then I have tried to show how the performativity of a linguistic behavior might be "happy" in the context of a second language acquisition (Sects. 21.2.1, 21.2.2, 21.2.3 and 21.2.4) and, conversely, how dysfunctional performative acts can be "unhappy" and lead to psychopathological behaviors, such as eating disorders (Sects. 21.2.5, 21.2.6 and 21.2.7).

21.1 Performativity: Definition of the Concept

As has been shown by Pennisi and Falzone (2016), since Chomsky has established the dichotomy between competence and performance (Chomsky 1965) the notion of *performativity* went through many changes. We can sum up the contents of the debate as follows: whilst Chomsky believes that performativity of language lacks any cognitive content and as such is uninteresting, Austin thinks there are actions that can be carried out exclusively through the performativity of some linguistic acts (such as "I baptize you"), which allows these actions to be effective on the world (Austin 1962). Even the aesthetic studies on performing arts carried out over the last 30 years pointed out the inconsistency of the dichotomy between performativity and

P. Pennisi (✉)
University of Messina, Messina, Italy
e-mail: ppennisi@unime.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*, Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_21

planning, showing the impossibility to conceive a work of art such as a narration, a picture or a play as the result of a project and not of an execution too.

In this paper I will take into account a notion of performativity that gained a lot of success in the field of cognitive science, to the point it became the main subject of the tenth edition of the International Conference on Cognitive Science (CoDiSco), which was held in Noto, Italy, in October 2017. Since Chomsky's ideas on performativity spread out (1965) until now, the cultural background underlying the study of cognition has changed a lot. The "4 E of cognition" put together by Rowlands (2010) are intended to widen the concept of *cognition*: the latter cannot be referred to the mental manipulation of symbols anymore, nor to a physiological phenomenon that calls into question the localization of cerebral functions; both these approaches showed in fact to be inefficient in shedding light on the real nature of cognition.

It is precisely the necessity to *embed* the cognitive processes in the executive contexts where they occur that made philosophy of mind and cognitive science aware of the importance and the urgency to put every claim about human cognition into the right phylogenetic frame.

In this respect, I believe that the twentieth-century research on language might be a gold mine of concepts adaptable to the new global philosophical context. The notion of performativity is a perfect example of that: in his reflections on performativity, in fact, Austin has highlighted a core aspect of this phenomenon that could be applied to the whole human cognition. Austin noticed that performatives do not describe something that exists before or outside language, but rather that they transform or produce new situations, new behaviors, new messages, new technological instruments, new ways of thinking.

According to this definition, performativity is the material action through which, in absence of a specific action plan and through our bodily interaction with the environment, we bring about a change in ourselves or in the environment. Thus, the essential properties of a performative behavior are:

1. the lack of a specific action plan preceding the execution of the behavior, or a sudden change in the project that underpins the action. In the latter case, it doesn't matter whether the change is intentional or not;
2. the material interaction with the external environment.

What makes this notion of performativity so innovative is the fact that it binds together the motor and the executive functions of a behavior with the physiological functioning of mind (Pennisi and Falzone 2016); that is to say, performing an action through one's own body in an indispensable part of the cognitive process, since it entails a change in the environment and simultaneously affects the cognitive process itself. In other words, action is not the externalization of a pre-existing cognitive process, but rather is a part of it.

21.2 Happiness and Unhappiness of Performative Acts

The difference between the notion of performativity born within the context of the embodied approaches to cognition and the one intrinsic to the linguistic acts described by Austin lies in the conventional aspect of these latter. The conventional and ritual nature of the performative linguistic acts is a necessary condition for their happiness (this is the condition of happiness A.1, described in lesson II, "Conditions for the happiness of performatives"). That is to say, in order to declare a man and a woman "husband and wife", the performative linguistic act must be pronounced during a specific and well codified ritual. Conversely, the happiness of a performative act in which the motor and the executive functions are considered as a part of the cognitive process does not necessarily depend on the compliance with precise conventions.

Precisely like in Austin's definition of performative linguistic acts, performativity doesn't have a truth value, but rather can only be assessed in terms of happiness or unhappiness. A performative behavior can neither be true or false, nor achieved or unachieved; it can only be happy or unhappy. In order to achieve something, in fact, we need to start from a pre-existing project or aim; conversely, the happiness and the unhappiness of a behavior depend on the (expected or unexpected) outcomes of the action.

It should be clear at this point that Austin's scheme to reveal the condition of happiness or unhappiness of a performative act cannot be applied to the notion of performative act drawn up by cognitive science (which, we must remember, is the main subject of this volume and of the international conference that inspired this work).

In this paper, I will define as "happy" or "unhappy" the performative acts by taking into account exclusively the performer's point of view. For instance, let's take the case of a baby who, with a spontaneous move, manages to catch a fly and rejoices for that. The performative act that allowed him to achieve that result is a happy one; conversely, the same performative act is unhappy from the perspective of the fly. However, what matters for us is exclusively the agent who performs the behavior; it follows that, as far as this case is concerned, we are dealing with a happy performative act.

The happiness of a performative act disregards the original intention of the agent: that is to say, a performative act is a happy one when it produces a cognitive *habitus* or a positive change for the agent who enacts it, irrespective of whether the outcome obtained was expected or not.

Whilst habits, rituals and protocols are intended to maximize the efforts and minimize the risk of unhappiness of the actions carried out, performative acts tend to expose the agent to a high risk of achieving unhappy outcomes. These latter, however, are offset by the possibility of gaining results that are happier than the ones reached through habits, rituals etc. Performativity can thus be the result of an unintentional act (i.e. a child who is learning how to walk) or, conversely, a well thought-out strategy developed to change a bad habit (i.e. a person who, in order to remember to floss every day, makes repetitive and ritual gestures) or to simply achieve a desired result (i.e. people who train to improve their sports performances).

In the following paragraphs, I will take a deeper look at the conditions of happiness and unhappiness of performative acts using positive (Sects. 21.2.1, 21.2.2, 21.2.3, and 21.2.4) and negative (Sects. 21.2.5, 21.2.6 and 21.2.7) examples. In the next paragraph, specifically, I will address the relationship between performativity and second language acquisition.

21.2.1 Happiness of Performative Acts and Acquisition of L2

In our high rate of schooling society, whilst the research on the acquisition of L2 and on the optimization of learners' cognitive performances is constantly increasing (for the statistics on this topic, see Pennisi and Torricelli 2018), students and teachers often claim to be dissatisfied with the level of knowledge they have reached. In the context of a research project named "*Theories of language and learning technologies of L2*", I and Patrizia Torricelli have administered some linguistic tests to 344 Italian students (241 in 2017, 103 in 2018) precisely to assess their level of knowledge of the English language. All the students were enrolled in college – hence they were graduated – and have been tested before they could participate to the English courses provided for by the university. Every test was administered by me or by Patrizia Torricelli, in collaboration with the teaching staff of the *University Language Centre of Messina* (in Italian, CLAM), which is an accredited institution for issuing certificates of linguistic competence in compliance with the guidelines of the *Common European Framework of Reference* for Language, *CEFR*. According to this framework, Italian graduated students should have reached a level of knowledge of the English language corresponding to a B1 (which, in turn, corresponds to the achievement of 25/45 points in the test we have administered); unfortunately, such level of competence was reached only by 96 students, that is the 27.9% of our sample.

Before they graduate high school, Italian students use to study English from 9 to 12 years. If we consider an average of 2 h a week over 33 weeks of school, an average Italian student takes from 594 to 792 h of English classes in his life. Moreover, Italian education system provides for the students to do homework out of school time.

In the light of these data, the outcome of our experiment seems to be quite startling. However, whilst language education often achieves poor results, more and more Italian are learning to speak English at their workplace, just because *they need to*. It looks like that the urgency to overcome the language barrier that prevents people from communicating with those on whom their livelihood depends (like clients or foreign commercial partners) eases the learning process more than the rituality of exams, tests and homework does.

The rituality of the school context tends to split the target of acquiring a second language in many sub-targets, like "use the correct verbal forms to properly scan the time", "find the right term to express such concept" or "find the concordance between adjectives and nouns". Such targets, despite being an important part of the knowledge of a language, are not cognitively ergonomic.

When we are abroad, we need to learn the local language in order to be integrated in the social fabric; analogously, learning a new language to be successful at work is a necessary condition for one's own livelihood. In both cases, the acquisition of L2 is not trapped within the framework of rituality, which impairs the performativity of communication. It's just a speaker who performs in front of one (or more) listener.

It is now time to analyze the influence of the environment on the linguistic performances of bilingual subjects.

21.2.2 Impact of the Environment in Bilingual Subjects' Linguistic Performances

The embodied approaches to cognition have not yet addressed the issue of second language acquisition. In a previous study (Pennisi and Torricelli in press) I and Patrizia Torricelli have tried to show, through the analysis of the results of some experiments, that some environmental cues, such as the eyes, the communicative gestures and the mimicry, can be philosophically intended as social affordances, which are necessary to the triggering of those communicative behaviors on which the development of linguistic competences is built. These are the same conclusions reached in his pioneering works (Atkinson 2002, 2010, 2011) by Dwight Atkinson, a linguist that has dedicated most of his career to studying the dynamics of second language acquisition. Atkinson stressed out the influence that the Vygotskijan sociocultural theory had on the application of the embodied approaches to cognition to the study of the acquisition of L2 (about the application of the sociocultural theory to the study of second language, see also Johnson 2004 and Lantolf 2000). Both ours and Atkinson's works emphasize the role played by the environment in determining the success of such cognitive process.

Many studies on bilingual subjects have shown that both the inputs that trigger the cognitive process and the environment might influence the process itself. For example, several discoveries on the functioning of memory in bilingual subjects have been made over the last years; it has been demonstrated that memory is not like a box that we fill over time and draw on when we search for a specific content. Usually, we do not *search for* the past tense of the verb "to go" in our memory; conversely, as the embodied cognition theorists claim, memory is engaged in different ways by the different kinds of affordance that trigger it.

Ulric Neisser, who at the time when it was first published (1967) was one of the proponents of the cognitive theory based on the computer metaphor for brain functions (Neisser 2014), radically reconsidered his position in the light of the ecological theory developed by Gibson (Neisser 1976). Neisser addressed the issue of the reenactment of memories and analyzed the role played by the environment in this process. In 2000, he and Viorica Marian published a paper on the autobiographical memories of bilingual subjects (Marian and Neisser 2000), in which they tried to explain what was the mechanism underlying the controversial phenomenon of the "Language-dependent recall". According to both the quantitative (Bugelski 1977) and the qualitative (Aragno and Schlachet 1996; Javier et al. 1993) approaches used to explain this phenomenon, the narration of autobiographical memories is easier when expressed in the language such memories were created in the first place. Marian and Nessier tested this hypothesis (Marian and Neisser 2000) by setting up two experiments. Whilst the first one basically confirmed the hypothesis, the second one added an important data: it showed in fact that Language-dependent recall not only is the result of the association between the specific inputs given during the experiment and the output that participants had to produce for the investigators, but even that the phenomenon was influenced by the linguistic environment where the subjects had to narrate their memory.

In the next paragraph I will show how the cognitive processes of bilingual subjects are influenced by the execution of linguistic tasks.

21.2.3 Impact of the Executive Function of Language on Bilingual Subjects

In a study carried out in 2004 by Viorica Marian and Margarita Kaushanskaya, the authors showed that different languages are associated with different cognitive styles. They took a sample of English and Russian bilinguals and, through a quantitative analysis, compared their self-narratives. What they found out is that the attitude of the participants changed according to the language they used: the bilinguals, in fact, produced more self-oriented narratives when the language was English than when it was Russian. This was reflected in the use they made of pronouns: when the subjects spoke in English, they frequently resorted to singular personal pronouns; conversely, when they spoke in Russian, they often resorted to plural personal pronouns.

The above findings suggest that the language we use to express a concept or to retrieve a memory has an influence on such elaboration processes, emphasizing certain cognitive styles (like, in the case we have just mentioned, an individualistic attitude rather than a collectivistic one) to the detriment of others. Many other studies showed that, when we use self-narratives to retrieve our memories, we often tend to unintentionally distort the latter to accommodate memory (Wilson and Ross 2003).

Another key conclusion of Marian's and Kaushanskaya's study is that the emotional response underlying the cognitive process of memory retrieval depends not only on the input that triggers it, but even on the nature of the narratives: i.e. if the input that triggers the linguistic performance is in the same language of the latter, the emotional involvement is higher than in the case where the two languages do not match. According to the authors of the paper, thus, “language functions similarly to other types of context” (Marina and Kaushanskaya 2003: 198); it means that the line between the context of execution and the execution itself is becoming increasingly blurred.

The correlation among emotional involvement, language and memory has been proven by another study carried out in 2006 by Marian in collaboration with Caitlin Fausey. The authors showed that the phenomenon I have described above involves bilinguals even when they have to retrieve memories about historical, scientific or mythological facts: the quantity and the quality of the data bilinguals recalled during the experiment were higher when there was a match between the language in which the data were collected in the first place and the language participants spoke at the moment of the experiment.

The above findings suggest that language provides the individual with great advantages in terms of cooperation and social integration both from an ontogenetic and an evolutionary point of view. Learning a second language and not using it to communicate with others is a huge waste of time. When we are engaged in a conversation and forced to speak a second language, our performance calls for great efforts: we need to pay attention to any detail in other’s non-verbal communication, strive to handle our emotions and plan what we are going to say next. This kind of naturalistic and immersive approach often turns out to be more effective than an approach based on the acquisition of strict rules about the use of the correct verbal form or the concordance between adjective and noun, making the learner less vulnerable to the risk of failing the communication.

The papers I have discussed in this paragraph stress the influence that the executive function of speaking a second language has on the ongoing cognitive processes of the speaker. I think that the line between the performance and the cognitive process itself should disappear at all: as I have already mentioned, in fact, different languages are associated with different cognitive styles. This is proven by the fact that, when retrieved, memories are shaped in different ways according to whether the speaker uses English, Spanish or Russian.

21.2.4 What the Cognitive Ergonomics of the Acquisition of L2 Tells Us About Performativity

The creation of ritualized and artificial contexts for testing the acquisition of L2 is a tendency at odds with the cognitive ergonomics of human being. As we saw in the previous paragraph, the execution of a linguistic performance is positively influenced by the matching between the input that triggered it and the requests of the context of execution; conversely, the success of the linguistic acts is impaired by the ritual nature of school education, which lacks the immediacy of face-to-face interaction.

When students are asked to pay attention to the concordance between adjective and noun or to find the correct verbal form, they miss the high level of ecological salience intrinsic to others' eye movements, communicative gestures and emotional expressions. Basically, as long as they need to answer the teacher or a computer about questions on linguistic competence, students can artificially draw their attention on the information they need to do the task; however, this approach is unhelpful when it comes to use L2 in a naturalistic context. In such case, bilinguals tend to plan what they are going to say and to focus on the pragmatic, non-linguistic cues of communication, such as tone and gestures of the interlocutor. Only when a lot of hours of practice will make them very good at mastering such skills, learners will be finally able to focus on grammar accuracy.

The obsession of the high rate of schooling societies for the dichotomy between competence and performance is a flaw we need to get rid of in order to improve the learning process of foreign language. What I have tried to show in the first part of this paper is that the acquisition of L2 is a striking example of the positive impact that performativity has on the learning process and, more generally, on all the automatable cognitive processes.

21.2.5 Unhappiness of Performative Acts and Onset of Psychopathological Behaviors

The role played by performativity in the interaction between man and environment is particularly evident in the case of "breakdown" of those motor or executive functions that normally take an active part in the physiology of specific cognitive processes. Let us take the example of the alteration of the instinct to eat in eating disorders.

Like most of the animal species, humans eat to satisfy two needs: the immediate urge to get energy for one's own sustenance (hunger) and the need to store an amount of energy which is sufficient to ensure survival until the next supply (appetite) (Pacini 2010). According to this definitions, whilst hunger seems to depend on endogenous factors, such as the entity of the energy deficit that the individual is experiencing, appetite appears to be influenced by the environment and by a combination of endogenous and exogenous factors. Hunger makes any man eat whatever he finds in front of him, regardless of whether it is his favorite dish or an unappetizing unseasoned salad; conversely, a man who's not hungry may feel his appetite increasing or not, depending on what food he is (or is not) in front of. Yet, a man might get no appetite at all even when staring at his favorite dish, just because he is sated or nauseated.

I think that the validity of the distinction between hunger and appetite made by Pacini lies in its correlation to adaptive factors: in case of emergency due to low levels of energy, being undemanding might be the right way to survive; conversely, when we can afford to choose the best source to fuel our energy supplies, being selective is the most advantageous strategy.

The alteration of the instinct to eat, if taken to the extreme, turns into a wide range of psychopathological behaviors that we know as “eating disorders”. Despite the culturalist interpretation of such phenomena gained a lot of success over the last century, the scientific community’s position about eating disorders has drastically changed. For example, Italian psychiatrist Matteo Pacini says that “eating disorders are substantially a biological problem, which is influenced – rather not determined – by a cultural factor. To become an actual disease, such behaviors need to be persistently repeated, to the point they become the only way the individual can relate to the instinct to eat. The anorexic patient can only avoid food, whilst the obese patient can only eat it” (Pacini 2010, translation mine).

According to the above interpretation, the onset of the disease depends on the anomalous ways the subject starts to (or not to) eat; thus, it’s the action that determines a change in the cognitive process, not the other way around. In this view, living in an environment that encourages people to be curvy rather than thin would make no difference for the anorexic patient, whose attitude towards food will already have been shaped by his habit of avoiding it.

Such observations on the psychopathologic nature of eating disorders lead me to believe that the common idea according to which homeostasis regulates nutritional mechanisms should be integrated with a performative model of the latter.

21.2.6 The Homeostatic Model of Nutrition

According to the Italian psychiatrist Armando Piccinni’s homeostatic model, “homeostasis is the capacity of any organism to maintain its biochemical balance even when environmental conditions change. Hunger and satiety are two of the most important mechanisms of the homeostatic balance control system. The adequate balance between these two opposed functions provides stability for the body weight” (Piccinni 2012: 53–54, translation mine). Under this model, the larger is our energy deficit, the more we get hungry, and that’s what keeps our body weight constant over the years. Nonetheless, common sense suggests that being able to choose from an extremely wide variety of foods increases our appetite, encouraging us to eat more than usual.

It is precisely the distinction between hunger and appetite that sheds light on the reasons why I think that the homeostatic model doesn’t fit nutrition. As Pacini says, in fact:

> If it were to up to the hunger, we would eat little and often. Conversely, we use to satisfy our appetite even when we are not hungry, accumulating in this way a lot of energy. We cannot increase our hunger to eat better or more than the availability of food lets us. Hunger leads to behaviors that are aimed at satisfying it: it cannot be otherwise. If we are hungry and there is no food, we just bear our sensation waiting for the next meal.

> Conversely, we use to stimulate our appetite in order to achieve a greater gratification. Figuratively speaking, appetite is like a fire rather than like a switch: it starts, grows and burns for a while (Pacini 2010, translation mine).

Thus, the homeostatic model accounts for the hunger, but not for the appetite. Piccinni himself had to admit that people put on and lose weight, often deviating from their initial one. Such oscillations are, in most cases, caused by dysfunctional eating habits, seldom by metabolic disorders. If we take a quick look at the recent scientific literature on the risk factors of abnormal eating behaviors, we can see that most of the studies relate such disorders to causes that have nothing to do with the physiology of the digestive system: negative affectivity (Dakanalis et al. 2016; Turton et al. 2017), body dissatisfaction, poor self-esteem (Dakanalis et al. 2016), high level of distress (Degortes et al. 2014; Palmisano et al. 2016; Elfhag and Rössner 2005); inability to actively respond to problems (Elfhag and Rössner 2005).

None of the above studies suggests that the problems addressed may be caused by the individual's behavior; this is the issue I am going to tackle in the next paragraph.

21.2.7 The Performative Model of Nutrition

"The core of the problem lies in the individual's behavior, which turns from being the manifestation of a normal need – searching for and eating food – to the psychopathological exaggeration of an instinct (the appetite)" (Pacini 2010). According to Pacini, appetite is a self-perpetuating mechanism: "whilst hunger decreases as the individual eats, appetite establishes a positive reinforcement with food: the more a man eats, the more his appetite grows" (Pacini 2010, translation mine).

Pacini claims that hunger is a homeostatic mechanism which cannot be artificially influenced by the quality of the food: once the requests of the organism are satisfied, hunger ceases.

Appetite follows a totally different pattern instead. Not only it can be influenced by the quality of the food, but it is an allostatic – rather than homeostatic – process, that is to say it is conditioned by endogenous and exogenous factors.

Let us take for instance the case of binge eating: it occurs when the individual, often encouraged by environmental factors (i.e. the availability of a great variety of appealing foods, or living in a society with a high rate of obesity), starts to eat excessive amounts of food. According to Pacini's model, the repetition over time of such gratifying behavior triggers the self-perpetuating mechanism of appetite, the growth of which makes the individual tolerant towards increasingly big amounts of food. Once triggered, this process leads the individual to be a food addict, making him incapable of satisfying his impulse.

Pacini's hypothesis on the self-perpetuating nature of the appetite is supported by studies carried out not only on humans, but even on lab rats (Ahn and Phillips 2012).

Similar findings had been previously achieved by independent research groups (Consoli et al. 2009; Artiga et al. 2007; Boggiano and Chandler 2006; Hagan et al. 2002, 2003); moreover, the link between social or interoceptive stress and food refusal were found in rats (Liang et al. 2012).

According to the model I have described above, the executive function of the act of eating causes, under the influence of particular environmental conditions, an alteration of the physiology of the cognitive processes linked to food consumption. Such dysfunctional behaviors, if repeated over time, prevent the individual from acting in different ways, leading to disorders such as anorexia or obesity. However, not all the people who eat a lot and for a long time establish a problematic relationship with food. The systemic alteration in the impulse to eat is linked to many factors, but still can only be triggered by the reiteration of the dysfunctional behavior. Both the studies carried out on humans and animals showed in fact that behavior and brain chemistry are heavily influenced by the overfeeding (see Corwin et al. 2011).

The multifactorial origin of the dysfunctional attitude towards food is confirmed by the results of some experiments on lab rats. Boggiano et al. (2007), in particular, found out that, in reaction to the same environmental triggers, different rats behave in totally different ways; this finding led the authors to make a distinction between "binge eating prone rats" and "binge eating resistant rats". Analogously, human's tendency to develop eating disorders depends on genetic predispositions (Trace et al. 2013) and on traumatic childhood (D'Argenio et al. 2009; Allison et al. 2007; Striegel-Moore et al. 2002) or adulthood (Palmisano et al. 2016) events. Moreover, human species is the only one that, *under natural conditions*, develops eating disorders such as anorexia, bulimia, obesity etc.

If we gather together the above data, we can draw the following conclusions: the development of a dysfunctional attitude towards foot depends on the combination of many genetic and physiological factors that man shares with other animals – such as rats – with particular environmental conditions. However, it is the *persistence* of such dysfunctional behavior that leads man to suffer from eating disorders. Such persistency, which can only be artificially inducted in animals, it is thus the cause of very widespread and typically human psychopathologies.

But why is man the only species who suffers from eating disorders? One of the most intuitive answer to such question might be that man is the only animal able to create environmental contexts where the quantity and the quality of food abound. Indeed, living in a society that encourages the consumption of sugar and fat and that promotes overeating is a huge risk factor; however, that's not all. I have just said that eating disorders and food addiction are caused by the reiteration of dysfunctional behaviors. Thus, the real question is: how do men get to this point?

I think that, in order to answer this question, we should look at the notion of performativity. Man is one the few species that processes food before eating it and that is able to make the latter as much appetizing and digestible as possible. Every step of this process – food cultivation, animal husbandry, food preparation and cooking etc. – affects the physiological, neurological and cognitive responses related to nutrition. Whilst such reaction of the organism increases our species' fitness, it is also the cause of the onset of eating disorders.

Obviously, not everyone who suffers from eating disorders uses to cultivate plants, breed or even just cook. On the contrary, binge eating is often related to the consumption of foods that require no preparation at all, and it is no coincidence that teaching to cook healthy food is one of the most successful therapeutic practices used to treat binge eating related obesity (see Leite et al. 2017); however, the above considerations give us a clear idea of the impact that performativity has on cognition: food processing is a striking example of how the performative act of a single individual or group of individuals can influence the neurobiological and cognitive processes of everyone who is involved in the environmental change that comes with it. The acts of cultivating, breeding, canning, enhancing the taste of food etc. are the result of our species' need to reduce both the time it takes for finding edible food and the risks that are associated with such process. This revolution in human habits turned into a cognitive and bodily revolution for the whole species; as a result, the appetite, which used to be fundamental in order to store energy between meals, became a force we need to learn to control and manage.

The environmental changes that men went through over time made the appetite unfit for its original purpose. As a consequence, the individuals often tend to eat too much or too little; the repetition of such behaviors is what leads them to pathology. Specifically, the effects of the performative function of human mind on eating disorders can be divided into two categories:

1. effects on the individual: eating too much or too little affects the patient's cognitive processes, to the point he cannot choose to act towards food in other ways;
2. effects on the community: food processing creates environmental conditions that overstimulate the impulse to eat, causing an alteration of people's behavior towards food and the subsequent eating disorders.

21.3 Conclusions

In this paper I have tried to show that the motor and the executive functions of any action are part of the cognitive processes, rather than acts that affects or interfere with them. The studies mentioned in Sects. 21.2.1, 21.2.2, 21.2.3 and 21.2.4 clearly demonstrate that the cognitive processes involved in the acquisition of L2 depend on the performative conditions that enable them. The inefficiency of the teaching methods I have talked about is a side effect of the dichotomy between performance and competence; such methods, in fact, might help the students to pass the exams, but not to fluently speak the language in natural contexts. Using second language in natural contexts is the best way to learn from one's own mistakes and to avoid associating the learning process only to stressful duties, homework and tests. This use of the second language is a perfect example of happy performative act, since it triggers a gradual change in the structure of the cognitive processes related to the acquisition of L2.

Conversely, the onset of psychopathological behaviors towards food is an example of unhappy performative act. In this case, the executive function of the instinct to eat deviates from its original purpose, altering the structure of the cognitive processes related to the physiology of nutrition. The reason why no other animal suffers from eating disorders under natural conditions is that human species is the only one able to create environments that are enabling factor (De Jaegher et al. 2010) for the development of potentially dysfunctional behaviors towards food.

References

Ahn, S., & Phillips, A.G. (2012). Repeated cycles of restricted food intake and binge feeding disrupt sensory-specific satiety in the rat. *Behavioural Brain Research, 231*(2), 279–285.

Allison, K.C., Grilo, C.M., Masheb, R.M., & Stunkard, A.J. (2007). High self-reported rates of neglect and emotional abuse, by persons with binge eating disorder and night eating syndrome. *Behaviour Research and Therapy, 45*(12), 2874–2883.

Aragno, A., & Schlachet, P.J. (1996). Accessibility of early experience through the language of origin: A theoretical integration. *Psychoanalytic Psychology, 13*(1), 23.

Artiga, A.I., Viana, J.B., Maldonado, C.R., Chandler-Laney, P.C., Oswald, K.D., & Boggiano, M.M. (2007). Body composition and endocrine status of long-term stress-induced binge-eating rats. *Physiology & Behavior, 91*(4), 424–431.

Atkinson, D. (2002). Toward a sociocognitive approach to second language acquisition. *The Modern Language Journal, 86*(4), 525–545.

Atkinson, D. (2010). Extended, embodied cognition and second language acquisition. *Applied Linguistics, 31*(5), 599–622.

Atkinson, D. (2011). A sociocognitive approach to second language acquisition: How mind, body, and world work together in learning additional languages. In *Alternative approaches to second language acquisition* (pp. 155–178). New York: Routledge.

Austin, J.A. (1962). *How to do things with words*. Oxford: Oxford University Press.

Boggiano, M.M., & Chandler, P.C. (2006). Binge eating in rats produced by combining dieting with stress. *Current Protocols in Neuroscience, 36*(1), 9–23.

Boggiano, M.M., Artiga, A.I., Pritchett, C.E., Chandler-Laney, P.C., Smith, M.L., & Eldridge, A.J. (2007). High intake of palatable food predicts binge-eating independent of susceptibility to obesity: An animal model of lean vs obese binge-eating and obesity with and without binge-eating. *International Journal of Obesity, 31*(9), 1357.

Bugelski, B.R. (1977). Imagery and verbal behavior. *Journal of Mental Imagery, 1*, 39–52.

Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge: The MIT Press.

Consoli, D., Contarino, A., Tabarin, A., & Drago, F. (2009). Binge-like eating in mice. *International Journal of Eating Disorders, 42*(5), 402–408.

Corwin, R.L., Avena, N.M., & Boggiano, M.M. (2011). Feeding and reward: Perspectives from three rat models of binge eating. *Physiology & Behavior, 104*(1), 87–97.

Dakanalis, A., Clerici, M., Caslini, M., Gaudio, S., Serino, S., Riva, G., & Carrà, G. (2016). Predictors of initiation and persistence of recurrent binge eating and inappropriate weight compensatory behaviors in college men. *International Journal of Eating Disorders, 49*(6), 581–590.

D'Argenio, A., Mazzi, C., Pecchioli, L., Di Lorenzo, G., Siracusano, A., & Troisi, A. (2009). Early trauma and adult obesity: Is psychological dysfunction the mediating mechanism? *Physiology & Behavior, 98*(5), 543–546.

De Jaegher, H., Di Paolo, E., & Gallagher, S. (2010). Can social interaction constitute social cognition? *Trends in Cognitive Sciences, 14*(10), 441–447.

Degortes, D., Santonastaso, P., Zanetti, T., Tenconi, E., Veronese, A., & Favaro, A. (2014). Stressful life events and binge eating disorder. *European Eating Disorders Review, 22*(5), 378–382.

Elfhag, K., & Rössner, S. (2005). Who succeeds in maintaining weight loss? A conceptual review of factors associated with weight loss maintenance and weight regain. *Obesity Reviews, 6*(1), 67–85.

Hagan, M.M., Wauford, P.K., Chandler, P.C., Jarrett, L.A., Rybak, R.J., & Blackburn, K. (2002). A new animal model of binge eating: Key synergistic role of past caloric restriction and stress. *Physiology & Behavior, 77*(1), 45–54.

Hagan, M.M., Chandler, P.C., Wauford, P.K., Rybak, R.J., & Oswald, K.D. (2003). The role of palatable food and hunger as trigger factors in an animal model of stress induced binge eating. *International Journal of Eating Disorders, 34*(2), 183–197.

Javier, R.A., Barroso, F., & Munoz, M.A. (1993). Autobiographical memory in bilinguals. *Journal of Psycholinguistic Research, 22*(3), 319–338.

Johnson, M. (2004). *A philosophy of second language acquisition*. New Haven: Yale University Press.

Lantolf, J.P. (Ed.). (2000). *Sociocultural theory and second language learning* (Vol. 78, No. 4). Oxford: Oxford University Press.

Leite, P.B., Dâmaso, A.R., Poli, V.S., Sanches, R.B., Silva, S.G.A., Fidalgo, J.P.N., Nascimento, M.A., de Oliveira, C.A.M., & Caranti, D.A. (2017). Long-term interdisciplinary therapy decreases symptoms of binge eating disorder and prevalence of metabolic syndrome in adults with obesity. *Nutrition Research, 40*, 57–64.

Liang, N. C., Smith, M. E., & Moran, T. H. (2013). Palatable food avoidance and acceptance learning with different stressors in female rats. *Neuroscience, 235*, 149–158.

Marian, V., & Neisser, U. (2000). Language-dependent recall of autobiographical memories. *Journal of Experimental Psychology: General, 129*(3), 361.

Marian, V., & Kaushanskaya, M. (2004). Self-construal and emotion in bicultural bilinguals. *Journal of Memory and Language, 51*(2), 190–201.

Neisser, U. (1976). *Cognition and reality: Prindiples and implications of cognitive psychology*. San Francisco: Freeman.

Neisser, U. (2014). *Cognitive psychology: Classic edition*. London: Psychology Press.

Pacini, M. (2010). *Dipendenza da cibo*. Vasto: Caravaggio.

Palmisano, G.L., Innamorati, M., & Vanderlinden, J. (2016). Life adverse experiences in relation with obesity and binge eating disorder: A systematic review. *Journal of Behavioral Addictions, 5*(1), 11–31.

Pennisi, A., & Falzone, A. (2016). *Darwinian biolinguistics: Theory and history of a naturalistic philosophy of language and pragmatics*. Cham: Springer.

Pennisi, P., & Torricelli, P. (2018). L'acquisizione della L2 in età adulta: cosa ci dicono i numeri sulle scienze del linguaggio. In Cavalieri, R., Bucca, A., (a cura di), *I linguaggi delle Scienze Cognitive*. Roma-Messina: CoRiSco Edizioni. isbn:978-88-9813-828-9

Pennisi, P., & Torricelli, P. (2018). Representing, photographing and studying cognitive processes: The case of second language acquisition. In D. J. Martínez Paricio & J. M. Moreno Carrillo (Eds.), *Comprender el presente, imaginar el futuro: nuevas y viejas brechas sociales*. CoRiSco: Roma.Messina.

Piccinni, A. (2012). *Drogati di cibo: Quando mangiare crea dipendenza*. Firenze: Giunti.

Rowlands, M. (2010). *The new science of the mind: From extended mind to embodied phenomenology*. Mit Press.

Striegel-Moore, R.H., Dohm, F.A., Pike, K.M., Wilfley, D.E., & Fairburn, C.G. (2002). Abuse, bullying, and discrimination as risk factors for binge eating disorder. *American Journal of Psychiatry, 159*(11), 1902–1907.

Trace, S.E., Baker, J.H., Peñas-Lledó, E., & Bulik, C.M. (2013). The genetics of eating disorders. *Annual Review of Clinical Psychology, 9*, 589–620.

Turton, R., Chami, R., & Treasure, J. (2017). Emotional eating, binge eating and animal models of binge-type eating disorders. *Current Obesity Reports, 6*(2), 217–228.

Wilson, A., & Ross, M. (2003). The identity function of autobiographical memory: Time is on our side. *Memory, 11*(2), 137–149.

Chapter 22
The Silent Work of Speech. On an Enactive Grammar's Insight

Francesco La Mantia

Abstract Many research programs have been worked out in recent years in order to account for an apparently trivial aspect of the human language activity. We refer to the fact that every speaker hears the sound of his own words. Our paper aims to embed this empirical insight in the theoretical framework of the so-called *enactive grammar*. This choice is justified by the fact that the enactive grammar introduced a formal distinction which allows to provide a clear formulation of the jakobsonian assert. In order to highlight this point, the paper will be subdivided into seven sections. The first section will be devoted to the experience of the hearing oneself speak. The second one will examine this experience from an enactive point of view. The third and forth section will try to show in which sense every speaker is his own interpreter (or co-speaker). The fifth one will analyze some theoretical consequences deriving from the remarks developed in the first four parts of the paper. Finally, the sixth and seventh section will seek to outline a realistic description of the so-called self-listening process. In the conclusion, we will give a synthetic résumé of the principal steps of our analysis.

Keywords Hearer · Listener · Enaction · Self-Monitoring · Other-Monitoring

22.1 Ouverture

Many research programs have been worked out in recent years in order to account for an apparently trivial aspect of the human Testo language activity. We refer to the fact that every speaker hears the sound of his own words. In the first half of the last century, authors like Roman Jakobson or Jacques Lacan had already reflected on this issue. For instance, according to the Russian linguist «L'experience auditive est le seul aspect du message encodé qui soit effectivement partagé par l'émetteur

F. La Mantia (✉)
Dipartimento di Scienze Umanistiche, Università degli studi di Palermo, Palermo, Italy
e-mail: francesco.lamantia28@unipa.it

A. Pennisi, A. Falzone (eds.), *The Extended Theory of Cognitive Creativity*,
Perspectives in Pragmatics, Philosophy & Psychology 23,
https://doi.org/10.1007/978-3-030-22090-7_22

et le receveur, puisque l'émetteur normalement s'entend parler lui-même».[1] Our paper aims to embed this empirical insight in the theoretical framework of the so-called *enactive grammar*. As we will show, this choice is justified by the fact that the enactive grammar introduced a formal distinction which allows to provide a clear formulation of the jakobsonian assert. In order to highlight this point, the paper will be subdivided into seven sections. The first section will be devoted to the experience of the hearing oneself speak. The second one will examine this experience from an enactive point of view. The third and forth section will try to show in which sense every speaker is his own interpreter (or co-speaker). The fifth one will analyze some theoretical consequences deriving from the remarks developed in the first four parts of the paper. Finally, the sixth and seventh section will seek to outline a realistic description of the so-called self-listening process. In the conclusion, we will give a synthetic résumé of the principal steps of our analysis.

22.2 Hearing Oneself Speak

Hearing oneself speak is a common human language operation. For, unless being affected by serious organic diseases, every speaker cannot avoid to hear the sound of his own words. This apparently trivial remark has been, and still is, one of the most discussed topics in many theoretical fields: from linguistics[2] to psycholinguistics,[3] from psychoanalysis[4] to audio-psycho-phonology,[5] to philosophy[6] and cognitive science,[7] the activity of the speaking subject as his own hearer has represented a scientific point of interest for many different scholars. In more recent years, a theoretical branch of the so-called enactive cognitive sciences has developed this intuition by introducing a formal distinction that enriched the metalinguistic repertoire of the contemporary language sciences. We are referring to the difference between *internal receiver* and *external receiver* that has been thematized in the framework of that research program known as *enactive grammar*.[8] Thanks to this categorical articulation, it has been possible to highlight the auditory activity of the speaking subject in appropriate terms: that is to say, as the activity of an «internal receiver». Moreover, this terminological specification allowed to describe the verbal exchange between two interlocutors as a dialogical relationship between two kinds of hearer: "the speaking hearer" (or *internal receiver*) and "the silent

[1] Cfr. Jakobson and Hallett (1963, pp. 131–132) cit. in Albano Leoni (2015, p. 56).
[2] Cfr. at least Culioli (2014), Coursil (2000, 2015).
[3] Cfr. at least Tomsen (2006), Di Cristo (2013).
[4] Cfr. at least Lacan (1981), Hartmann (2011).
[5] Cfr. at least Tomatis (2013, 1990).
[6] Cfr. at least Derrida (1972, 1987), Malabou (2017).
[7] Cfr. at least Hoffman (1997), Wilkinson (2014).
[8] Cfr. Bottineau (2010, 2011, 2012, 2013, 2017).

hearer" (or *external receiver*). Furthermore, «speech is the vocal conduct of sense-making processes that involve both an external receiver (the hearer) and the speaker envisaged as an internal receiver».[9] Naturally, this last theoretical result is, in itself, a very poor one. Nevertheless, it has the merit of introducing a second aspect of the speaking subject's auditory activity: that is, his *reflexive behaviour*.

22.3 Speaking as Acting on Oneself

Insofar as the speaking subject is an internal receiver, his verbal gesticulation can be conceived as a particular way by means of which he acts on himself. More precisely, since the speaker is able to hear himself, he can impress on himself, more or less consciously, the bodily experience of his own phonatory gesture. It is an *enactive* process, because it implies the activation of a system of perception-action (or *perçaption*)[10] in which resides one of the main aspects of the enaction in the sense of F.J. Varela and H.R. Maturana (cfr. at least Maturana 1978; Maturana and Varela 1980; Varela et al. 1993). This aspect consists of the generation – or *bodily synthesis* (cfr. Bottineau 2013) – of perturbations related to specific ecological universes. In the case we are discussing, it is the bodily synthesis of perturbations related to the acoustic universe of the speaker. As it is well known, such a *synthesis* (or *enaction*) is multimodal. It is not just auditory, but also tactile. Put in more concrete terms, the internal receiver not only can hear the sounds of his own words, but he can also perceive the movements of his own phonatory organs. So «le locuteur s'inflige l'expérience proprioceptive de sa parole, et par voie auditive, et par voie tactile».[11] Therefore, we have a complex system of *perçaption* inasmuch as the multimodal synthesis operated by the internal receiver refers to a retroactive sensorimotor *loop*: the speaker *perceives* what he *produces* by *acting* on himself. It is, however, necessary to observe that this multimodality is at the service of the dialogical circulation of meaning:

> Ces mouvement du corps vont bien au de-là du simple codage multimodal du sens. Ce qui est representé s'inscrit corporellement dans l'espace interlocutif: le sujet parlant prête son corps aux significations qu'à la fois il «fabrique» [. . .] et met en scène [. . .] jouant corporellement symboles et opérations sur ces symboles.[12]

Trivially, to speak is always to speak to the other. So, the sensorial activity of the internal receiver – as well as one of the external receiver – is subjected to the semiotic (or *semiopoietic*) constraints of the interlocution. It is for this reason that the enactive grammar conceives the bodily experience of hearing oneself speak as a *bodily experience of meaning*. In other words, because to hear oneself speak – as

[9] Cfr. Bottineau (2013, p. 5).

[10] Cfr. at least Berthoz (1997, 2009), Olivier (2012).

[11] Cfr. Bottineau (2006, p. 303).

[12] Cfr. Lapaire (2013, p. 57).

indeed to hear the other speak – is not a simple sensorial fact, enactive grammar describes the auditory activity of the interlocutors as a *semiotically organized* activity. More specifically, as an activity of understanding. From this point of view, the bodily experience of hearing oneself speak can be conceived as the experience of hearing-understanding oneself speak. Apparently, this is still a poor result, but it is fraught of epistemological consequences. In particular, it allows to see the locutor as an *utterance producer* which is at the same time his own *interpreter*.

22.4 Self-Repair in Speech

The self-correction behaviour of the speaker provides a strong empirical confirmation of this role duality. More specifically, we refer to those language operations by means of which every locutor can revise the (lexical, phonological or morpho-syntactic) *form* of his own discourse. For illustrative purpose, we will discuss an example freely adapted from the French linguist Jacqueline Authier Revuz. It is a verbal exchange between a student and a professor during a University oral exam:

- *Que pensez-vous de ce livre?*
- [. . .] *Ce qu'il y a d'original/original, non, mais tout à fait crucial dans* [. . .][13]

The answer – especially, the enunciative sequence "[. . .] *original, original, non, mais* [. . .]" – is particular enlightening. From this sequence we can go back to three language operations by means of which the interlocutor (i.e. the student) revise some portions of his own discourse. These operations are: (1) the *reprise* of what has been said; (2) the *negation* of what has been reprised; (3) the *reformulation* of what has been negated. As for (1), it consists of a sort of *lexical reduplication*: the adjective "*original*" is immediately presented again in the spoken chain. Regarding (2), it involves the *rectification* of "*original*". From a technical point of view, it constitutes an exemplary case of «metalinguistic negation»[14]: in short, it is a negation that operates on previous forms. Finally, as to (3), it involves the substitution of the "*original*" with "*crucial*". Hence, we have an assemblage of language operations activated by the speaker in order to revise in real time his own discourse. This linguistic mechanism provides, as we have already said, a good proof of the fact that the locutor is his own interpreter.

[13]Cfr. Authier-Revuz (2004, p. 154).

[14]Cfr. at least Ducrot (1984), Horn (2004).

22.5 The Non-premeditation of Speech

We could say that if the speaker was not able to hear his own words, he couldn't be his own interpreter. The reason of this fact relies on a peculiar aspect of human language activity known as the «non-premeditation of common speech».[15] Usually linguists use this expression to refer to the so called «umpredictability»[16] of the spoken chain. That is to say, to the fact that the speaker is unable to construct word-by-word what he will say before he says it. In fact, except maybe for certain particularly simple utterances, the speaker doesn't have global previews of the lexical and syntactical form of his own discourse. If anything, this form is discovered by the speaker as his own hearer:

> [. . .] la parole n'est ni préméditée, ni assemblée par celui qui parle. C'est un acte improvisé qui ne procède pas d'une construction réfléchie. Quand on y prête attention, on constate qu'elle sort à vif, impromptue, sans pré-travail combinatoire volontaire ni raisonnée: elle se trouve assemblée sans que nous l'assemblions. Autrement dit, la chaîne énoncée n'est pas annoncée. Elle vient à notre insu sans préavis.[17]

But if that is the case, the speaker will have access to the semantic content of his own words just because is his own hearer. Which is another way of saying that speakers can interpret his own utterances only insofar as they are able to hear such utterances.

22.6 Some Theoretical Consequences

Based on this analysis, we can draw some theoretical implications. First, insofar as the locutor is an internal receiver, there is an aspect of the verbal exchange with respect to which all the interlocutors stay on the same interactive level. This aspect concerns the fact that both the "speaking hearer" and the "silent hearer" hear the spoken chain at the same time. As it has been remarked by Jacques Coursil:

> Dans le dialogue, la parole s'impose à tous, ensemble et en même temps. Le parlant découvre sa parole au même moment que les autres à qui il parle. Les sujets en dialogue entendent la chaîne ensemble. [. . .] Autrement dit, l'avènement correspond à une prise en acte simultanée par chacun des membres du dialogue. Du plus simple énoncé au trait d'esprit, l'acte de parole réunit les participants en même temps de perception. En d'autres termes, la prise en acte de la parole est un point rythmiquement syncrone.[18]

Second, the aspect of the verbal exchange that we have just described allows to deepen a fundamental theoretical notion of the linguistic research. That is, the one of linguistic usage. As is well known, in the broad sense of the word, it refers to what

[15] Cfr. at least Coursil (2015b, p. 227).

[16] Cfr. at least Coursil (2015a, p. 45).

[17] Cfr. Ibidem p. 40.

[18] Cfr. Ibidem p. 46.

the speaker "can do" with the language. But the possibility that all the interlocutors hear the spoken chain at the same time allows to see this notion under another aspect. This refers to what the hearer "can do" with the language, where "doing" refers to what has been called by Coursil (2000) the «silent function» (*la fonction muette*) of the human language activity: «l'activité de cette langue sans parole correspond à la fonction muette du langage».[19] Notably, this function consists of converting acoustic waves into significant forms. Put in these terms, the silent function of language identifies a *semiopoietic* process that is distributed from one extreme to another of the interlocutory field and that is internally embedded in the speaker insofar as he is an internal receiver.

22.7 Is the Locutor His Own Listener?

At this point, we would like to examine a fundamental theoretical issue related to the general topic of our analysis. In short, one wonders whether the silent function of the speaker makes this his own *listener*. From a certain perspective, the answer should be obvious. To put it another way, it should be clear that every speaker is his own listener. According to many scholars, there are two facts that justifie this assumption: (1) the locutor cannot avoid to hear the sound of his own words (cfr.§ 1); (2) he can understand his own words (cfr.§§1&4) We are already familiar with those results. But it is interesting to notice how some of the most important psycholinguists seem to adhere to a particular model of the speaking subject underlying these results. Naturally, this model see the speaker as his own listener. For istance, according to Levelt (1993: 13) «the speaker is his own listener. More precisely, [...] He can understand what he is saying, i.e., he interprets his own speech sound as meaningful words and sentences». Authors like Hofer (2015: 70), Denes and Pinson (2016: 217) or Bottineau (2011: 190) share the same perspective. However, other authors like Pêcheux (1992: 95) are more careful. According to the French analyst of discourse, every speaker is at most his own «potential listener». We believe that the term "potential" can be read in two ways: (1) as meaning the fact that every speaker is ready to be his own listener; (2) as meaning the fact that every speaker may or may not be his own listener. Furthermore, the scientific literature seems to provide different points of view on the subject. But in our opinion this perspectival difference needs to be examined in the light of strict definitions of "listening".

[19]Cfr. Coursil (2000, p. 3 n. 6).

22.7.1 Two Definitions of Listening

According to Emmert (1994:6) «Listening is the process of receiving, constructing meaning of, and responding to spoken and/or non-verbal messagges».[20] Psycholinguists like Levelt (1993), Hofer (2015) or Denes and Pinson (2016) base their judjements on definitions of «self-listening» that are consistent with the definition given by Emmert. Strictly speaking, they equate the experience of hearing/understanding oneself speak with the reflexive version of the listening in the sense of Emmert (1994). And this is the reason why they can conceive every speaker as his own listener. But it is necessary to remark that there are other definitions of listening. We are referring to those that define listening as the process of paying attention to what someone is saying. In the words of the philosopher of cognitive sciences Peter Szendy «[. . .] nous dirigeons tout le temps notre attention sur tel ou tel son, sur telle ou telle voix. On pourrait même dire que c'est précisement la définition de l'écoute. Écouter veux toujours dire [. . .] diriger son attention en laissant tomber un aspect ou une région du sonore pour en choisir une autre».[21] Then, if you construe «self-listening» in the light of this second kind of definition, it will be clear that locutors may and may not be his own listeners. For, locutors not always pay attention to what they say when they speak. Slips of the tongue provide an empirical proof of this fact. As it is well-known, some of them are not perceived by the speakers, and, in this case, there is a local reset of the self-listening.

22.7.2 Towards a Realistic Conception of the Self-Listening

But even such cases are consistent with the possibility that the locutor is his own listener. In fact, they permit to deepen this peculiarity of human language activity. More precisely, they provide a realistic view of such a functional specificity. When I say "realistic", I'm referring to a particular framework within which the conception of the locutor advanced by linguists like Coursil or psycholinguists like Levelt can take into account some contexts of interlocution where the self-listening is locally inactive. Of course, the eventuality of a self-listening's local inactivity is a common aspect of the linguistic behaviour of every speaker. Moreover, what we said on the self-listening it also applies *mutatis mutandis* on the listening. For, the external receiver not always pays attention to what the internal receiver is saying. But, more generally, it is necessary to remark that paying attention to what is said is not an "all-or-nothing" property. It is, on the contrary, a property with degrees: it may be absent, partially or fully present – and such graduality concerns both the internal receiver and the external receiver.

[20] Cit. in Brownell (2012, p. 112).

[21] Cfr. Szendy (2017, p. 63).

22.8 Self-Monitoring and Other-Monitoring

Naturally, we don't aim at suggesting a strict identity between listening and self-listening, or, in other words, between internal and external receiver. For a cognitive scientist, to adopt a perspective of this kind would be absolutely incorrect. For, internal and external receiver are different with respect to several conditions. In particular, they differ regarding the monitoring processes underlying, respectively, listening and self-listening. As it has been well remakerd, «the attentional requirements for self-monitoring and other-monitoring are different».[22] In short, «When listening to others' speech, the job of the listener is to extract meaning out of the signal. When self-monitoring, the job of the speaker is to inspect the utterance for deviations at any level of production».[23] But excluding these differences, self-monitoring and other-monitoring they converge at least on one point. That is to say, they operate on significant forms generated by the same silent semiopoietic function. In conclusion, we believe that it is possible for every speaker being his own listener in the general sense that he may have access to this silent function. As we have seen, this function allows to the speaker to revise the form of his own discourse, or, in other words, to respond to his own discourse as well as would respond to it his own interlocutor.

22.9 Conclusion

The main topic on which this paper has been centered is that every speaker cannot avoid to hear the sound of his own words (cfr.§ 1). We deepened this first insight by introducing a formal distinction belonging to the theoretical framework of the so-called enactive grammar: i.e. the difference between internal and external receiver (cfr.§ 1). Then, we have demonstrated that the verbal gesticulation of the internal receiver can be conceived as a particular way by means of which he acts on himself (cfr.§ 2). In other words, we have discussed the fact that every speaker can impress on himself, more or less consciously, the bodily experience of his own phonatory gesture. (cfr.§ 2). After having examined the semantic aspects of such a bodily experience (cfr.§§§ 2;3;4), we pointed out the necessity of distinguishing between two kinds of linguistic praxis: that is, the expressive praxis of the speaker and the silent praxis of the hearer (cfr.§5). Furthermore, we identified the second one with a *semiopoietic* process that is distributed from one extreme to another of the interlocutory field and that is internally embedded in the speaker (cfr.§ 5). Finally, we tried to show how this capacity makes every speaker his own listener (cfr.§ 6). In order to explain this fundamental aspect of human language activity, we discussed

[22] Cfr. Hartsuiker and Kolk (2001, p. 152).
[23] Cfr. Ivi.

the main theoretical approaches to this one by distinguishing two notions of listening (cfr.§ 6.1). Then, we have sketched a realistic conception of the «self-listening» (cfr.§ 6.2) by discussing the fundamental difference between self-monitoring and other-monitoring (cfr.§ 7).

References

Albano Leoni, F. (2002). *Des sons et des sens. La physionomie acoustique des mots*. Lyon: ENS éditions.

Authier-Revuz, J. (2004) *Ces mots qui ne vont pas de soi. Boucles réflexives et non-coïncidence du dire*. Limoges: Lambert-Lucas

Berthoz, A. (1997). *Le sens du mouvement.* Paris: Odile Jacob

Berthoz, A. (2009). *La simplexité*. Paris: Odile Jacob.

Bottineau, D. (2006). L'émergence du sens par l'acte de langage, de la syntaxe au submorphème. In M. Banniard & D. Philps (Eds.), *La fabrique du signe, Linguistique de l'emergence* (pp. 299–325). Toulouse: Presses Universitaires du Mirail.

Bottineau, D. (2008). *Co-experiencing prosody: the distributed motives and effects of prosody in languaging processes*, forthcoming.

Bottineau, D. (2010). Language and enaction. In J. Stewart, O. Gapenne, & E. Di Paolo (Eds.), *Enaction: Toward a new paradigm for cognitive science* (pp. 267–306). Cambridge: MIT Press.

Bottineau, D. (2011). Parole, corporéité, individu et société: l'embodiment entre le représentationnalisme et la cognition incarnée, distribuée, biosémiotique et enactive dans les linguistiques cognitives. *Intellectica*, *56*, 187–220.

Bottineau, D. (2012). La parole comme technique cognitive et incarnée et sociale. *La Tribune internationale des langues vivantes*, *52–53*, 44–55.

Bottineau, D. (2013). Pour une approche enactive de la parole dans les langues. *Langages*, *192*, 11–27. https://doi.org/10.3917/lang.192.0011.

Bottineau, D. (2017). Incarnation langagière et grammaire des langues naturelles: vers la fin d'un clivage. In *La cognition incarnée* (pp. 251-294). Paris: Vrin.

Brownell, J. (2012). *Listening: Attitudes, principles, and skills*. London: Routledge.

Coursil, J. (2000). *La fonction muette du langage.* La Martinique: Ibis.

Coursil, J. (2015a). *Valeurs pures. Le paradigme sémiotique de Ferninand de Saussure.* Limoges: Lambert-Lucas.

Coursil, J. (2015b). Hidden principles of improvisation. *SEMEIOTIKE Signs Syst Stud,* 15, 226–234. https://doi.org/10.12697/SSS.2015.43.2-3.05.

Coursil, J. (2017). Semiotica dell'ascolto. *Scienze e ricerche*, *44*, 21–27.

Culioli, A. (2014). *L'arco e la freccia. Scritti scelti*. Bologna: Il Mulino.

De Cristo, A. (2013). *La prosodie de la parole*. Bruxelles: De Boeck éditeur.

Derrida, J. (1972). *Marges de la philosophie*. Paris: Les éditions de Minuit.

Derrida, J. (2010). *La voce e il fenomeno*. Milano: Jaca Book.

Ducrot, O. (1984). *Le dire et le dit*. Paris:Les éditions de Minuit.

Emmert, P. (1994). A definition of listening. *Listening Post*, *51* (6), 6–25.

Hartmann, F. (2011). L'imaginaire, c'est le sens. Quelques remarques sur la théorie de Jacqueline Authier-Revuz. *La revue lacanienne. La psychanalyse et le langues*, *11*, 181–186. https://doi.org/10.3917/lrl.113.0181.

Hartsuiker, R.J., & Kolk, H.H.J. 2001. Error monitoring in speech production: A computational test of the perceptual loop theory. *Cognitive Psychology, 42*, 113–157, https://doi.org/10.1006/cogp.2000.0744.

Hofer, B. (2015). *On the dynamics of early multilingualism. A psycholinguistic study*. Berlin: Mouton De Gruyter.

Hoffman, R. (1997). What Neural Network Studies suggest regarding boundary between Conscious and Unconscious mental processes. In D.J. Stein (Ed.), *Cognitive science and unconscious* (pp. 121–140). Washington: American Psychiatric Press.

Horn, L. (2004). *A natural history of negation.* Oxford: Oxford University Press.

Lacan, J. (2007). *Le séminaire*, Livre III, *Les Psychoses 1955-1956*. Paris: Les éditions du Seuil.

Lapaire, J.-R. (2013). Gestualité cogrammaticale: de l'action corporelle spontanée aux postures de travail métagestuel guidé. *Maybe* et le balancement épistémique en anglais. *Langages*, *192*, 57–72. https://doi.org/10.3917/lang.192.0057.

Levelt, W. (1993). *Speaking: From intention to articulation*, Cambridge, MA: A Bradford Book, MIT Press.

Malabou, C. (2017). *Les noveaux blessés. De Freud à la neurologie, penser les traumatismes contemporaines.* Paris: PUF.

Maturana, H. (1978). Biology of language: The epistemology of reality. In G. Miller & E. Lennenberg (Eds.), *Psychology and biology of language and thought: Essays in honor of Eric Lennenberg* (pp. 27–64). New York: Academic Press.

Maturana, H., & Varela, F. (1980). *Autopoiesis and cognition: The realization of the living*. Dordrecht: Reidel.

Olivier, G. (2012). *La cognition gestuelle. Ou de l'écho à l'égo*. Grenoble: Presses Universitaires de Grenoble.

Pêcheux, M. (1992). Automatic discourse analysis. Amsterdam: Rodopi.

Peter, D., & Elliot, P. (2016). *The speech chain: The physics and biology of spoken language.* Dordrecht: Springer.

Szendy, P. (2017). *Prêter l'oreille. Petite conférence sur l'écoute*. Paris: Bayard.

Tomatis, A. (1990). *L'oreille et la vie. Itinéraire d'une recherche sur l'audtion, la langue et la communication*. Paris: Réponses-Santé/ Robert Laffont.

Tomatis, A. (2013). *L'orecchio e il linguaggio*. Milano: Ibis.

Tomsen, O.N. (2006). *Competing models of linguistic change: Evolution and beyond (CURRENT ISSUES IN LINGUISTIC THEORY).* Amsterdam: John Benjamin Publishing.

Varela, F., Thompson, E., & Rosch, E. (1993). *The embodied mind: Cognitive science and human experience.* Cambridge: Cambridge University Press.

Wilkinson, S. (2014). Accounting for the phenomenology and varieties of auditory verbal hallucination within a predictive processing framework. *Consciousness and Cognition*, *30*, 142–155. https://doi.org/10.1016/j.concog.2014.09.002.