



# METAPHOR AND ARGUMENTATION

edited by

Francesca Ervas  
Massimo Sangoi



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# **METAPHOR AND ARGUMENTATION**

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Volume 5  
*Metaphor and Argumentation*  
Francesca Ervas and Massimo Sangoi, eds.

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# The Role of Metaphor in Argumentation

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Metaphors are cognitive processes used to represent the world and better understand ourselves. This view, widely accepted in contemporary metaphor studies and confirmed by an extensive range of analysis and experiments, allows to explain why metaphors have such deep impact on several contexts of human language and thought: they can range from syllogisms to poems, from newspapers headlines to adverts, from scientific models to thought experiments. There has been considerable study of the persuasive effect that metaphors have in advertisements, political speeches, arguments in debates, educational material, and elsewhere. While an apt metaphor can strengthen an argument and make it more persuasive without doing violence to the truth, metaphor can also, by exacerbating problems of ambiguity, contribute to fallacies of argumentation. The present volume collects nine papers which combine logical and philosophical analysis and empirical research to study different aspects of metaphors in argumentation. The aim of this collection is to theoretically analyse the way metaphors are used in argumentation, and the linguistic and epistemological phenomena involved in metaphor production and comprehension in different research fields, such as science, literature and philosophy.

All the collected papers were presented at the first Cagliari-Urbino Meeting on “Metaphor and Argumentation”, held at the Department of Edu-



cation, Psychology, Philosophy of the University of Cagliari on June 13-14, 2012. The meeting was jointly organised by the research groups Linguistica-Mente and ALoPhiS - Applied Logic, Philosophy and History of Science (University of Cagliari), Synergia Research Group in Logic, Language, Cognition, History and Philosophy of Sciences (University of Urbino) and APhEx. Portale italiano di filosofia analitica ([www.aphex.it](http://www.aphex.it)). The workshop was divided into four sections, presenting four different perspectives on the role of metaphor in argumentation.

The first section, “The language of metaphor”, investigates the use of metaphor as a linguistic phenomenon from a historical point of view, paying attention to its role in literature. After having introduced the major theories of metaphor from Aristotle to Relevance scholars, it focuses on live metaphors in Italian contemporary literature. The second section, “Epistemology of metaphor”, focuses on the role of metaphor in scientific theories and discusses the functions and characteristics metaphor needs in order to be a real tool for scientific discovery and argumentation. The third section “Arguing with metaphors”, more specifically analyses the effects of metaphor in argumentation, from both a general perspective as in the case of the ontogenesis of universal and a specific perspective as in the case of *quaternio terminorum*. The fourth section “Experimenting with metaphors”, proposes two methodologies to test metaphor comprehension in argumentation. The first one comes from psycholinguistics and consists in indirectly asking people whether and how they recognize that a conclusion follows from some premises containing metaphors. The second one is rooted in philosophical tradition and consists in imagining radical situation and/or particular context where metaphors could be investigated in their deeper mechanisms.

## **1. The language of metaphor**

In “Metaphor and Reasoning: Aristotle’s View Revisited”, Elisabetta Gola argues that all contemporary theories of metaphor claim that metaphors and reasoning are somehow bound. Indeed, whether emphasizing metaphors’ conceptual features or underlining its linguistic peculiarities, in any case these theories are aimed at showing that metaphor is a powerful device to increase our knowledge, because it enhances the connections between human thought and reality (Gola 2005). Elisabetta Gola investigates the historical roots of this idea, by defining the terms of the problem in the philosopher who set them first: Aristotle. Aristotle thought that metaphor is proper to learning and understanding, because it allows a transfer of knowl-

edge from different domains (from a concrete domain to an abstract one), which are isomorphic. According to Aristotle, metaphor is a way to grasp by intuition the similarities we find in nature. Other conceptual procedures intervene to understand whether such similarities are true and metaphors are then grounded.

This view on metaphor has been interrupted when classic rhetoric has coded metaphor and other tropes of language according to their use, classifying them as language embellishments. Metaphor lost the power of connecting language, thought and reality until 1954, when Max Black proposed the interactive theory of metaphor, focusing on the role of imagination in the language of science. The main idea of the theory is that a metaphor involves at least two domains of knowledge and that the relation among them cannot be reduced to their single words nor to the entire domains considered as separated. The interaction among domains is created through a metaphor, which restructures the domains themselves, by (1) selecting, (2) emphasizing, (3) suppressing, and (4) organizing their traits. In 1980 George Lakoff and Mark Johnson proposed another view, the conceptual theory of metaphor, which brings back to the foreground the cognitive role of metaphor. Metaphors are just the linguistic surface of deeper structures, called image-schemata, lying between propositions and images. Such image-schemata guarantee conceptualization through a complex system of primary and cultural projections from a source domain to a target domain. Therefore metaphors are the litmus paper of the mechanisms of projections between domains according to the context of use.

Psycholinguists such as Raymond Gibbs (1994), Sam Glucksberg (2001), and Rachel Giora (2003) and others bring in front of the tribunal of experience the major theories of metaphor, by testing the mechanisms involved in metaphor comprehension to understand whether they are different for literal and figurative meaning and whether they need different processing times. Elisabetta Gola discusses different hypotheses showing that there still is no shared answer to these problems in the field of metaphor studies. However scholars such as Deirdre Wilson and Dan Sperber, who proposed the Relevance theory in 1986, show that there is a “continuum” between literal language and figurative language, metaphor included, and that therefore the dichotomy between literal and metaphorical uses of language is inaccurate. They are just different solutions to the same problem: understanding in each communicative encounter and for each exchanged message, which its more relevant interpretation is, i.e. the interpretation optimizing the costs/benefits relationship between processing effort and cognitive effect.

Their explanation of the explicit meaning challenges the traditional distinction between literal and non-literal uses of language, insofar as what is considered as “literal” is the result of a pragmatic process of modulation (Carston 2002). Appealing to a “unified approach” to literal and non-literal uses of language, Robyn Carston (2002) explained metaphors as a local, on-line pragmatic adjustment of the encoded lexical meaning resulting in an *ad hoc* concept. However, in the case of live metaphors, an alternative, “imaginative” route is hypothesized (Carston 2010; Carston and Wearing 2011): the literal meaning would be maintained in a more global pragmatic process resulting in a range of communicated affective and imagistic effects. This route to understanding metaphors does not exclude the *ad hoc* concepts mechanisms, i.e. a more conceptual way to metaphor understanding. In Carston’s view, literal meaning plays indeed a fundamental role for metaphor understanding. However, in the case of live or literary metaphors the literal meaning endures in evoking an image with more important effect with respect to the first route.

Giuseppe Bompreszi’s paper, “Bontempelli, Calvino, Montale and Luzi: Thoughts on Metaphor within Contemporary Italian Literature”, specifically focuses on live metaphors taken from Italian contemporary literary texts. Bompreszi outlines a theory of literature which should be able to provide an explanation to the specificities of literary texts when compared to other kind of texts. Quoting Miller (2002), Bompreszi states that “Literature derails or suspend or redirects the normal referentiality of language. Language in literature is derouted so that it refers only to an imaginary world” (Miller 2002: 18). He focuses his attention on Roman Jakobson’s view on poeticness, a property identified as the core characteristic of literary texts. However, Jakobson maintains that metaphor is the most prominent figure of speech in poetry, whereas metonymy is the most important scheme in prose. In order to criticize Jakobson’s view, Bompreszi analyses the use of metaphor in four Italian authors, providing two counter-examples from poetry and tales.

In the tale *The Good Wind* (1961), Massimo Bontempelli introduces some figurative expressions Italians use in ordinary communicative interactions. The tale presents both metaphors and metonymies as expressions we no longer perceive as non-literal, since they have entered our everyday language. Only by an effort of abstraction we could get to consider them as figurative. Bompreszi argues that the tale can be read as the aesthetic realization of the theory of metaphor, according to which we should hypothesize a plurality of worlds in order to make sense of an utterance which is not referentially coherent with the actual world. In *The forest on the Superhighway*

(1966), Italo Calvino clearly mentions the alleged wood to refer to something else: a heap of billboards. As Bomprezzi argues, this is not a metaphor because this case is more similar to an epistemological misinterpretation. The children of the tale have a model, which is in a sense a metaphor, but allows them to infer something true, despite its being false, with a funny effect.

In *I Have Often Met the Pain of Living* (1925), Eugenio Montale does not properly use metaphor but more precisely “objective correlatives”, i.e. denotation of specific things and/or situations, to evoke a feeling without necessarily speaking of that feeling as such. For instance, the “pain of living” is evoked by “the obstructed brook that gurgles”, “the shrivelling up of the burnt leaf” and “the collapsed horse”. These expressions *represent* the suffering of being-in-the-world in physical terms, i.e. without referring to psychological states. In *Under the Yoke of Metaphor* (1935), Mario Luzi invites the reader to consider metaphor not as a “further-ness” or something that comes after the literal or a shared background of successful communication in its turn connected to a shared world. Metaphor is rather the very condition of human being, to whom any object is symbolically intentioned. Therefore metaphor comes first, before the literal, and – as Bomprezzi suggests – “the world is never the correlate of an empty and simple faculty of ‘seeing’”.

## **2. Epistemology of metaphor**

Overall the first two papers concern the language poets as well as laymen use to express metaphor and the theories scholars have introduced to explain such a complex cognitive-linguistic phenomenon. The following papers focus on science as the special field where metaphor’s argumentative power can better display its effect.

In “Features and Functions of Scientific Metaphors”, Massimo Sangoi aims at understanding why and under which conditions metaphor, which is omnipresent in scientific discourse, can really contribute to knowledge increasing. As several studies have shown, metaphors are essential not only because of their communicative and pedagogical functions, but also (and more interestingly) because of their epistemic role.

Sangoi reviews the debate on this topic to show why metaphors can play an essential role in theory-making. In order to understand the role and the heuristic effectiveness of metaphors in scientific reasoning, he outlines the cognitive mechanisms underpinning the effects of this figure of speech.

As a linguistic phenomenon, metaphor is an act of transfer of a word or phrase from one domain to another grounded in some similarity between the domains. In this transfer some properties are selected, while others are ignored according to some relevance criteria, which are based on the context and the conceptual frameworks of the domains involved. Following Lakoff and Johnson's theory (1980), Sangoi highlights the fact that metaphor is not just a linguistic matter, but it rather concerns our thought and action. Metaphors are indeed rooted in our experience, so they are not on the same level of any metaphorical linguistic expression met in spoken or written speech. Well-known examples of conceptual metaphors are LIFE IS A JOURNEY, ARGUMENT IS WAR, TIME IS MOTION, SADNESS IS DOWN, etc. Their source is provided by Gestalten, i.e. "image-schemata" directly emerging from our bodily experience or representations of more familiar domains. Many linguistic metaphors can be derived from such conceptual metaphors: for example, sentences such as "Sam's life took an unexpected direction after he met Jenny" and "Mary was at a crossroads, she did not know which way to go" are different manifestations of the same LIFE IS A JOURNEY conceptual metaphor.

First, Sangoi considers some influential theories of metaphor, such as Max Black's *interactive view* (1962) and its developments, George Lakoff and Mark Johnson's *conceptual theory of metaphor* (1980), and the *structure mapping theory* proposed by Dedre Gentner and her colleagues (1982, 1993). This leads him to explore Indurkha's interaction-based approach (Indurkha 1992), with particular reference to the creative side of metaphor. In this framework, cognition is characterized by an interaction between a cognitive agent and her environment, which are equally essential to determine the structure of our conceptual system (Indurkha 1992, 2006, 2007). Reassessing Black's theory on the mechanisms of projection and accommodation, Indurkha shows how metaphor can bring new possibilities of meaning into being (Indurkha 2006). Second, Sangoi shows how different views about scientific theories could influence the attitude towards metaphor and prejudice the expectations as to its actual import in scientific reasoning. In this respect, pursuing the analysis in the direction suggested by Mary Hesse, he argues that moving from an approach focused on the syntactic structure of theories (Duhem, Hempel, Popper, etc.) to those approaches that are more interested in the semantic (Suppes, Van Fraassen, Suppe, etc.) and cognitive (Giere, Machamer, Glennan, etc.) aspects of theories brings out the centrality of the activity of representing things or situations (based on the recognition of similarity) as an essential connection between metaphor, cognition and theorizing. In doing so, Sangoi takes a

look at several issues that have been extensively discussed in the philosophy of science, such as theory ladenness, underdetermination of theories by data, idealisation, etc. Finally, he shifts the focus on some cases of metaphor that seem to play a constitutive role in scientific theories. This allows him to show the mechanisms highlighted in the previous analysis at work in concrete situations.

Valentina Favrin and Pietro Storari, in “The Role of Metaphor in Mary Hesse’s Language Theory”, address Mary Hesse’s epistemology. Her thought questioned the very idea of an ideal language supposed to perfectly fit a world whose ontology should reflect the hierarchical structure of Aristotle’s categories (Arbib and Hesse 1992). According to Logic Empiricism, scientific language should be the mirror of nature. According to her, scientific language is instead nothing but a refinement of natural language, where metaphor maintains its priority over literal language, thereby allowing the adaptation of the discourse to a progressively extended worldview. Therefore understanding scientific language is not reducible to the assignment of an external referent in the world, but rather should incorporate recognition of the family resemblances a linguistic community takes as more salient. Wittgenstein’s notion of “family resemblance” is indeed used in Hesse’s theory of language to identify a set of properties belonging to different objects and a strategy for the selection of the relevant properties. Family resemblance allows considering objects as members of the same class and then categorizing them under the same concept. However the relation of similarity is not simple, being a matter of degrees and respects. So, if on the one hand it is quite immediate to regard certain objects, qua provided with specific properties, as central to a class, on the other hand any categorization involves some degree of vagueness, because the properties some of its members have set them at the periphery of the class, what sometimes makes the categorization itself problematic.

By recognizing similarities and differences among objects, the process of categorization implies a loss of information. If we tried to restore all the information by making explicit the conditions whereby a category has been applied to certain objects, the analysis would enter into an infinite regress and we would never come to completely explain concepts through the resemblances of their properties. Going to the origin of the act of recognizing similarities cannot be put into words and we need to stop at a point where concepts cannot no longer be explained by further new concepts. At this primitive point we can neither rest on resemblances established beforehand, nor on a theory providing a strategy for the selection of relevant properties (Hesse 1974). A literal description of the primitive concept is then impossi-

ble and we can only rely on exemplification. Therefore, the *explanans* is constitutively a metaphorical redescription of the *explanandum*. Hesse's theory of language questions the very notion of literality, as the peculiar characteristic of metaphor is to have a fluctuating meaning which cannot describe the world in terms of classical logic or formal semantics.

In "Gaia Hypothesis: The Metaphor of Planet Earth as a Living System", Sara Matera considers a specific metaphor, *Gaia*, as metaphor of the Earth, wondering whether it could be considered a step to scientific theory. The *Gaia* hypothesis has been formulated by Lovelock and Margulis at the end of Sixties. *Gaia* is the name they assigned to the planet Earth considered as a whole as a living being. In their opinion, *Gaia* would have faculties and powers far superior to the sum of its single components (Lovelock 1979). A decrease in entropy in the atmosphere of the planet would have been a sign of the presence of life. In particular, *Gaia's* atmosphere would have been optimally kept and settled by living beings in the surface, i.e. the biosphere. In spite of large-scale variations, *Gaia* has been able to maintain the optimal condition for life in the planet through a complex process of cooperation among all its parts: biosphere, soil, oceans and atmosphere.

Matera is particularly interested in the relationship between *Gaia* and the mankind. The point is that, on the one hand, Man is part of *Gaia*, but, on the other hand, human activities have been provoking disastrous effects on her. This could seem a paradox, as if *Gaia* wanted to destroy herself. According to Lovelock, the awareness of ecological dangers and the effort in laws and technologies against earth destruction are just examples of auto-regulation processes *Gaia* uses to hinder human lumbering presence on the planet. This is indeed *Gaia's* peculiarity: remaining itself despite of radical changes and human attempts at life survival on Earth. However, even though Lovelock presents *Gaia* as a scientific theory, many scholars have questioned it and argued that it can be seriously considered just an interesting and illuminating metaphor, but one that is unable to shed light on the causality mechanisms as a real scientific theory should do (Kineman 1997, Gould 1997).

Matera wonders whether *Gaia* is just a rhetoric tool, as literary metaphors usually are, or rather a scientific metaphor. She argues that, in literary texts, metaphors serve to evoke images, while in science they are used to make complex concepts easier to understand, by linking them to better-known, everyday concepts. *Gaia* seems to have both these features: on the one hand, the name *Gaia* makes it look like a person and immediately evokes the feeling of being part of a living system; on the other hand, the term *Gaia* remembers the Greek mythological *Gea*, the mother Earth, and

makes the hypothesis easier to understand for the public. A scientific metaphor has indeed three functions (Bradie 1999): a rhetoric function to popularize and divulge scientific theories; a heuristic function to make new discoveries; and a cognitive function to offer a new explanation to phenomena or processes in nature. Matera argues that *Gaia* displays all these three functions and thus can be considered a scientific metaphor. What is at stake is rather the truthfulness and usefulness of *Gaia* as scientific metaphor. As Matera points out, a scientific metaphor should evoke meanings which are not theoretically misleading, even though they are useful from a practical point of view. However, this is precisely the reason why *Gaia* hypothesis has been criticized: its manifest finalism seems to suggest a (non-scientific) optimism about *Gaia* and the future of mankind.

### **3. Arguing with metaphors**

The two following papers address the role of metaphor a) in a broader sense by wondering how we acquire concepts and whether they are in some way bound to metaphorical language and b) in a more narrow sense by analysing specific arguments possibly containing similes and/or metaphors, as in the case of *quaternio terminorum*.

In “Metaphors and the Ontogenesis of Universals”, Vincenzo Fano and Tommaso Panajoli focus on the relation between metaphor and perceptual concepts, like colours and physical sensations, and defend a philosophical thesis on their ontogenesis. They aim at understanding how we come up with perceptual concepts and the extent to which metaphor could intervene in this process. The authors firstly introduce a definition of concept and consider different philosophical positions on the ontogenesis of concepts. While the role of metaphor is now ascertained as regards abstract categorization, it is not so in the case of more basic levels of categorization, utterly when dealing with perceptual experience. Indeed, referring to a wide series of examples on abstract concepts such as love, discussion, time, and so on, Lakoff and Johnson (1980) have shown that the conceptual framework through which we understand and categorize the world is shaped by metaphor. However, the occurrence of transference mechanisms is confirmed by several studies on synaesthetic experiences (cf. Marks 1996, Cacciari 2005) and, based on those studies, are also confirmed the relations that psychologists and linguists have inferred between cognitive processes and figurative language. Synaesthesia is a particular kind of metaphor combining two or more sensory domains based on similarities between the data they afford,



whereby it establishes a connection between language and perception. Synaesthetic experiences are prototypical examples of embodiment, held to allow giving linguistic expression to the interactions happening in the sensory domains. Thanks to their experiential grounding, synaesthesias act as *linguistic passe-partouts*, providing access to complex perceptual experiences and effective ways of communicating them. In the light of these characteristics, the authors argue that this kind of metaphor takes part in the apprehension of perceptual concepts.

When compared with perceptual properties, the process of categorization struggle to domesticate the variety which occurs in experience. What seems essential in the metaphorical mechanism is the effect of *prototypicality*. In this respect, the authors embrace an Aristotelian point of view: as metaphors are based on the recognition of analogies, they are likely to bridge the gap between the world and the words. Thus metaphors, engaging abductive reasoning as well as imagination and creativity, imply an “immediate learning”. As Fano and Panajoli state “the analogical mechanisms of approximation, intuitive knowledge and creative expression (metaphor) would therefore be the basis of the ability to abstract from experience, to universalize the qualities that in appearance are presented to us as disparate and unrelated”. However, following Aristotle’s view, the authors argue that these features make metaphor more coherently placed in the field of argumentation than in science.

Claudio Ternullo and Giuseppe Sergioli, in “Fallacious Analogical Reasoning and the Metaphoric Fallacy to a Deductive Inference (MFDI)”, are concerned with fallacious analogical reasoning and, in particular, the Metaphoric Fallacy to a Deductive Inference (MFDI), recently discussed by Brian Lightbody and Michael Berman (2010). The authors describe the structure of *analogical reasoning* and of *fallacious analogical arguments* and show that, in some relevant cases, the kind of fallacy involved in MFDI can be more properly described as a *quaternio terminorum* and therefore there is no need to introduce a new fallacy. Analogical reasoning thrives indeed on comparisons which are very frequent in everyday language and play an important role in human reasoning. A fallacious analogical argument establishes a *faulty analogy* as its conclusion. In the authors’ view, metaphors – because of their intrinsic ambiguity – are particularly likely to deceive us as to correctly assess the strength of an argument, i.e. the proper attribution of a certain analogy as its conclusion. *Quaternio terminorum* may appear *prima facie* strong and *formally valid*, but it is actually based upon lexical ambiguity.

*Quaternio terminorum*, or fallacy of four terms, was coined in the context of the Aristotelian syllogistic theory. The basic syllogism consists of a *major* (P<sub>1</sub>) and a *minor* (P<sub>2</sub>) premises and a conclusion (C) containing three terms: the subject, the predicate of the conclusion, and a third term (*the middle term*), which connects the subject of the first premise to the predicate of the second premise. *Quaternio terminorum* occurs when a syllogism has four terms rather than three, as required. The authors present the following example:

(P1) A star is a massive luminous ball composed of plasma in hydrostatic equilibrium.

(P2) George Clooney is a star.

(C) George Clooney is a massive luminous ball composed of plasma in hydrostatic equilibrium.

The reasoning involved in this argument is fallacious because of the dead metaphor “star” which is used in its literal meaning (*celestial body*) in the first premise and in its figurative meaning (*movie celebrity*) in the second one.

In some arguments presented by Lightbody and Berman, the lexicalization of metaphor is so deep that the equivocation is unavoidable. In other arguments, on the contrary, live metaphors are created and, therefore, fallacious analogical reasoning is really at work. According to Sergioli and Ternullo, MFDI is only at work whenever metaphors really induce a false analogy and that depends on the satisfaction of what they call ‘principle of lexicality: a metaphor is a *live metaphor* if and only if it is not an already established *lexical item*, or, in other words, if and only if it is not listed among the different meanings of a dictionary item. All metaphors satisfying the principle may give rise to faulty analogies. Metaphors which do not satisfy it are anyway very likely to engender equivocation and, in particular, *quaternio terminorum*. *Live* metaphors really provide new insights on the relations between two different items, while *dead* or *lexicalized* metaphors give rise to ambiguities which invalidate the argument. Therefore fallacious analogical reasoning involving dead metaphors is only affected by the use of *quaternio terminorum*.

#### 4. Experimenting with metaphors

In the volume two ways of experimenting metaphors in argumentation are discussed. The first one tests metaphor comprehension when premises of an argument contain metaphorical meanings. The second one highlights the use of metaphor in thought experiments. The first approach is empirical and based on an experimental design regarding a specific kind of fallacy: *quaternio terminorum*. The second approach is properly philosophical and concerns thought experiments used to understand deeper mechanisms or structures of some phenomena.

Francesca Ervas and Antonio Ledda, in “Metaphors in *Quaternio Terminorum* Comprehension”, use the first method to understand the effect of metaphors in arguments having the structure of a *quaternio terminorum*. As it has been shown in Sergioli and Ternullo’s paper, metaphor as middle term plays a fundamental role in the comprehension of the overall argument. *Quaternio terminorum* is indeed based on the intrinsic ambiguity of the middle term, which might have two different meanings. Ervas and Ledda aim at understanding how of ambiguity of meaning, as occurring in the case metaphor, might influence the comprehension of an argument and whether it could have a persuasive effect in argumentation. In their paper, they discuss in detail four cases of ambiguity – homonymy, polysemy, dead metaphor and live metaphor – in order to understand whether they actually play any role in *quaternio terminorum* comprehension. In their opinion, some pragmatic processes such as disambiguation and modulation are required in identifying the meanings of the middle term in the two premises, and therefore their being true or false. Determining the truth or falsity of the premises influence the overall understanding of the argument.

Focusing on metaphor interpretation, the authors argue that the literal meaning of the source domain shares some semantic properties with the intended, non-literal meaning. Following relevance scholars’ perspective, metaphor interpretation is a context-sensitive modulation process resulting in an “ad hoc” concept (Carston 2002, Vega Moreno 2004), especially in the case of *dead (lexicalized)* metaphors. The process of metaphor interpretation requires more demanding attentional resources to suppress the corresponding literal meaning (Rubio Fernandez 2007), when compared to homonymy disambiguation, where the irrelevant meaning is suppressed by default (Gernsbacher and Faust 1991). Therefore the authors hypothesize that *quaternio terminorum* comprehension should mainly depend on the corresponding cognitive-pragmatic process required to disambiguate the middle term and on the degree of shared semantic properties.

The norming studies of an experiment on the influence of lexical ambiguity and metaphor on *quaternio terminorum* understanding (Ervas, Gola, Ledda and Sergioli 2012), show that most premises containing dead metaphors are considered *true* by participants, whilst premises of arguments containing live metaphors are perceived as *false*. These results could be explained by the fact that participants assigned to premises containing dead metaphors the intuitive truth conditions they have once the pragmatic process of modulation has produced the “ad hoc” concept. In a narrow context, dead metaphors are perceived as true because the encyclopaedic knowledge linked to the everyday use is sufficient to recognize the relevant properties required for the “ad hoc” concept construction. In case of live metaphors, the premises would instead need a wider context to be properly processed to produce the desired imagistic effect and thus to be recognized as true. This, they hypothesize, is the reason why dead metaphors make the arguments more persuasive than others.

Adriano Angelucci, in “On a Few Convergences between Metaphor and Thought Experiments”, explores another experimental path: thought experiments, which are – in the author’s view – a kind of defeasible and non-monotonic reasoning. Angelucci notes that comparing the literature on metaphor and on thought experiments a number of connections between these two domains emerge. In particular, Angelucci draws the attention on three aspects: 1) reductionism: the attempt to reduce the implicit cognitive content of metaphor and thought experiments to a literal formulation has proven misleading in accounting for both of them, 2) appealing to the *tension* within the subject’s conceptual system as a factor that explains both metaphor and thought experiments effectiveness, and 3) the resemblances in the way of reasoning by means of metaphor, thought experiments and scientific *models*, in that they all involve abstraction and projection. Furthermore, he suggests that these three concordances allow to identify another unnoticed epistemic function of metaphor, i.e. its effective contribution to philosophical analysis.

First, both literatures on metaphor and thought experiments present reductionism as a possible approach to understanding of these phenomena. In the case of metaphor, the so-called substitution view of metaphor (Black 1954) has maintained that the same cognitive effect produced by a given metaphor could always be produced, at least in principle, by an equivalent literal formulation of that metaphor. This view relies on three (false) assumptions on figurative language comprehension: i) human conceptual system is essentially literal, ii) metaphor is a deviant use of language, iii) the meaning and truth claims of a metaphor are just those of its literal para-

phrase. Similarly to what happened in the case of metaphor, within the debate on thought experiments, the elimination thesis (Norton 1991, 1996, 2004) claims that a thought experiment is introduced in argumentation when the corresponding straightforward argument would be difficult to develop, in order to facilitate the accomplishment of cognitive tasks. In both cases then, reductionism has consisted in reducing the epistemic virtues of one research object to another object supposed to subsume the first.

Second, both cases rely on a similar cognitive mechanism specifically denoting the kind of reasoning involved in metaphor and thought experiments, i.e. a tension between two different conceptual system in the case of metaphor, within a single conceptual system in the case of thought experiments. In metaphor both literal and non-literal meanings are essential to interpretation, even though they seem to clash for some respect in a given context. Quoting Beardsley, “A metaphorical attribution, then, involves two ingredients: a semantical distinction between two levels of meaning, and a logical opposition at one level” (1981 [1962]: 112). Some kind of tension is involved in thought experiments as well. If in the case of metaphor, the tension occurs between different levels of meaning, in the case of thought experiments it occurs among conflicting *intuitions*, namely between our current intuitions and the intuitions coming from an imaginary scenario, whose consequences clash against a rival theory. As Thomas Kuhn highlighted, the paradox created by thought experiments is intentionally generated by its creator.

Third, both the heuristic power of metaphors and thought experiments can be connected – in a sense – to the notion of model. The epistemic effectiveness of thought experiments rests on a similarity between their functioning and the functioning of scientific models: in both cases two processes take place one after the other: idealization and projection (mapping) from a domain to another. Critical thinking is needed to understand whether such a mapping is sound and useful. Angelucci discusses such a similarity, taking as an example Gettier’s scenarios, and concludes that – given the relation G – Gettier cases “seem to succeed in rejecting as inadequate the standard analysis of knowledge in that they land a strong intuitive pull to the possibility of finding real world instances of the state of affairs described by G” (Angelucci in this volume: 215-216).

Finally, Angelucci considers Daniel Dennett’s philosophy of mind as an example of interaction between the kind of reasoning involved in metaphor and a thought experiment. Not only Dennett used metaphors to express his own theories, but he also deeply understood the potential productiveness of metaphor from an epistemological point of view, as well as the inevitable

risks we mentioned above. In particular, Dennett's argumentation starts with the analysis of a specific metaphor in order to create a specific counterfactual scenario. Dennett explicitly talks about "pedagogically useful metaphors" (Dennett 1987: 22), but even though not always explicitly, this is the way of arguing of other philosophers. And this would show that metaphor has proven to be useful in philosophical reasoning.

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# Metaphor and Reasoning: Aristotle's View Revisited

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## 1. Introduction

According to the wide and multidisciplinary community of scholars who deal with non literal meanings, metaphors represent a non eliminable way to communicate and to think as well. Aristotle already knew it, as in his works *Poetics* and *Rhetoric* he puts forward the first theory, calling it the application of an alien word from genus to species, from species to genus, from species to species, and by analogy as well.

Aristotle gives different examples of such cases and a certainly interesting angle is the fact that in his scientific texts the analogy is used as a method to understand domains that are not completely known, but need to be specified. For instance, in his *On the parts of Animals* Aristotle mentions what nowadays are known as 'gills', claiming that "while some <animals> have lungs, other animals have no lungs, but something else" that, 'by analogy', stands in the place of what a proper lung stands for in the animals with it. Aristotle also underlines, showing surprisingly modern intuitions, that the metaphor shows things under your eyes and fosters learning, making speech more pleasant. Through Aristotle we will trace back the origins of the history of the theories about metaphors.

Our doing this is not only due to the fact that the Greek philosopher was the first one who defined and gave a theory about this phenomenon, but also because he did so after noticing (or at least, exploiting) its cognitive character<sup>1</sup>. In particular, we will try to emphasize the link between metaphor and categorization, between the metaphor and the ability to see the similarity.

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<sup>1</sup> Cf. Eco (1980), Briosi (1985: 15-17), Mortara Garavelli (1988: 163).

We will try to discuss the problem, in particular by analyzing a small part of the Aristotelian epistemology, selected from his works about animal biology. There, we can actually find a classification by analogic similarity, methodologically expressed, and practically applied to a kind of context that nowadays we can certainly call scientific. We will show that for Aristotle this kind of classification is not characterized by the inferences the isomorphism between two domains causes, but represents the application of the similarities by which classes are generated.

## **2. Early ideas of metaphor**

### **2.1. Aristotle's detractors**

Aristotle has been unanimously attributed the origin of the theoretic reflection about the metaphor (Lo Piparo 2003, Eco 2004, Lorusso 2005, Manetti 2005). However, Aristotle has also been attributed, less unanimously though frequently, the responsibility for the origin and persistence of a set of ideas that have been the linguists, the psychologists, the epistemologists and the philosophers' target, as, in the latest decades, they have been trying to understand the role of the metaphor in the processes of knowledge, thought and language at a deeper level. The theoretic barrier that has kept the metaphor closed in a context of undesirability, deviation, exceptionality, has been eventually undermined and eroded. Unfortunately, the Greek philosopher is still variously charged, especially (but not only) by the disciplines that can be gathered under the common label of cognitive sciences. The core of the most frequent criticism to Aristotle's metaphorology includes items of a different nature and not always consistent ones. For instance, Aristotle suggested the feature of exceptionality in the ability to metaphorize (Richards 1936: 85); as well as the notion of difference between literal and metaphoric, claiming that the metaphorical expression is not desirable, and it can be substituted with the corresponding literal enunciation without any loss of meaning; the Greek philosopher is also attributed the idea that the metaphor is a useless embellishment of the speech for hollow minds (Ortony 1993:3). Though the list might be even longer, Aristotle was also attributed the concept according to which the metaphor would be an implicit comparison (Ortony 1993: 3) and, still connected to the relationship between metaphors and similarities, the authority of the philosopher from Stagira would be responsible for the short sightedness about the important fact that many metaphors are perceived in terms of similarities (Miller 1993: 368). Last, from an

epistemologic point of view, Michael Arbib e Mary Hesse<sup>2</sup> (1992) argued that for Aristotle the metaphor appears in any of the above said dichotomies because of the peculiar structure of the 'Aristotelian' world, in which objects and events would be divided into sets of natural fixed genera (in great but limited numbers). According to both writers, the Aristotelic idea of the metaphor derives in particular from his studies on biological species (which impressed him – the writers say – both for their stability and interrelation) (Arbib-Hesse 1986: 230).

This kind of ontology perfectly fits, still according to Arbib and Hesse, the kind of linguistic theory and epistemologic concept that produced the idea of the superiority of the literal language, as a mirror of reality, and of the incidentality of the metaphorical use, somehow unsuitable and misleading. Provided this is true, we think it would be much more relevant to wonder whether Aristotle's linguistic idea can be consistent with the ontological one. In particular, we can consider if the theory of metaphor in Aristotle is consistent with the traditional interpretation of his theory of language and nature. To make it easier, if we could reply 'yes, it is', then we should probably consider the metaphor as an inaccuracy of the language, as to a proper denomination. But if the answer is 'No, it isn't', we would have to understand where the interpretation is inconsistent: in the language, in the ontology, or in the metaphor?

## 2.1. An opinion in defense of Aristotle's ideas

A late and interesting attempt to make sense, supporting the theory of the language expressed in his *De Interpretatione*, and the semiotic reference to the world of the *prágmata* and the cognitive role of the metaphor, was made by Jean Lallot in his paper *METAPHORA: le fonctionnement sémiotique de la métaphore selon Aristotle* (1987). Basically, his theory shows the meta-

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<sup>2</sup> Mary Hesse specifically dealt with the Aristotelian analogy in her article *Aristotle's Logic of Analogy* (1965) where she proves that the scientific analogies in Aristotle transcend the premises on which they are based: "it might seem that even substantive analogy in Aristotle's scientific examples is trivia, in that it depends on identical common properties, each of which is univocally predicated to its subject" (Hesse 1965: 333). Mrs Hesse therefore claims: "But proper analogy, it may be argued, is not reducible to identities and differences; it is rather a third way between univocity and equivocality, and as such it does not really seem to be required in the scientific cases (*ibid.*) In our opinion, we should rather wonder if these are the assumptions on which Aristotle would base the idea that the metaphorical discourse is a parasitary one compared to the univocal one, and logically reducible to it.

phor as a mechanism of naturality (or, better, of mimesis) inside the conventionalist theory of the linguistic sign. Lallot (1987: 48-49) in fact, starting from the consideration that Aristotle distinguishes the names of enunciations because in the first case (names) parts do not mean anything, while in the second one (enunciations) they do, he deduces that this simplification leads to consider names and verbs as a list of distinguished *pragmata*.

From this naive point of view, Lallot assumes, Aristotle is about to express how the metaphor works, a metaphor centered on the name. Thus, Aristotle would soon be faced with a choice: there would actually be two possible solutions to explain the difference between the ordinary and the poetic use of names:

ou bien on change leur forme vocale / graphique, partiellement (mots courant diversement déformés) ou totalement (emprunt à un autre usage, invention pure et simple d'un nom); ou bien on utilise des noms courants, mais on change leur application (*epiphora*) pour faire signe vers un *pragma* donné, on va substituer au nom approprié (*oikeion*)<sup>3</sup> un nom impropre (*allotrion*) (Lallot 1987: 49-50).

But what Aristotle later says on the role and the functioning of the metaphor, above all in his *Rhetoric*, hardly suits this pattern of purely vocal or, at the best lexical, substitutions. In particular, the idea that the metaphor is a source of learning, makes us think of a more complicated relationship between language and *pragmata*. Lallot therefore infers:

A l'intérieur d'une théorie conventionnaliste du langage – Aristote dit expressément au début de *De Interpretatione* que les symboles phoniques sont *katà sunthéken* “conventionnels”, donc ne doivent rien à une expressivité mimétique naturelle (*phúsei*) – ce statut de la métaphore mérite d'être remarqué: en raison du parcours sémiotique particulier qui conduit du nom au *pragma* en passant par le semblable, la métaphore réintroduit une dimension mimétique, sinon dans la langue, du moins dans son usage (Lallot 1987: 53-54).

Despite the naive theory of linguistic conventionalism, as Lallot seems to assert, the theory of the metaphor suggests a relationship between language and the world, grasping the real feature of the *pragmata* through a link of “mimesis poétique qui trouve place dans la lexis” (Lallot 1987: 54).

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<sup>3</sup> In reality Aristotle quite often contrasts *allotrion* to *kúrion*, not to *oikeion*.

### 3. Language, concept, reality: what about metaphor?

But how does this relation of mimesis take shape? Actually, supposing that it is free from the proper and literal relation between spoken forms (*phonè*) and affections in the soul (*pathèmata*) established by convention (*katà sunthéken*), mirroring the structure of the latter more naturalistically thanks to the mimetic relationship between *pathèmata* and facts (*pragmata*), it would be difficult to understand neither why Aristotle explicitly talks about the use of alien, improper terms, nor why he feels it necessary to apply to a conventional origin of the linguistic meaning.

The relationship among spoken words, concept and reality is defined in *De Interpretatione* (16 a 3-8), one of the most famous and debated passage of aristotelian *Corpus* for his theory of language. Lo Piparo (2003: 34-37) noted that such 'standard' reading would be contrary to the theory of metaphor. This would explain less what the interpretation of the metaphor as a deviation does, which, actually, is difficult to refute because of for its consistency (though probably based on a lucky series of misunderstandings).

In our opinion, the knotty problem is exactly at the crossroads of the theory of language, of the epistemology and the theory of the Aristotelian metaphor: if, as Mary Hesse claims, the definition of genus and species, and of the universals, suggests the existence of names that are universally used, then the metaphor is an inaccuracy and a gap in this description, and the names properly used are the mirror of that pre-labelled nature. If names, as it is usually claimed, are words referring to *pathémata* similar for everybody, metaphors then stray from reality. We are not able to refute if whether Aristotle really considered the world of *pathémata* the same for everybody, if it mirrored the *prágmata* in a univocal and identical way.

What we are able to prove is that the theory of the metaphor seriously baffles this interpretation. Not because, or not only because it introduces an element of mimesis that cannot be easily explained inside the conventionalist theory of language, but because it is explicitly and naturally accepted in the scientific context, in particular in the work of the classification into genus and species that Aristotle introduces in his biological studies. Following his methodological reasoning and how it is applied, we actually come to establish that we cannot absolutely solve the conflict, emphasized by Jean Lallot as well, between the simplified semiotic view of language and the metaphor, unless we abandon the idea that the world is divided into genus and species, before any cognitive operation. And if we are reluctant to accept the "mimesis poétique" as an answer to the fixity of the sign relationship among sounds, conceptual world and facts (*phonaì, tà en têi psykhêi*

*pathémata, tà prágmata*), we only have to consider the metaphorology more seriously. Together with the problem of the metaphor Aristotle, therefore, introduces the problem of the relationship between naturalistic objectuality and epistemologic objectivity, rather than the one between pre-labelled reality and mirroring instruments, conventionally or naturally established.

In order to view this possible change of perspective in the reading of the Aristotelian metaphorology, however, we cannot just turn to the classical passages in which the philosopher from Stagira develops both his language and metaphor theories. In this work, in particular, we will analyse what Aristotle says about analogy, similarity and metaphor in his treatise *On parts of Animals*.

#### 4. Metaphor reasoning in scientific discourse: *The Partibus Animalium*<sup>4</sup>

The first striking thing in *On the parts of Animals* is a rather enigmatic use of the notion of metaphor, if we accept its definition as an improper use of a word. Aristotle actually writes:

Only the viviparous have horns, though by similarity and metaphor we talk about horns even for some other kinds of animals: but in none of these they do the proper office of horns (*On the parts of Animals*, III, 2, 662 b, 24).<sup>5</sup>

Aristotle uses the adversative *dè* (though [...] are metaphorically spoken [...] in virtue of a certain resemblance) to explain that we can say that even some other animals have horns, though, at the same time, he seems to imply that it is not completely correct. This is the meaning that comes roughly to mind at first, but we should also consider further possibilities of interpretation if we apply the notion of metaphor given by Aristotle in his *Poetics*: as far as we can understand in the passage drawn from *On the parts of Animals* [III, 2, 662 b, 24], the non viviparous appear as a non defined species according to the difference with the viviparous. If the metaphor was of the first type (from species to genus), the attribute ‘horns’ would belong to a genus higher than the viviparous and it would be improperly applied to

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<sup>4</sup> Translations from Aristotle in text are all author’s translations. In note we will quote the edition of Clarendon Aristotle Series (Oxford University Press), edited and translated with notes by D. M. Balme.

<sup>5</sup> “We have now to treat of horns; for these also, when present, are appendages of the head. They exist in none but viviparous animals; though in some ovipara certain parts are metaphorically spoken of as horns, in virtue of a certain resemblance. To none of such parts, however, does the proper office of a horn belong”

one of its species, causing the problems of definition expressed and talked about by Aristotle in Book I (A), 3-4 of his work *On the parts of Animals*. The opposite case (from genus to species) seems to be excluded by the opening sentence (only the viviparous have horns): the complementary category, actually, cannot certainly be also a subgroup of the group from which it is distinguished by complementation. As for the third case (*epiphora*, from species to species), provided that there may be a more general category including both viviparous and non viviparous, it would not solve any problem. Actually, a more general category that, according to the traditional interpretation given to the mechanism of the general metaphor, should pre-exist to the metaphor and include the attribute of having horns among the characteristics inherent in the essence (*toîs en têi ousía*), would put the problems met in the first two cases together. The last possibility is the analogy, that crosses the genus, and that could thus be attributed to species belonging to different genus, without meeting the problems that are distinctive of non specific *epiphora*. But this time it is Aristotle himself who retracts, as in the following lines he claims that what we call 'horns' in the case of the non viviparous does not have the *érgon* of the same 'horns' referred to in the viviparous:

It is in order to defend or offend that the viviparous have them, what cannot be found in any other animal which is said to have horns: none of them uses horns neither for defense or offence, that is the most proper purpose of a strong organ (*On the parts of Animals*, III, 2, 662 b, 24).<sup>6</sup>

The definition of analogy given by Aristotle in his *Poetics* could be adequate to understand why the lack of *érgon* prevents us from interpreting the metaphor in the previous passage as a metaphor *katà análogon* :

I call it an analogy if the second word is related to the fourth, and the first to the third one, in a similar way (*homoíōs*) (*Poetics*, 57 b, 16).<sup>7</sup>

If this definition still implies the possibility that shell fish horns are *homoía* to the viviparous' ones (it might be hard to understand the other two words, though the purpose is not actually the same), the examples of *homoíōs* given by Aristotle in his *On the parts of Animals* and by the

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<sup>6</sup> “[...] for they are never used, as are the horns of vivipara, for purposes which require strength, whether it be in self-protection or in offensive strife.”

<sup>7</sup> “Analogy or proportion is when the second term is to the first as the fourth to the third. We may then use the fourth for the second, or the second for the fourth”, (*Poetics*, 57 b, 16, translated by S.H. Butcher).



analogic relationship, would exclude the possibility of a fourth interpretation once and for all. Aristotle actually says:

I say by analogy, because while some <animals> have lungs, others have no lungs, but something else that is where the lungs are in the ones it belongs to (*On the parts of Animals*, I, 645 b).<sup>8</sup>

Even if Aristotle does not use the word ‘purpose’, we can interpret the analogy as something that keeps the purpose and the relationships, while changing from one genus to the other. After all, such interpretation is confirmed in several passages of the treatise: the brain generates sleep in those animals who have got it, while in the ones who haven’t got it, sleep is generated by its analogous part (thus analogy keeps the purpose of generating sleep) [*On the parts of Animals*, II, 653 a, 11]. In a further passage, the cuttlebone is analogically related to the fishbones<sup>9</sup>. We can say that the so defined analogic similarities are fundamental for the given categorization. And we believe we are not exaggerating, since in the quotation in 645b 20, among the common attributes, this is the first one according to Aristotle

Actually <animals> have common attributes by analogy, according to the genus and according to the species (*On the parts of Animals*, I, 645 b, 27).<sup>10</sup>

What is common by analogy, thus, is exactly what keeps both *ergon*, and *dýnamis*, and causes the same effects. Therefore, it is exactly the opposite of what Aristotle meant by metaphor in the passage we have quoted at the beginning of the paragraph. On the contrary, we can now claim that it is just an opposition between a still unknown meaning of the metaphor and the meaning it has by analogy, which does not imply a superficial and apparent similarity allowing to do or undo classes at our will (as with unsuccessful similarities), but it must offer a real analogic similarity (that is, it must include a metaphor). We have therefore come to a contradiction: by metaphor we can talk about horns in animals in which these supposed horns keep some original features but lose their original purpose; by metaphor, we

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<sup>8</sup> “[...] while in other groups the affections and organs are only so far identical as they are analogous. For instance, some groups have lungs, other have no lung, but an organ analogous to a lung in its place; some have blood, others have no blood, but a fluid analogous to blood, and with the same office”.

<sup>9</sup> See *On the parts of Animals*, II, 654 a, 20.

<sup>10</sup> “In the first case the common attributes may be called analogous, in the second generic, in the third specific”.

exactly refer to a kind of similarity in which everything can be altered except the purpose.

At the moment we can only falsify what we called the assumption of univocity at the beginning of this chapter and see if Aristotle really theorized

A "world" in which all objects and events are divided into sets of a number of fixed natural species or groups (Arbib and Hesse 1986: 230).

or if we would rather consider the possibility that even in Aristotle there might be a more changeable relationship between reality, thought and language. And if this changing our point of view could allow us to interpret the difference between metaphor and analogy more easily, and to explain why, after all, Aristotle considers the first one more basic and general than the latter.

Just at the beginning of his work on the parts of animals, Aristotle debates about the best way to describe and classify animals. That is, since the purpose of science, applied to any object, is understanding its essence (*ousía*), even as far as the biological analysis is concerned, the problem is going through nature, the real essence of the animal reality:

it is thus obvious that even in the natural research there must be such criteria by reference to which we can criticize the methods of the expositions, regardless the question whether the truth lies in this or in that way (*On the parts of Animals*, I, 639 a 13).<sup>11</sup>

According to Aristotle, the boundary between scientific knowledge (*epistémē tou pragmatos*) and knowledge of the learned man (*paideía*) is not represented by the fact that the former knows the reality (that is, he has the right instruments to know the world in a real way) while the second one does not. The critical power extended to any research field is a feature of the learned man. The scientist, instead, will have a critical power limited to a given research field. The difference between the one who is '*pepaideuménos*' and the one who is knowledgeable only in a particular field is not only a quantitative one. Actually, the different sciences require different demonstrating methods and different choices, as needed.

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<sup>11</sup> "It is plain that, as in other sciences, so in that which inquires into nature, there must be certain canons, by reference to which a hearer shall be able to criticize the method of a professed exposition, quite independently of the question whether the statements made be true or false".

As for animal biology, the main problem is to establish criteria of classification allowing us to arrange the phenomena so as to get a division into groups and species of all animals, and to find the similarity (*homoíon*), that is, what is common (*koinòn*).

As we anticipated, Aristotle claims that there are three kinds of common attributes: the ones given by analogy, the ones setting the genus, and the specific ones:

I call common (*koinàs*) those <properties> belonging to every animal, while for each genus the ones that <among the animals> differ in excess; I thus call the birds a genus, but the men a species, and everything that on the whole does not show any difference as for the universal definition (*katà tòn kathólou lógon*) (*On the parts of Animals*, I, 645 b, 22).

Within the same genus, homogeneity is given by the fact that the attributes varying in the different animal species only differ in grade: such is for instance the difference between a bird with a wide wingspan and a bird with a narrow one, that is a quantitative difference (*kai tò mállon kai êtton*). This kind of difference does not discriminate between the two genera, but gathers them into one.

The specific difference is the essence, and its identification remains the privileged target of learning.

On the contrary, the separate genera are the ones showing analogic relationships. The passage we refer to emphasizes that it is not belonging to different genera what allows us to make analogic comparisons; on the contrary, it is the ability to catch similarities of a different kind, among which the analogic ones, what allows us to make the genera. Somewhat later, this is confirmed when Aristotle defines the relationship of similarity between animals belonging to the same genus, by contrast with the relationship of analogy.

In a sense, it is the similarity in the shape of the parts and of the whole body, what determines the genera, as much as birds, fish, cephalopoda and gastropoda are quite a separate class. *Actually their parts do not differ by analogic similarity*, that is as much as what the bone is for the man and the spine is for the fish, but they show differences in excess as for somatic conditions, such as largeness, smallness, softness and hardness, smoothness and roughness, in one word, according to their degree (*On the parts of Animals*, 644 b, 10).<sup>12</sup>

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<sup>12</sup> “It is generally the similarity in the shape of particular organs or of the whole body, what determined the formation of the larger groups. It is in virtue of such similarity that Birds, Fishes, Cephalopoda, and Testacea have been made to form each a separate class. For

## 5. Conclusions

If, while determining the structure of reality, we emphasize the role played, on the one hand by the form of the bodies and the *ousía*, and, on the other, by the ability to catch the similarity (under its multiple shapes), we will better understand what Aristotle further claims about classification. For instance, a single difference, unlike what asserted in the dichotomic method, is not enough to define a genus:

every <genus> is determined by many differences (*On the parts of Animals*, I, 643 b, 12).<sup>13</sup>

Therefore, we say, we must define the unity from the beginning according to multiple differences (*On the parts of Animals*, I, 3, 643 b, 24)<sup>14</sup>.

If so, the epistemologic idea of the philosopher from Stagira looks a much better organized one, connected to language and history, than an ontology of the fixed genera would generate. Trapped between the necessity to consider single realities separately (*perì tôn kat' ékaston kai atómon tói éidei theoreîn khorìs*<sup>15</sup>) and the necessity to avoid repeating the same things that are good for many realities of this kind, Aristotle prefers the latter that, however, is very far from being a list of similar attributes:

It would probably be more correct, then, to talk about what is common to each group, as it has been properly determined by men, and has a common nature, and species that are not too different in themselves, such as birds and fish, and possibly some less known ones but similarly including the species in themselves; those <animals> which, on the contrary, are different from that, are singularly different, such as man and may be someone else (*On the parts of Animals*, 644 b, 1)<sup>16</sup>.

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within the limits of each such class, the parts do not differ in that they have no nearer resemblances than that of analogy -such as exists between the bone of man and the spin of fish – but differ merely in respect of such corporeal conditions as largeness, smallness, softness, hardness, smoothness, roughness, and other similar oppositions, or, in one word, in respect of degree.”

<sup>13</sup> “[...] each of which groups combines a multitude of differentiae, and is not defined by a single one as in dichotomy.”

<sup>14</sup> “As we said then, we must define at the outset by a multiplicity of differentiae”.

<sup>15</sup> *On the parts of Animals*, 644 a, 31.

<sup>16</sup> Perhaps, then, it will be best to treat generically the universal attributes of the groups that have a common nature and contain closely allied subordinate forms, whether they are groups recognized by a true instinct of mankind, such as Birds and Fishes, or groups non popularly known by a common appellation, but withal composed of closely allied subordi-

We have therefore to start from what we could call natural groups, that is from the divisions that, by their nature and history, confine some given animals into different categories: for example the bird and the fish category. While applying this methodology to the operation of labelling and describing animals, Aristotle adds some considerations that, in our opinion, confirm the active role that the analogy and the ability to see the similarity (the one Aristotle talks about in his *Poetic* with reference to metaphor), as well as language, play in the representation and the acquisition of learning. We also understand what Aristotle meant when he asserted that by metaphor and similarity we can call ‘horns’ also those parts having a purpose different from their being horns. To interpret it we must stop to consider a classification as a fixed and univocally determined one. And we have to consider the metaphor at the origin of the classifying process and not at its final stage, that is the starting flash and not the synthesis relying on a transposition of isomorphic domains. Further conceptual operations will establish whether the similarity caught is also a true one, as much as further illocutionary and rhetorical phenomena will tell us whether given similarities, antithesis and metaphors are more or less successful. If we had to point out a privileged mechanism in the linguistic meaning, therefore, we wouldn’t recommend, for what has been previously said, the univocity of the general terms, but, on the contrary, their multivocity or, more approximately and in a language closer to the Aristotelian one, the multiple meaning talk (*tò pollakôs légesthai*<sup>17</sup>), that is also a peculiar characteristic of the metaphor. This basic equipment of the linguistic meaning that allows us to put different languages into communication (languages that could not be considered equivalent), keeping them active contemporaneously, creates new similarities and generates new meanings. Thus, if it weren’t historically incorrect, we could rightfully say that Aristotle’s metaphorology is the first interactive concept of the metaphor (according to Max Black’s classification), since Aristotle recognizes its cognitive role in understanding, showing and learning what can be naturally known by theorizing similarities, an operation of the mind that

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nate groups; and only to deal individually with the attributes of a single species, when such species -man, for instance, and any other such, if such there be- stand apart from others, and does not constitute with them a larger natural group.

<sup>17</sup> An example of this type of meaning is also given in *On the Parts of Animals* (II, 648 b, 12) for the word ‘hot’: a body can actually be called ‘hotter’ to refer to the heat it produces in what comes into contact with it (*thermaínetai tò haptómenon*); or the violence of the sensation it causes when a hot body is touched (*aíthesin empoioûn en tò thiggánein*); or even the ability to melt the materials (*tò tektikóteron toû tectoû*), to burn them (*toû kaustoû kaustikóteron*), etc.

does not lead to deductions about some elements belonging to given classes or not, but whose equally respectable task is to force the way through the intellectual jungles.

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## **Bontempelli, Calvino, Montale and Luzi: Thoughts on Metaphor within Contemporary Italian Literature**

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All things are words of a language  
in which Someone or Something, night and day,  
writes that infinite muddle  
that is the world and its becoming.

In this whirl everything do pass away:  
Cartago and Rome, I, you, it,  
my life which I can't make out, this agony  
of being enigma, hazard, cryptography  
and all the discord of Babel.

Beyond the name there's what you cannot name;  
today I have felt its shadow gravitating  
just in this blue needle, so sweet and light,

which aims with dedication to the end of the sea,  
with something of a watch seen in a dream  
and something of a bird felt asleep which moves.

J.L. Borges, *A compass*

After having sketched a theory of literature which is able to save the being of the texts as created entities, by avoiding at the same time their reduction to those material objects that instance them, I will discuss the specific difference that literary texts have with regard to other linguistic productions. Then, I will analyze Jakobson's notion of poeticness, which is told to be what makes the difference between a linguistic text with aesthetic properties and another having just a communicative purpose. By doing so, I will show the weak points of Jakobson's theory, together with its effectiveness. In



particular I will suggest that Jakobson misinterprets what literary prose really is, absorbing its specificity into the being of poetry, even though he used to speak of two different principles for poetry and prose: in the first case, one has a combination of self-excluding categories; in the second case, instead, one deals with a combination of categories which lays side by side in the system of language and may be seen as extremes of a continuum. Having done that, my paper will take into account some relevant views of metaphor in literature, which will be checked through the analysis of two tales and two poems of 20<sup>th</sup> century Italian production. This anthological choice is personal, since it depends on my critical scholarship, so that others may develop similar arguments by means of different pages. The only important thing for the proposals to discuss, indeed, is their being widely acknowledged as masterpieces (or “classics”, if you prefer) and that they may test the three theories of metaphor summarized here: 1) metaphor as a linguistic trope, 2) metaphor as a pragmatic trope, and finally 3) metaphor as a gate towards other possible worlds. With Bontempelli it will be shown, in particular, that we can fully appreciate a literary page only if we dismiss the skeptic and logical attitude of rational empiricism in order to play a sort of “Asperger game”, so that the communicative deviance becomes a launching pad towards another possible world. With Calvino it will be highlighted the similarity between metaphor and the conceptual model of reality and it will be stressed that the model may be wrong from an epistemological point of view but pragmatically effective at the same time, just as metaphor seems to be in general. Then, a famous poem written by Montale will be considered for its way of expressing feelings without the drift of subjectivism and introspection, thanks to the particular technique of “objective correlative”. This last may be regarded as a special case of the metaphorical treatment of language: a case in which the semantic leap from the literal to the figural level of the speech involves also the pulp of the words, and let us feel what is expressed as a virtual reality. Finally, a wonderful composition written by Luzi (one of the most important Italian poets of the last century) will help us to focalize that metaphor is not something we put on an alleged basic level of communication, since existence as such is involved in the figural power of our mind.

At the end, I will try to rehabilitate Nietzsche’s metaphysics of fiction (with this word meaning what it means in Latin, thus being much more than just a synonym of “narrative”) as it is expressed in *On truth and lie in an extra-moral sense* (1873). The hypothesis of the “worn out coin”, indeed, is very useful in order to develop a theory of language in which literature never appears to be a special and derivate case of human expressive enter-

prise, even though it is necessary to admit that literary texts are just the best occurrences of what we call “expression”.

Literary texts the paper refers to: Massimo Bontempelli, “The Good Wind”; Italo Calvino, “The forest on the Superhighway”; Mario Luzi, “Under the Yoke of Metaphor”; Eugenio Montale, “I Have Often Met the Pain of Living”.

## 1. A sketch of literary theory

What is literature? A quite common answer is that literature may be considered first and foremost as the sum of certain cultural objects, namely poems, tales and dramas. In mathematical terms, we could say that literature is the set of all literary texts. Literary texts, in turn, must be considered as relevant issues of speech: as discursive items, they are always provided with some kind of authority which makes them relevant. It is because of this meaning that we can speak of literature also as the bibliography one has to refer to for specific subjects (see Livingston 2002: 536). Of course the notion, in this case, covers many more phenomena than those which belong to the art of interweave words. At the same time, the concept of literature as bibliography is restricted to written items, while literature as aesthetic production may be also oral (Marino 1987: 48-55). However, when we speak of literature as the bibliography one has to take into account in a specific field, we keep on referring to texts, not to any kind of expertise, and thus the technical notion of literature works as an extension of the common meaning of the word.

### 1.1. Literature as the dynamic set of literary texts

Texts are somehow objectified entities, since they can be put together in a class. Of course this is a static view of what is actually at stake in our literary experience. However, what we deal with as readers is hardly a fixed reality, since it changes its features with the very process of reading, both by the individual and the collective point of view. The identity of each text – what Duns Scotus would have called the *thisness* (*heacceitas*) of a poem, a tale or a play – is never given once for all, because it is the result of some hermeneutical activities which project the object of literature beyond its static and abstract givenness.

To explain what I mean, let’s suppose a student – say John – starts to read Pavese’s last novel as an example of realistic narration, according to

what he was told by a teacher at school. Let's also suppose that the teacher was a well-informed scholar: the fact that *The Moon and the Bonfires* is an example of realistic narrative was indeed what all the critics reasonably believed some years ago. The world of criticism, however, was also convinced that a literary work, just as any other work, is an *ergon* (not an *energeia*), and so it simply cannot change.<sup>1</sup> Readers – scholars used to say – may have different opinions on a given text, but the text as such has just one truth. So John at first rationally assumes that Pavese's last novel is what his teacher has studied years before. Nevertheless, if he reads carefully the text he will probably feel quite soon that something does not work with the image of the novel he inherited, even if it is the only one he has to use in order to understand the specificity of the text. The events and the characters illustrated in *The Moon and the Bonfires* are in fact much richer than what they seem to be at first sight; the process of reading brings the original idea of the novel into question. Of course John will end up with the acknowledgement of the symbolic halo which is proper of Pavese's alleged simplicity and he will recognize that the referential attitude of *The Moon and the Bonfires* turns out to refer to something which lays outside spatiotemporal experience. What the text is has changed and will change again, since different generations use to find different properties within literary works. Likewise the literariness of some texts (what middle ages philosophers would have called the *essence*, or *quidditas*) may, in certain specific cases, appear and disappear with the passage from one age to another: many chronicle of the past, whose purpose was only to report some pieces of news, are now read as example of aesthetic narrative; vice versa, some poems written with a clear literary intention are now regarded as mere historical documents.

Therefore, even if it could be useful for some specific purposes to consider literature as a mere amount of things (for instance in order to construct a history of literary expression, or for the redaction of a school anthology), it is not fair to reduce these phenomena to simple inert entities: literature involves also the rules and the conditions of literary texts, such as genres, poetics and rhetorical schemes, which in turn are living realities. Of course we can wonder whether there really be something like the sonnet or science fiction,<sup>2</sup> but nominalism does not imply that literature is reducible to con-

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<sup>1</sup> A work is something done, a result, not a process. But literary texts are alive: we can talk to them as we do with other people because they are both artefacts and "intentional systems" (see Dennett 1996: 62-68). Therefore literary texts are objects and processes at the same time (see Barthes 1977 on this remark).

<sup>2</sup> See Mazzoni 2005, for a special development of this sort of thought.

crete, well defined objects, because – first of all – texts are not concrete entities as books instead are, and – secondly – a radical inscriptionalism, *à la* Scheffler (1979), cannot explain why we still have the same given literary text, also when it is translated in many versions in another language.<sup>3</sup> In short, by refusing to extend the concept of literature to include genres and rhetorical schemes (with all the equipment of living values they entail), we do not make up with the idea of a set of static things.

## 1.2. Beyond the synchronic view of literature

Let's analyze better the situation: the fact that intuitively we try to deduce the extension of literature in terms of objects that are defined by an essential property (which may also be a complex of simpler and insufficient properties connected together)<sup>4</sup> entails that texts are perfect-born realities, while it is well known that many authors have to polish their works for a quite long time, so that the text as such (namely, the final outcome) has not existed since the beginning. In addition, if the class theory of literature were true and if the set of texts were in turn a static reality, then the catalogue of literary phenomena would never change, with the consequence that all future literary items already exist in some mysterious place and no past production has ever really disappeared, neither because of oblivion, nor for destruction. In short, the real extension of literature would be given once for all, so that the development of the list of all literary texts (with new proposals getting in and old items going out) would be just a matter of epistemology. This is clearly a Platonic view of the literary world. It is not so easy to prove beyond any doubt whether Platonism is right or wrong, even because, as a theory which aims at making sense of our phenomenal experience of literature, it is possible to support it with some important pieces of evidence, like Michelangelo's poetics or Coleridge's declarations about the genesis of his *Kubla Kahn* (quoted also by Borges, 1952 in a suggestive paper published in

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<sup>3</sup> The premises for what I consider a correct answer will be found in the second-last paragraph of this paper.

<sup>4</sup> Taking Plato's dialectics as a starting point, we could say, for instance, that the class of all the cats is defined by the property of being-a-cat, which indeed expresses the "ti esti" of all the items that fell, fall and will fall inside the set at issue. By a biological point of view, this essential property may be analyzed further as the logical product of being-an-animal, being-a-mammal, being-a-feline and so on. Likewise, if we could really describe literature in terms of Venn diagrams, the characteristic property of every literary text would be classically defined as the logical product of being-a-semiotic-device, being-preeminently-linguistic, and so on.

*Other inquisitions*). However, these arguments are not decisive pro Platonism, because the idea of a transcendent dimension that contains all the possible texts is clearly underdetermined by the data, with the indirect consequence that it is not the only chance we have to hold water in literary theory.

Personally, in fact, I think we have to save some kind of universality and abstraction, so that no text is ontologically the same of one of its own concrete occurrences (see Peirce 1906: 220), but I am afraid it is quite hard to agree with any Platonic view of the literary world, because within idealistic boundaries the concept of *discovery* seems to be more reliable than that of *invention*, against the factual paradigm of literature. If we say that an author creates (which means “invents”) his images, or his story, or again his characters, then we have to admit that Platonism does not suit us. Notice that, by a logical standpoint, it is not necessary that all authors do invent, neither that all the images or the characters of a given text are inventions.

An alternative view could be at hand by considering literary communication in general in a historical and empirical way, which in any case avoids the risk of running aground in the waters of nominalism.<sup>5</sup> In particular, we could start from Siegfried Schmidt’s basic idea, that is to move away from literary texts to literary systems:

Following the epistemological assumptions of ELS [Empirical Literary Study], observers construe their worlds, objects, and pictures of other living systems through interactive dialectical processes concerned with experiences and representations. Living systems do not encounter things as independent objects but only as related items in interactive process. Accordingly, we must seriously take into account the *observer* as an indispensable item in the construction of objects, world-models, sense, ‘laws of nature’, etc. This advice holds true *a fortiori* with regard to so-called cultural objects as e.g. literary texts. If we follow the constructivist lesson we have to abandon the idea of the autonomy or objectivity of verbal texts [...] Consequently, the smallest units under investigation in literary studies should not be isolated texts but, instead, actions focusing phenomena which the actor deem literary (Schmidt 2000: 331-332).

With such a constructivist empirical view, texts are no longer mere objects, even if they imply also an objective dimension which is that of literary

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<sup>5</sup>After having considered the similarity between literature and music according to Goodman’s theory of arts (1968: 102), instead of following his path toward an essentialist reductionism of literary texts (ivi: 180-183), see what Levinson (1980: 22) says about musical works and try to consider literary texts in a similar way. By doing so, you will end up with a theory of literature in which it is possible to hold that texts are notational objects (therefore reproducible things) and events (or else singular facts) at the same time.

communication (see also Bachtin 1924:, 65-66). Literary texts are now *events* (Attridge 2004), or – if you prefer – *facts* (Wittgenstein 1922, to be interpreted in the light of Wittgenstein 1953).

## 2. Literary process: abracadabra and the art of fingere

In a pure synchronic view of literature, such as that of Platonism, texts are just independent realities. Their forms and their contents are independent as well. To understand a literary text is therefore to make reference to something that lays out there, just as a thing we can grasp and weigh. This is an assumption which has been proper of natural science till the 19<sup>th</sup> century and that we can find also at the foundations of classical logic, whose arguments indeed struggle to avoid the liar paradox. The class of all independent objects makes no troubles for the reason, because, even if we say that it is not itself an independent object (since it is a concept, and so it depends on our mind), it does not fall under its own definition. On the contrary, the class of all dependent objects is affected by self-reference, because it falls into the category described by its own property.

Although realism seems to be a good ontological frame in some field of human knowledge, it is not valid in literature. Indeed, we reckoned that literature is a matter of invention and we must add that it has got a strong performative aspect: literary texts are (also) processes we are involved in, which may be defined as state of affairs, as soon as they have been performed.

A literary work is not, as many people may assume, an imitation in words of some pre-existing reality but, on the contrary, it is the creation or discovery [sic] of a new, supplementary world, a metaworld, a hyper-reality. [...] Literature derails or suspend or redirects the normal referentiality of language. Language in literature is derouted so that it refers only to an imaginary world. The referentiality of the words a work uses, however, is never lost. [...] Reading is an incarnated as well as a spiritual act. The reader sits in his or her chair and turns material pages with bodily hands. Though literature refers to the real world, however, and though reading is a material act, literature uses such a physical embedment to create or reveal alternative realities. These then enter back into the ordinary “real” world by way of readers whose beliefs and behavior are changed by reading – sometimes for the better, perhaps sometimes not. We see the world through the literature we read, or, rather, those who still have what Simon During calls “literary subjectivity” do that. We then act in the real world on the basis of that seeing. Such action is a performative rather than a constative or referential effect of language. Literature is a use of words that makes things happen by way of its readers. (Miller 2002: 18-20)

There is no ontology of the presence in the domain of literature (Bertens 2008: 95), but rather an ontology of secular magic (Miller 2002: 21: “A work of literature is an abracadabra or hocus pocus that opens a new world”), of the virtual (ibidem and Heim 1993: 129-130). What the text talks about is something that is given *through* the very act of speaking, embodied by the work of an author. This act is just the first half of what we may call the text-as-experience (see Dewey, 1934), because the work needs the co-operation of a reader in order to realize its own expressive being. In Latin words, we could summarize all these arguments by saying that literature always provides us with verbal *fictiones*, which is to say that in literature we deal with acts of *fingere*, *realized* by means of the ordinary language<sup>6</sup> that keeps on being communicative, while it turns out to be strongly expressive at the same time.

### **3. Metaphor and metonymy**

Communication and expression are the two basic concepts that scientific thought uses in order to understand literature and its specificity. A first interesting articulation of these categories may be found in the logical empiricism of Carnap and Schlick, according to which literature is what metaphysics should be reduced to:

We have here to distinguish two functions of language, which we may call the expressive function and the representative function. [...] The aim of a lyrical poem in which occur the words “sunshine” and “clouds”, is not to inform us of certain meteorological facts, but to express certain feelings of the poet and to excite similar feelings in us. A lyrical poem has no assertional sense, no theoretical sense, it does not contain knowledge.

The meaning of our anti-metaphysical thesis may now be more clearly explained. This thesis asserts that metaphysical propositions – like lyrical verses – have only an expressive function, but no representative function. Metaphysical propositions are neither true nor false, because they assert nothing, they contain neither knowledge nor error, they lie completely outside the field of knowledge, of theory, outside the discussion of truth or falsehood. But they are, like laughing, lyrics, and music, expressive.

Thus we find a great similarity between metaphysics and lyrics. But there is one decisive difference between them. Both have no representative function, no

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<sup>6</sup> It is important to underline that in literature we have a reality which is not the ordinary, spatiotemporal one and that this reality is given by the power of language, which in turn is a tropic, expressive power of construction. Of course, “to define language as a modeling device means nothing but to focus on its power of simulation of other possible worlds” (De Ruggeri 2000: 58).

theoretical content. A metaphysical proposition, however – as distinguished from a lyrical verse – seems to have some, and by this not only is the reader deceived, but the metaphysician himself. He believes that in his metaphysical treatise he has asserted something, and is led by this into argument and polemics against the propositions of some other metaphysician. A poet, however, does not assert that the verses of another are wrong or erroneous; he usually contents himself with calling them bad (Carnap 1935: 44-47).

Notice that to express an emotion or a mood does not mean to denote some kind of separate mental reality, neither it implies the transmission of a content whichever. A poem does not describe a feeling, just as a tale does not inform about the vicissitudes of some characters. Poems are specific feelings in words, and tales are the experiences of some characters. It is unfair to distil a formless content in literature, because literary texts are never simple vehicles of messages. On the contrary, what is at stake within the so-called literary communication is always the form, as Schlick clearly explains:

Let us consider the case of the poet. Most people believe that he has the gift of expressing things that can be expressed by no other power – except perhaps by music, painting or sculpture, but certainly not by science or ordinary language and that the realm, of art certainly must be content, joy and sorrow as such, color and sound in itself. No one can feel more strongly than I do that the greatest miracles on earth are wrought by the poet and that no revelations and values can compare with those given to us by art, and I have the greatest admiration for the expressive power of poetry, but at the same time I know that the poet cannot express anything that could not be expressed by science, and that most certainly a volume of poetry does not communicate content any more than a scientific book.

We must acknowledge the great magic of art, but we must not attribute it to the wrong causes. The merit of poetry does not lie in its wonderful capacity of expression, it is to be found in the great effects it produces in our souls by that which it expresses. While the ultimate purpose of science is knowledge, perfect expression of real facts the purpose of art is to evoke in us certain emotions, and expression is but a means to this end. Emotions are *content*(possessing, of course, a certain structure), they are not communicated by poetry, but *produced* by it (Schlick 1938: 211-212).

It is the *form* that produces a *content* as the response to the work of art in the mind of the reader. All in literature is a matter of form. “Ineffable content remains beyond forever” (Schlick 1938: 212).

Now, in general, we use to distinguish two main types of formal expressions in literature: that one which organizes the words and the sentences in a poetical way, articulating the stream of the sense in a rhythmic



sequence (which may be highly phonetic or basically conceptual), and that one which prefers to develop the meaning of the discourse in harmony with its syntax. As Umberto Eco explained once, in occasion of a conference at Genoa,

[...] poetry is that thing which begins a new line before the margin of the page, and prose is that thing which goes on till there be a portion of page to write in, reducing to a minimum the margins, because paper is not free, also by an ecological standpoint, and so it is allowed even to break the word in two pieces rather than to start a new line too early, what in poetry usually is forbidden, except for the frenzy of the most extreme avant-garde production – and look how long the avant-garde Sanguineti, as a good Genoese, stretches his verses in order to avoid the purchase of another copybook (Eco 1985: 243).

The difference between poetry and prose is therefore a matter of blanks: poetry depends strongly on the blanks of the page, because the linguistic signs used by the poet change their meaning in function of the pauses of reading, which are represented by the interruptions or the absence of written text (the so called “dystonia of meaning and syntax”).<sup>7</sup> The comparison with the musical score may be very useful in order to understand this point. A poetic text is what it is, thanks to the words it uses and to their disposition on the page. In other words, the semantic value of what is expressed in a poem depends on the interaction between the ordinary sense the signs have in the system of language in use and the null outputs of the blanks.<sup>8</sup> This fact does not imply that literary prose is easier than poetry, or at least more similar to informational speech. Literary prose is just horizontally fluent, where literary poetry prefers to develop a vertical, discrete speech. Aesthetic narratives are characterized by the principle of “agreement between the expression and the content” (Eco 1985: 250), so that the words point more toward their referents than in poetry. The referent, however, is not the world out there, even in the case of realistic narrative (Amigoni 2001: 53). Moreover, paratactic and hypotactic strategies will mark each one a specific expressive intentionality (Eco 1985: 250) of literary prose, an intentionality which in turn will be declined in further definite ways, because of other rhetorical devices. All in all, we could also say that what is at stake in a literary prose is again, in Frege’s terms, the *sense* of the text and not its *meaning*. But to

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<sup>7</sup> “It is by finding, or nullifying this blank around the word (or by substituting the blank with a silence, a breath or the beginning of a new line) that one can recognize the difference between poetry and prose” (Eco 1985: 244).

<sup>8</sup> It is clear that “*Mattina / M’illumino d’immenso*” and “*Mattina / M’illumino / d’immenso*” are not the same literary text, because they have two different mathematical *matrices* and so they express two different things.

tell something in prose is first of all to create a fictional world, whose constraints will determine the actual development of the story. To start a tale is, ontologically speaking, a cosmological decision and only on this basis it involves a linguistic commitment, while to start a poem is first of all a formal decision and only later a matter of content (Eco 1985: 253-254).

By a formal point of view, to write a tale is a matter of fluency and reliability of the semiotic chain that connects together a starting and an ending point of a sequence of fictional facts. On the contrary, a poem is a matter of fragmentation of the verbal flow, whose aim is to suggest some further dimensions of meaning through the inexhaustible recombination of the broken rings of the linguistic chain. In 1956, Roman Jakobson anticipated these remarks by saying that the sign of the poetry is metaphorical, while the sign of the prose is metonymical.

The development of a discourse may take place along two different semantic lines: one topic may lead to another either through their similarity or through their contiguity. The METAPHORIC way would be the most appropriate term for the first case and the METONYMIC way for the second, since they find their most condensed expression in metaphor and metonymy respectively. [...] In normal verbal behavior both processes are continually operative, but careful observation will reveal that under the influence of a cultural pattern, personality, and verbal style, preference is given to one of the two processes over the other. [...] The principle of similarity underlies poetry; the metrical parallelism of lines, or the phonic equivalence of rhyming words prompts the question of semantic similarity and contrast; there exist for instance, grammatical and anti-grammatical but never a-grammatical rhymes. Prose, on the contrary, is forwarded essentially by contiguity (Jakobson 1956: 40-45).

According to Jakobson, metaphor and metonymy would correspond to poetry and prose in their pure forms. Literary prose, as something different from ordinary prose,<sup>9</sup> would be somehow poetic too, since it does not aim to inform us about anything (which is to say that it is expressive of some kind of linguistic potentiality, rather than being communicative of a piece of *knowing-that*<sup>10</sup>), but it develops according to the laws of metonymy, while

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<sup>9</sup> Consider for instance the difference between a piece of crime news and Gadda's novel.

<sup>10</sup> In order to develop this point, see Walsh 1969. Literature, Walsh says, is mainly a form of "knowing by living through" (see for instance pp. 100-101), so that it is a wrong move to settle the question of its cognitive power because of the self-reference of its aesthetic being, and also to overestimate its contributions of knowledge by assuming them as factual propositions. Such a thesis is developed by Catherine Wilson, who specifies, however, that there seem to be two ways of knowing what something is like: the first at the deep level and the second at the superficial level of experience (Wilson 1983: 494). Personally, I am quite skeptic about the relevance of this remark, but what is important here is that, even if the

poetry is said to be eminently metaphorical, because it is based on the symbolic power of linguistic signs. Literature in general would depend on the focusing of communication on the message as such:

The set (*Einstellung*) toward the MESSAGE as such, focus on the message for its own sake, is the POETIC function of language. This function cannot be productively studied out of touch with the general problems of language, and, on the other hand, the scrutiny of language requires a thorough consideration of its poetic function. Any attempt to reduce the sphere of poetic function to poetry or to confine poetry to poetic function would be a delusive oversimplification. Poetic function is not the sole function of verbal art but only its dominant, determining function, whereas in all other verbal activities it acts as a subsidiary, accessory constituent. This function, by promoting the palpability of signs, deepens the fundamental dichotomy of signs and objects. Hence, when dealing with poetic function, linguistics cannot limit itself to the field of poetry (Jakobson 1958: 189-190).

I think we can agree with Jakobson when he suggests that all literary production is expressive rather than communicative, for aesthetic texts propose themselves in an opaque way, even if different genres and different poetics will combine this opaqueness with other functions of language (see Lepschy 1992: 149). Literariness exhibits the rhetorical constructiveness of the discourse so that the referent may drift into the background, or share the foreground with the figural frame of the language at issue. But I believe that Jakobson's view is spoiled by Platonism as far as it puts in brackets the historicity of literature, in order to identify a mere constant of structure (see Marino 1987: 249, where it is underlined the formalistic origin of such an idea).<sup>11</sup>

Moreover, it seems that the definition of literariness as the projection of "*the principle of equivalence from the axis of selection into the axis of combination*" (Jakobson 1958: 192) risks to water down the distinction between metaphor and metonymy as constructive devices of artistic poetry and

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Wilson is right, the general frame of a theory of knowledge which is wider than we usually admit does not change. On the same track, as far as I can see, we find the practice of the emotional laboratory proposed by Carola Barbero (2012).

<sup>11</sup> The poetic function is a device of language as such, therefore it does not entail any consideration of time and circumstances. It is true that, within Structuralism, there have been attempts to conciliate the a-temporal study of textual devices with the history of literature (see Ceserani 1990: 32-65), but the ontology at issue was at best three-dimensional: the evolution of the structures was not seen as a real flow, but rather as a sequence of static realities, since only what has made up a balance might be properly studied.

prose.<sup>12</sup> Indeed, by stating that within literature “the equation is used to build a sequence”, Jakobson misinterprets the very mechanism of metonymy, which is not  $A = B$ , but rather  $A \rightarrow B$  or else  $A \leftarrow B$ .

#### 4. Being is said in many ways...

To project the rule of selection onto the axis of combination means to produce a sequence in which A is B, even if normally we should choose between A or B, with no reasonable possibility of having both together.

Some examples will elucidate what I mean. At the end of the lyric of *Wish you were here*, one of the most famous hits by Pink Floyd’s, we find these verses: “We’re just two lost souls / swimming in a fish-bowl / year after year”. The song has an existential relevance, despite the very specific tribute to Syd Barrett, the first guitar player of the group, who has gone insane. The meaning of these verses is therefore more or less what is expressed by the following complex of sentences: we human beings are uncertain and unhappy, we live trapped onto the Earth just like goldfish that swim in a fish-bowl, repeating always the same acts and with no hope of redemption, no sense of the future. There are too many things to analyze in such a discourse, but I will focus only on the equivalence of human beings and fish. Actually, the text does not say that we are fish, but just that we are “lost souls / swimming in a fish-bowl”. By a literal point of view, however, the sentence would be proper *iff* it is true that we really use to swim in a fish-bowl. It is for this reason that one is led to the conclusion that human beings are compared to fish in a direct but implicit way. By a linguistic point of view, the syntagm “we are...” may be completed with all the paradigmatic possibilities of language: we are human beings (technical), we are

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<sup>12</sup> We could say, with Fry (2012: 120), that Jakobson, with his structural analysis, is a champion of decomposition of the fabric of signs (the TEXTUS) in order to show its mechanism. But the critical comprehension of literary texts is not only a matter of discursive anatomy: the critic then recomposes the textual threads in order to show their coherence, which is to say the very specific being of the text. Fry (*ibidem*) suggests that “what’s recomposed in Jakobson is a phantom axis of selection hovering above and within the axis of combination. Everywhere along a composed line combining signifiers, which one can think of as a *row*, especially where the poetic function is the dominant, one senses above and below each new signifier the virtual *column* consisting of all the metaphorically related signifiers that were not selected but could have been”. Of course, also when one reads a passage of prose it is possible to feel for each word the unselected alternatives which could make more transparent the discourse at stake. But if Jakobson is right, these alternatives are based on a linguistic principle that has nothing to do with the metaphoric device.

people (quite trivial), we are bipeds without feathers (correct but odd), and so on. What is sure is that the paradigm does not contemplate the equivalence “human beings = fish”, therefore, by stating that we are fish, one produces an overlap of two different paradigms.<sup>13</sup> Our scientific awareness reminds us that all the elements of mankind are mammals and mammals are not fish at all. Thus, the selection activated by the first plural person of “to be” jumps onto a forbidden paradigm and combines the reference of the verb with this second, weird categorization of the subjects. The result is  $A = B$  (where  $B \rightarrow \neg A$ ). In Jakobson’s terms, this is an example of poetic function of metaphorical kind.<sup>14</sup>

If the passage just considered is metaphorical, in the same lyric there are other expressions in which we can recognize the principle of metonymy at work. Let’s take the words which follow immediately, for instance: “Running over the same old ground. / What have we found? / The same old fears”. In this case, it is clear that the subjects do not “run” literally, looking for things to collect. “Running” here means “living” and “found” can be translated with “obtained”, in the sense of weighting up one’s life. These overlaps are metaphorical only at first sight: “to obtain”, in fact, is a special case of “to find”, so that we have no real jump from one paradigm to another. Likewise, “running” is a manifestation of life, as any other negation of stillness. Now metonymy is defined as “the substitution of a term with another which has a relationship of contiguity with the first” (Dardano and Trifone 1983: 437). As Bice Mortara Garavelli (1988: 148) explains better, “the connections that distinguish metonymy from the other tropes concern

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<sup>13</sup> This overlap can be logically understood as an equivalence or else as the intersection of two different sets: “the rhetorical figure of speech of metaphor can be explained through a set-theoretical model. A few examples will help. If I call ‘pearls’ the eyes of a child, I am actually implying this sequence: the child’s eyes are clear, bright and beautiful as pearls, therefore, instead of ‘eyes’, I say ‘pearls’, since they share the same brightness; by a set-theoretical point of view, the child’s eyes can be configured as a set, the pearls as another set and the brightness is their intersection. Another example: if I describe a fierce way of looking as a ‘wild look’, I am actually implying the following steps: that look is unpleasant, it scares you exactly like the glance of a wild beast, so instead of ‘unpleasant’, I say ‘wild’ operating just a transfer (and metaphor means ‘transfer’). Also in this case, the gaze and the beast are two different sets and their intersection is the ‘unpleasantness’. In short, then, metaphors can be understood as the intersections of some concept-classes” (Guadalupi, 1985: 158-159).

<sup>14</sup> Fully analyzed, the poetic structure turns out to be the following argument: we are human beings and our bustling about is senseless; swimming in a fish-bowl is senseless too thus our bustling about is just like swimming in a fish-bowl; but fish swim in fish-bowls; therefore we are fish; in conclusion, human beings are fish. Which is to say that they are what they can never be said to be, by an epistemic point of view.

those conceptual fields which are contiguous and for some regards interdependent”, what is exactly the case at stake here. Therefore, the figural structure of these expressions is again “poetical”, according to Jakobson’s theory of the functions of language, because the sentence is not a real locative statement, but now it has first of all a metonymical feature:  $A \rightarrow B$ . What is even more metonymical is the definition of the world as “the same old ground”. Here, in fact, the ground is the surface of the Earth, the planet we live in, and so the phrase at issue is based on a typical *pars-pro-toto* scheme.

In short, in a paradigmatic literary utterance, A and B are incompatible entities, but A is said to be exactly B ( $A = B$ ); in a syntagmatic literary expression, on the contrary, A and B are linked together, even if they have not the same extension, so that A is said to be B, because A implies B ( $A \rightarrow B$ ).

We have here two different meanings of the verb “to be” and we should never forget that we deal with a polarity. But Jakobson, by saying only that “*The poetic function projects the principle of equivalence from the axis of selection into the axis of combination*” (Jakobson 1958: 192), invalidates the difference between the poetic function of literary poetry and that of literary prose, a difference – let’s remind it – which he himself helped to point out.<sup>15</sup> It is not a valid excuse to declare, as he does, that “metonymic structures are less explored than the field of metaphor” (Jakobson 1958: 214).

## 5. Figural language and literature

It is well-known, we use to say, that “I drink a glass of water” is a metaphorical statement, but actually it is metonymical, because it defines my drink by substituting the content with the container. Likewise, “the sweaty papers” Leopardi mentioned in *To Sylvie* are not metaphorically but metonymically wet (the effect for the cause), although it is quite common to read that the sweat is a metaphor which stands for the poet’s studies. It is not allowed to muddle up metaphor and metonymy for reasons of linguistic usage, but it is necessary to point out that pure metaphors and metonymies are very rare. What is common, in fact, is the combination of both in one single expression.

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<sup>15</sup> “The study of poetic tropes has been directed mainly toward metaphor, and the so-called realistic literature, intimately tied with the metonymic principle, still defies interpretation, although the same linguistic methodology, which poetics uses when analyzing the metaphorical style of romantic poetry, is entirely applicable to the metonymical texture of realistic prose” (Jakobson 1958: 214).

Let's consider this baroque verse, written by Giuseppe Artale: "il crin s'è un Tago e son due soli i lumi". The poet compares his lover's hair to a river (Tago) for its flowing aspect, and her eyes are said to be two suns ("Maria's hair is a Tago and two suns are the eyes"). According to Dardano and Trifone (1983: 437), the quoted verse is a good example of a metaphorical construction in literature, but this is just a simplification. Defining a woman's hair as a river is a metaphor, but to express this equation by naming just one specific river among the others (that moreover ceases to be an individual and becomes a class) is a metonymy.

	<p>Her hair is a river (metaphor)</p>
	<p>Tago is a River (premise of a metonymical shift: an individual refers to a universal; but the individual at stake is generalized as the prototype of a class)</p>
	<p>Her hair is a Tago (metonymical metaphor: Maria's hair is a kind of river, it is an instance of the Tagos)</p>

Thus, instead of using of the adjective "metaphorical", we would better speak, very often, of the "figural" property of literary texts, because it is hard to identify completely metaphorical statements. Figurativeness not only makes possible a more effective approach to the specificity of literary language (since it is no more necessary to cut off the purity level of a rhetorical choice), but it also seems to bear easily the different views of the tropes at issue, with the intuition of an ontological scenery which is able to reabsorb the contradictions developed by our analytical theories. I will come back on this point at the end of the paper, precisely to suggest that we have to drop the analytical rigor in the field of the speculative enjoyment of literary lan-

guage and production.<sup>16</sup> It is important indeed to understand that, when we talk about literature, what is at stake is an experience which implies a “form of life” (as Bachtin 1926: 43 also says) and that, as such, passes over the boundaries of science and takes its place in the framework of a *collective social enthymeme* (Ronchi 2013: 29-31), where the power of empirical proofs and of classical logic is no more so determinant.<sup>17</sup>

### 5.1. Some theories of metaphor we could find interesting

However, we can keep on studying metaphor as one of the main devices we find in literary production. But metaphor itself is not one single entity. Or better: what is at work in metaphors is not always the same linguistic mechanism. This fact is widely recognized by some modern theories, even when they stress on the conflict of interpretations that any metaphor imply (see Prandi 2003). However, the most important distinction is that between an ontological and an instrumental figuralism.

Theories of metaphor may be divided into those that see metaphor as a secondary use of language, a departure from its basic function of describing our responses to the outside world, and those that see it as an essential characteristic, inherent in the nature of language itself. Put otherwise, the question is whether all language is metaphoric or whether there is a literal as well as a metaphoric use of it (Levin 1992: 285).

I would like to anticipate that I will subscribe a theory of language in which there is indeed a basic degree of signification, but this standard form is the result of a figural development of the comprehension of the world. The latter, therefore, lays outside the epistemic sphere of language, but is entailed in the semantic power of the word.

Commonly, anyway, people think that the world comes prior to any language, and that language first of all reflects in its own structures the arrangements of the things. It seems to be a guarantee for science to conceive the topic at issue in such terms.<sup>18</sup> This is the reason for speaking of a figura-

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<sup>16</sup> What I am speaking about is a kind of reflexive but unguarded attitude towards the virtual experience disclosed by the aesthetic speech. See Iser 1974: 50: the experience of literature is the active (re-)construction of a sensible structure, in which our sensibility is involved together with our intellect, but avoiding the preeminence of what we call “ratio”.

<sup>17</sup> See Ponzio 1980: 24: there are many forms of life that may set up our sceneries of knowledge and experience, therefore to isolate the epistemic one is at least thoughtless.

<sup>18</sup> Notice that, even in the so-called first Wittgenstein (1922), such a view turns out to be very problematic. See the propositions 1: “The world is all what happens”, 1.1: “The world



tive dimension of all those linguistic intercourses that cannot be classified as mistakes of communication, but in which objects and events are told with names and expressions they usually do not bear. If we try to understand linguistic transactions in which metaphors are decisive by giving credit to this assumption, then we will have to consider two main theories of metaphor.

When regarded as the modified use of literal language, metaphor may take one of two basic forms: in one, the modification reflects itself in an incongruity between the literal sense of the expression and the (non-linguistic) environment in which it occurs; in the other, the incongruity is reflected in the expression itself. Thus, in responding to an opponent's argument, a speaker might say, "That's a pile of garbage"; a poet, to describe the formation of dew at nightfall, might say, "When the weak day weeps". The latter expression – Shelley's – is syntactically well formed, but it is semantically deviant, in that the grammar of English does not 'sanction' predicating *weak* and *weep* of a *day*. In the first type of metaphor, on the other hand, nothing in the expression is linguistically unorthodox; there is, however, a form of deviance in the *use* to which the expression is put; we might refer to metaphors of this type as pragmatically deviant (Levin 1992: 286).

Metaphors, in the broad sense we have specified above, are linguistic expressions that, by a logical point of view, have more than one single truth value, because they can be interpreted at the literal and at the figural level. For sure, this fact implies that metaphors, and figurative language in general, deviate from the ordinary rules of explanation of the message. If metaphor is an *unorthodox use of language* which anyway is not wrong,<sup>19</sup> then we have to distinguish this heresy according to whether it is a violation of linguistic rules or pragmatic rules: in the first case we have a linguistic choice that is not allowed in ordinary speaking, in the second case we deal with a verbal pattern that is absolutely normal and correct, but that clashes with the laws of referring to the world.

To tell the truth, there is a third possibility (see Levin 1988): if it is really important to save the realism of a basic degree of signification, we can also think that metaphors are false in the actual world, but true in other possible worlds. Thus, the speaker who receives a figural message, having ascertained that its traditional explication contrasts against the actual state of affairs, should try to conceive the world which fits better the discourse.

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is the whole body of the facts, not of the things" and above all 5.6: "*The boundaries of my language mean the boundaries of my world*".

<sup>19</sup> Against Davidson (1978), who states that there is no semantic deviance in metaphors, because they have no deeper sense. Metaphors, therefore, would be just false utterances.

## **6. The trial of the texts: Bontempelli, Calvino, Montale, Luzi**

We can check the validity of these theories of figurative speech by analyzing the mechanism of some metaphorical elaborations we can find in modern Italian literature.

The first text we have to consider is a tale written by Massimo Bontempelli, an author whose “magic realism” strongly contributed to the renewal of narrative production, in particular in the first half 20<sup>th</sup> century. His characteristic aspect, with regard to the style, is the clearness of expression, that anyway does not lead to a mimetic representation of the world, but is much more similar to the exactness of some metaphysical paintings realized by De Chirico.

As the title “The Good Wind” suggests, the tale deals with some figural expressions we Italians commonly use in ordinary verbal interactions. In this case, metaphor and metonymy are revealed as the vital core of idioms. The point, however, is that we do not perceive any longer idiomatic expressions as figural utterances, because we are too accustomed to their presence to remark that what they say is literally weird. In order to become aware of the figural structures idioms imply, we must consider them as an Asperger<sup>20</sup> would do. Hence the humor that pervades Bontempelli’s story. Let’s consider, for instance, the following passage:

Some twelve years ago I fitted up for my amusement a sort private chemical laboratory, where I devoted myself to the absorbing pursuit of trying to isolate a substance intermediate between the physical and the spiritual world. One day I unexpectedly found in my hand the very thing I sought. My reader will realize at once that it was the most marvelous discovery ever made. It was a fine powder, which I could hold in my palm, neither cold nor warm. It was impalpable and imponderable, even if my hand could feel it. It was colorless, and yet very visible. [...] Such was that substance I had been seeking, as I felt at once, and quickly demonstrated. I proved it by a succession of extraordinary effects, which I will now describe to see who believes me.

It was midsummer. I was living at the time in a little town in the midst of a broad Italian plain. Wrapping the powder in a paper, I placed it in my pocketbook. As I did so, I noticed that I had no money. I felt it all my pockets without result. Up to the present I had not tested the magic powers of the powder. I hastily planned a series of experiment to demonstrate them. It was noon. Two problems of a financial nature faced me immediately. The first was to get money enough for lunch; the second, to secure funds for carrying out the experiments I had in mind. The second problem embraced the first.

I left my house with the powder in my pocket. The midday streets were vacant. My footsteps echoed on the pavements beat down unmercifully by the burning

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<sup>20</sup> See Rondal and Quiros Ramirez 2007: 5-7.

sun. I pondered my next move. I knew two gentlemen of means in town: Bartolo and Baldo. I also remembered that Bartolo sometimes visited the restaurant of the Burning Spur, which Baldo owned. Thither I accordingly directed my steps. The proprietor was not in, he had gone to his vineyard; but luckily Bartolo was just finishing lunch with his wife, a portly lady, and his daughter, a mere wraith of a girl. I spoke to Bartolo at once:

“I was just looking for you, Mr. Bartolo, to get you to take an interest in an enterprise of mine. I have discovered a remarkable powder. I do not yet know just how it can be employed most profitably [...] I need twenty-five thousand lire to finish my experiments. I expect you to furnish them.”

[...] Bartolo gulped down the peach he had just finished peeling so hurriedly that it nearly choked him. [...]

“Mr. Massimo,” he answered, “you don’t know that I am poor. I can’t give you even twenty-five cents. I swear that it makes my heart bleed to refuse your request.”

He stopped. I gazed at him. He gazed back at me, so that I dropped my eyes for embarrassment. I then noticed just over his breast, a little to the left and below the pocket where he carried his pocked handkerchief, a tiny red spot staining the white cloth of his suit. I was about to press my case further, but I noticed that the red spot was fresh and growing larger. I was going to warn him when he kept on speaking: “It makes my heart bleed,” he repeated “and I want to explain you...” But I was no longer listening for a suspicion, a hope, an explanation, an intuition. Perhaps, for sure, indeed absolutely for sure! I now realized what were the effects of my discovery. This gentlemen had spoken within the radius of influence of my powder, of the substance that marked the point of contact between the real world and the world of images: my powder makes physical all the figures of speech men use when they talk to each other. *My heart bleeds*, he said more than once, and his poor heart... I watched him breathlessly. The spot ceased to extend. I stared at him. He grew pale. Then I attended again to what he was saying.

“My money is over,” he repeated in a weak voice, turning to leave. “And do you know how I’ve spent all I had? In a year of medical treatments for my wife and my daughter.”

The two ladies, one excessively fat and the other excessively thin, had now withdrawn to a corner of the room in the shade, where they stood watching us silently.

“Yes, I’ve had an expensive doctor for my wife who wants to reduce, and for my daughter who wants to put on flesh. And you see the result: my wife’s a tub and my daughter’s an anchovy. Good-bye, Mr. Massimo. Come on, ladies!”

Mr Bartolo glanced at the corner where they had been standing, but no one was there. That did not surprise him. He mumbled: “They must have gone home to make the coffee”. He stumbled uncertainly out of the restaurant, and without turning around vanished down the street.

I stared with an icy chill in my heart toward the dark corner where the ladies had stood only a moment before. There was a tub. I shivered. I dared a couple of steps toward it, I stopped, and from there I bent over a little studying the floor. Just at the bottom of the tub lay a miserable salted anchovy. Bartolo’s wife and his daughter.

I stepped back. I dropped weakly into a chair in front of a table. The waiter was just getting back in the room from the kitchen and he came up to me. I had barely strength to murmur: "A piece of cheese, a glass of wine."

He brought them. I sat in silence. Little by little I recovered from my shock. By the time I had finished the cheese I felt immensely proud of myself. The scientist had conquered the man in me. I surveyed with a thrill of satisfaction my work in the dark corner beyond. At length I finished also my wine.

I noticed that a cat was smelling at the anchovy, I turned my eyes away.

"When will your boss be back? I want to talk with him."

"He's gone to the vineyard. He'll return this evening." After a short while, with an obsequious smile the waiter added: "If the gentleman will pardon me, I happened to overhear his conversation with Mr. Bartolo. If the gentleman wishes money, I might be so bold as to say that he applied to the wrong person. I would advise him to go to the Commendatore."

"You mean that man who lives at the end of the square? What's his name?"

"Indeed. his name is... oh, I don't remember. Wait, I've got it on the tip of my tongue."

"Well. Show me your tongue!"

"Pardon?"

"Show it, right now."

I said it so imperatively that he automatically obeyed. He stuck out his tongue. I got closer, I read aloud: "C-o-m-m-e-n-d-a-t-o-r-e B-a-r-b-a."

"Exactly. How did you know it?"

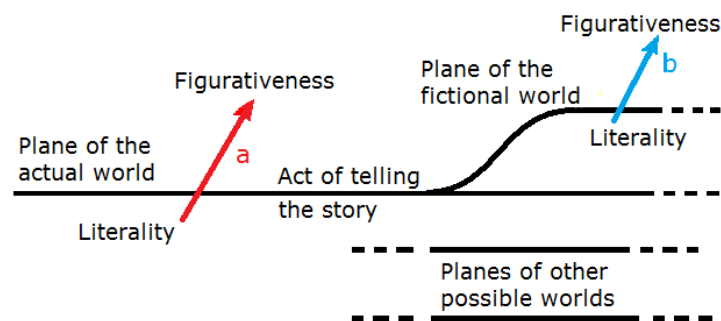
"You had it on the tip of your tongue."

(Bontempelli, 1961, 722-724)

What is at stake here? At first sight the tale is built mainly on the pragmatic deviance of language. The heart, for example, may bleed, as it does when wounded, but in ordinary communication the fact that it is bleeding should be taken as a metaphorical statement, with the meaning of "being very sorry". By a formal point of view, the expression does not violate any rule of language, but it is in contrast with the actual picture of reality. Only a magic powder can turn the figural image into a real event. The magic powder the story is about is therefore an alchemic comb that highlights the intrinsic rhetoric of our verbal transactions. But it is also possible to read the tale as the aesthetic realization of that theory of metaphor in which we have to conceive many worlds at the same time: in order to understand an utterance – even a complex one as the quoted passage is – we cannot blindly be confident of the actual world we live in, but we should look for that thought universe in which the utterance at issue makes sense, with no reduction to more basic statements. In this case, what seems figural here-and-now is not secondary at every ontological level. Indeed, we have to take the *fiat* suggestion as such, if we want to appreciate the text for its literariness. Moreover, by developing this idea, it is also imaginable that literature produces

ontological shifts, up and down in the range of the worlds, so that it is improper to tell what is literary from what is literal, because by doing so the text will be observed from the outside. In the narrative sequence just considered, the sentence “my wife is a barrel” starts as a metaphorical statement but ends as a literal assertion, as one can see in the scheme below.

*Ontology of "The good wind"*



- a) “my wife is a barrel”, or else *my wife is as fat as a barrel*;
- b) “my wife is a barrel”, namely  $\left\{ \begin{array}{l} \textit{my wife is as fat as a barrel (t_1)} \\ \textit{my wife is literally a barrel (t_2)} \end{array} \right.$

In order to verify the theories of metaphor sketched in the previous paragraph, I think we should read carefully also another tale: “The forest on the Superhighway”, written by Italo Calvino.

Cold has a thousand shapes and a thousand ways of moving in the world: on the sea it gallops like a troop of horses, on the countryside it falls like a swarm of locusts, in the cities like a knife-blade it slashes the streets and penetrates the chinks of unheated houses. In Marcovaldo’s house that evening they had burned the last kindling, and the family, all bundled in overcoats, was watching the embers fade in the stove, and the little clouds rise from their own mouths at every breath. They had stopped talking; the little clouds spoke for them: the wife emitted great long ones like sighs, the children puffed them out like assorted soap-bubbles, and Marcovaldo blew them upwards in jerks, like flashes of genius that promptly vanish.

In the end Marcovaldo made up his mind: “I’m going to look for wood. Who knows? I might find some”. He stuffed four or five newspapers between his shirt and his jacket as breastplates against gusts of air, he hid a long, snaggle-tooth saw under his overcoat, and thus he went out into the night, followed by the long, hopeful looks of his family. He made a papery rustle at every step; the saw peeped out now and then above his collar.

Looking for wood in the city: easier said than done! Marcovaldo headed at once towards a little patch of public park that stood between two streets. All was

deserted. Marcovaldo studied the naked trees, one by one, thinking of his family, waiting for him with their teeth chattering.

Little Michelino, his teeth chattering, was reading a book of fairy-tales, borrowed from the small library at school. The book told of a child, son of a woodsman, who went out with a hatchet to chop wood in the forest. "That's the place to go!" Michelino said. "The forest! There's wood there, all right!" Born and raised in the city, he had never seen a forest, not even at distance.

Then and there, he worked it out with his brothers: one took a hatchet, one a hook, one a rope; they said good-bye to their Mamma and went out in search of a forest.

They walked around the city, illuminated by street-lamps, and they saw only houses: not a sign of a forest. And so they reached the area where the houses of the city ended and the street turned into a highway.

At the sides of the highway, the children saw the forest: a thick growth of strange trees blocked the view of the plain. Their trunks were very very slender, erect or slanting; and their crowns were flat and outspread, revealing the strangest shapes and the strangest colors when a passing car illuminated them with its headlights. Boughs in the form of a toothpaste tube, a face, cheese, hand, razor, bottle, cow, tire, all dotted with a foliage of letters of the alphabet.

"Hurrah!" Michelino said. "This is the forest!"

And, spellbound, the brothers watched the moon rise among those strange shadows: "How beautiful it is..."

Michelino immediately reminded them of their purpose in coming there: wood. So they chopped down a little tree in the form of a yellow primrose blossom, cut it into bits, and took it home.

Marcovaldo came home with his scant armful of damp branches, and found the stove burning.

"Where did you find it?" he cried, pointing to what remained of a billboard, which, being of plywood, had burned very quickly.

"In the forest!" the children said.

"What forest?"

"The one by the highway. It's full of wood!"

Since it was so simple and there was need of more wood, he thought he might as well follow the children's example, and Marcovaldo again went out with his saw. He went to the highway.

Officer Astolfo, of the highway police, was a bit shortsighted, and on night duty, racing on his motorcycle, he should have worn eyeglasses; but he did not say so, for fear it would block his advancement.

That evening, there was a report that on the superhighway a bunch of kids was knocking down billboards. Officer Astolfo set out to inspect.

On either side of the road, the forest of strange figures, admonishing and gesticulating, accompanied Astolfo, who peered at them one by one, widening his near-sighted eyes. There, in the beam of his motorcycle's headlight, he caught a little urchin who had climbed up on a billboard. Astolfo put on the brakes. "Hey, what are you doing there? Jump down this minute!" The kid did not move and stuck out its tongue. Astolfo approached and saw it was an ad for processed cheese, with a big child licking his lips. "Yes, of course," Astolfo said, and zoomed off.

A little later, in the shadow of a huge billboard, he illuminated a sad, frightened face. “Don’t make a move! Don’t try running away!” But nobody ran away. It was a suffering human face painted in the midst of a foot covered with corns: an ad for a corn-remover. “Oh, sorry,” Astolfo said, and dashed away.

The billboard for a headache tablet was a gigantic head of a man, his hands over his eyes, in pain. Astolfo sped past, and the headlight illuminated Marcovaldo, who had scrambled to the top with his saw, trying to cut off a slice. Dazzled by the light, Marcovaldo huddled down and remained motionless, clinging to an ear of the big head, where the saw had already reached the middle of the brow.

Astolfo examined it carefully and said: “Oh, yes. Stappa tablets! Very effective ad! Smart idea! That little man up there with the saw represents the migraine that is cutting the head in two. I got it right away!” And he went off, content.

All was silence and cold. Marcovaldo heaved a sigh of relief, settled on his uncomfortable perch, and resumed work. The muffled scrape of the saw against the wood spread through the moonlit sky.

(Calvino 1966: 36-39)

The alleged forest is clearly something else: namely, a heap of bill boards. But we are not dealing with a real metaphor here. Actually, this case is much more similar to an epistemological misinterpretation, just like what has often happened in the development of science. The concept of wood the kids have in mind is vague enough to support a false identification, which however produces positive effects (serendipity<sup>21</sup>). For this reason, the act of reference is not reset but confirmed, despite its patent falsity. What Marcovaldo’s children have at their disposal is not a metaphor but a model; however a model is somehow a metaphor too, since it is not a complete or mimetic reproduction of a given reality, but rather a heuristic proposal of perception:

By definition, a model is not a complete and faithful rendering of reality. It is no more than an analogy or *metaphor*. It implies a structure of logical and mathematical relations that has many similarities with what it purports to explain, but cannot be fully identified with it. The wise theorist does not assert or attempt to prove the necessary validity or verisimilitude of his model; this is to be discovered by further experience. He says (often in just these words) “Suppose we think of this way: what follows?” [...] a model is no more than a guide to thought, or a framework for a mathematical interpretation of inexplicable phenomena (Ziman 1978: 23).

Even if, as a model, the identification of the billboards by the motorway with a fairy wood may be regarded as a metaphor in a very broad sense, the story, at a formal level, is as figural as it is realistic. With regard to the style of writing, the tale does not indulge, in fact, in the use of just one expressive

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<sup>21</sup> See Eco 1998.

register, but it is based on the unsolved dialectics of literal and figural. “The headache is a saw that cuts your head”, the agent realizes; but this was not the original figure in order to make vivid what the headache is, this is instead the outcome of the interference between the (fictional) reality and the (fictional) figurativeness. The general effect of Calvino’s linguistic fantasy is as funny as in the story written by Bontempelli. But humor is not a necessary feature of figurative speech.

This fact is proved by the third and the fourth texts I would like to analyze briefly: “I Have Often Met the Pain of Living” and “Under the Yoke of Metaphor”. Montale and Luzi.

I’ve often met the pain of living:  
it was the obstructed brook that gurgles,  
it was the shriveling up of the burnt  
leaf, it was the collapsed horse.

No good I have known, but the miracle  
disclosed by the divine indifference:  
it was the statue in the drowsiness  
of the noon, and the cloud, and the hawk up in the sky.  
(Montale 1990: 35)

In this poem we find some good examples of what the critics called the “objective correlatives” of Montale’s writing. The term was first used for Eliot’s production, where it refers to a combination of some words denoting specific things and situations, in order to evoke a feeling without necessary speaking of that feeling as such.<sup>22</sup> We could also say that this is a rhetorical trick in order to avoid introspection and the exaltation of one’s inner experience in literature. In the text at issue, the pain of living is therefore objectified at first in “the obstructed brook that gurgles”, “the shriveling up of the burnt leaf” and “the collapsed horse”. These expressions *represent* the suffering of being-in-the-world in terms of physical realities, with no apparent psychological deformation. In Montale’s poetry metaphors are not metaphorical at all, which is to say that poetic language does not cover a previous reality with a special cloth of images. There is no secondary use of the words in these verses, but only an intent of showing what the world actually is. Figurativeness is therefore the flesh of our actual experience.

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<sup>22</sup> Eliot himself (1919) defined the “objective correlative” as “a set of objects, a situation, a chain of events which shall be the formula of that particular emotion [one is going to express]; such that when the external facts, which must terminate in sensory experience, are given, the emotion is immediately evoked”.





## **7. Is it true that literature (as the running of the figurativeness of signs) is just another way of using language?**

Figural and literal, we said. It is for sure possible to conceive literature as the result of a special way of using language. Everybody can declare their love, but only a poet can write a sonnet at the same time. Literature seems to be a way of telling something by means of figural resources and not directly: “In the middle of the path of our life” (Dante) would just be an elaborate manner of saying “at the age of 35”.

Likewise, we can say that to describe life as the “following a wall with sharp pieces of glass on it” is literary, while to tell our existential destiny as the sequence of birth, growth, struggle and death is just philosophical or perhaps sadly realistic. As it is often specified, if the first expression is literary, the second is literally. Therefore, we would have a state of affairs (the fact that life is so and so) and then several descriptions which try to fit the structure of this state of affairs. One of those descriptions would grasp the fact as it is, so that the corresponding sentence should work as the basic meaning of all the other statements. Another description is that of the wall just quoted. If this remark were correct, then all the figural sentences related to a basic descriptive statement whichever would be reducible to this latter, with no loss of semantic power. Expressions should be reducible, just as it happens in mathematics with  $x - \sin \frac{\pi}{2} = 0$  and  $3x = -3 \cos \pi$ , which, in what is called their “normal form”, are indeed nothing but  $x - 1 = 0$ . Tempting, of course, but wrong. In literature it is impossible to reduce a sentence to an alleged “normal form”, because literary language is incommensurable to the ordinary systems of signs. “Life is suffering” is not the same of saying that life is “following a wall with sharp pieces of glass on it”.

Again, the famous verse composed by Gertrude Stein “Rose is a rose is a rose is a rose” is not the same of saying “a rose is a rose” (just once), or worse: “a rose is a flower”, even despite the reminder of the law of identity, stated by the author herself. There is something more, in literary expression, than the alleged basic meaning of the words used. Within literature nothing is additional, and there are no accidental repetitions or unproductive embellishments; thus whatever is said must be taken into account and must have a role in the general task of expression.

Actually, the sentence “following a wall with sharp pieces of glass on it” is not as literary as the original sequence of words used by Montale. The so-called synonymous expressions lay on a line without a clear discrete

articulation, a line, however, whose extremes are not equivalent at all.<sup>23</sup> This is the reason why we need the original arrangement of signs in the proper cultural context to be sure that we can *feel the poetry*:<sup>24</sup>

E andando nel sole che abbaglia  
sentire con triste meraviglia  
com'è tutta la vita e il suo travaglio  
in questo seguire una muraglia  
che ha in cima cocci aguzzi di bottiglia.  
(Montale 1990: 30)

Literariness involves figurativeness, but literariness is not equivalent to the figural use of the signs. Some kind of rhetoric elaboration of the message is a necessary condition for having a piece of literature, but it is not a sufficient condition too. If we deal with Montale's image, we can express a similar sense through a different arrangements of signs, we can also try to explicate what is at issue in those verses, but it is not *a priori* true that we will lose the aesthetic halo of the passage. This halo, in fact, emerges from the structure of the speech with all its centripetal and centrifugal links. No word is ever innocent and standard, even if it is possible to define some basic meanings of our linguistic tools.

Therefore, it is not a fault of the paraphrase as such that makes us lose the essence of literature in expressing the meaning of a text in certain other words. We can destroy the figurative pattern of a literary text and save the literariness of the text at the same time. Indeed, a special case of paraphrase is translation, and I think that we may grasp the essence of a foreign literary text through its (good) translations. But if we paraphrase a literary text with the only intent of making its meaning more transparent, putting between brackets any formal peculiarity, then the text ceases being what it is and

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<sup>23</sup> The same happens in mathematics, for example with 3,14 and  $\pi$ .

<sup>24</sup> As it seems possible to derive from the studies on synesthesia carried out by Ramachandran (2003) and developed by Cytowick and Eagleman (2009), to understand a figurative speech is most likely a neuropsychological matter. To feel the poetry, on the contrary, is a much more complex task, which involves skills of cultural as well as linguistic type: the essence of literature implies the recognition of a figurative language at work, but is not limited to this simple thing. The intertextual echoes of literature (see Corti 1997: 15-32) are something that occurs in a discursive horizon in which the aesthetic dimension of the text is something that makes system with the background knowledge of the speakers and with the tradition of those complex statements that a culture considers eminent. In conclusion, it is only because the linguistic heritage is largely the sediment of the evolution of literature that the text in the original linguistic form usually warrants the production of literary harmonics more easily than that in translation.

becomes something else: a more or less complex statement that is related to the literary text at stake, but which at the same time is radically different from it.

### **8. A constructive ontology: Nietzsche**

The analysis of the literary texts just proposed should have demonstrated that the idea of a natural degree of signification is at least very problematic. Literary figurativeness is hardly conceivable as the addition of some ornamental effects to a literal statement.

Besides, in dealing with literature, it seems reasonable to recognize that one cannot provide a complete definition of it. However I think we can say clearly what literature is not: literature is a family of linguistic games that has nothing to do with other linguistic games, such as the referential communication. Literature may tell us something about a specific subject, but such a potentiality is not what makes the difference between a literary text and another enunciation. Therefore it is of no use to evaluate the sense of a literary text with regard to the alleged referential meaning of the words.<sup>25</sup> By doing so, in fact, we would reduce expression to communication.

Even bees can communicate with their fellows, and they are able to give very sharp pieces of information. With a special dance, a bee informs the hive about where the food is and how much it is. It sounds odd, anyway, to say that bees can express something for aesthetic sake, and of course it would be dangerous for the hive to have an individual who “speaks” referring to a fictional world, or in a figurative way.

Moreover, the ability of expression seems to depend on some specific human genes of the X chromosome (Rondal and Quiros Ramirez 2007: 7-9), which is said to be responsible for the right development of the mind. If we say that figural language needs a well-formed mind to be performed, then it is clear that animals without a real mind cannot produce figural messages. Since it seems bonded to a theory of mind, figurative expressions should be related (also) to a specific kind of neurons, which play a crucial role in the development of human beings (both by an ontogenetic and by a phylogenetic standpoint), but seem to be less decisive for other animals: mirror-neurons.<sup>26</sup> Such clues should be developed in another context, but it is

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<sup>25</sup> See, on this subject, Meyer 1983.

<sup>26</sup> What seems to be definitively proved about mirror-neurons is that they are responsible for our understanding of the others' intentional activity (see, for instance, Rizzolatti and Sinigaglia 2006: 121-127). It has been said that mirror-neurons activate an “as if” physical

important to remind that, since I share the basic theorists' standpoints (in particular, the difference between theory of literature and epistemic discourses<sup>27</sup>), they are just back up clues.

However, if the mental activity of humans depends on these biological devices for the production of images, then it seems reasonable to claim that figural linguistic games are – so to say – more fundamental than the referential ones. Therefore, it is improper to think of a basic degree of meaning for the sentences we utter, what is confirmed also by some contemporary linguists (see Lakoff and Johnson 1980).

The best conclusion, therefore, seems to be a redefinition of the ontology of the world (which is not the same of the thing-as-such, since the world is just phenomenal).<sup>28</sup> We find a good outline of what I mean in Nietzsche's first theorization about truth:

What is then truth? A mobile army of metaphors, metonyms, and anthropomorphisms – in short, a sum of human relations, which have been enhanced, transposed, and embellished poetically and rhetorically, and which after long use seem firm, canonical, and obligatory to a people: truths are illusions about which one has forgotten that this is what they are. Truths are metaphors which have been worn out and so have lost all their sensible power, they are coins whose image is no more visible and so they are taken into account only as pieces of metal, nuggets, and no longer as coins (Nietzsche 1873: 361).

The words we commonly use, in order to define in an objective way the reality we live in, are not objective in turn. On the contrary, as De Saussure (1922: 86) clearly reminded, in some regards the words and the syntactical structures are always arbitrary and constructed, or better conventional: what they stands for is related to their form without any basic reason, nevertheless

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circuit (Damasio 2003: 143-144), which in turn could explain the virtual dimension of literary experience. To put oneself in someone else shoes is actually the most important activity of literary comprehension, both by the narrative and the poetic point of view. These remarks, together with the thesis which follows about the preeminence of figural language, could be the basis for a reevaluation of Heidegger's avowal that animals are poor-in-world.

<sup>27</sup> See also Bachtin 1935: 159: "In a very different way [with regard to what actually happens in literature] we have to consider the word in scientific thought. Here the relevance of the word is scarce. Mathematics and natural science do not know the world as a trend. [...] The whole methodological equipment of mathematics and natural science is turned towards the control of a thing- and silent object".

<sup>28</sup> I therefore agree with what Alai (1994: 46) calls "metaphysical ontological realism". See also Vasa (1981: 32): "That a world exists and has always existed without correlations to any possible intentionality is all but evident; in order to say that, one ought to have an almost self-contradictory confidence in some "essences", in one single space and one single time, and in some "final laws" of matter".

the system of language works *as if* the signs were necessary and the speaker perceives them as pre-existing and necessary resources of expression.

But once we recognized that language is not directly linked to the world, is it a logical inference the dismissal of any realistic knowledge, also of that of our classical view of science?<sup>29</sup> Not really, and the reason is again explained by Nietzsche:

The falsehood of a judgment is not yet, for us, an objection to that judgment; it is here that our new language sounds maybe odder than ever. The question is how much that statement may promote and preserve life [...] and we are fundamentally inclined to maintain that the falsest statements (among which we can find the *a priori* synthetic judgments) are for us the most necessary, and that without them it is impossible to keep in force the logical fictions, that without a comparison of reality with the purely imagined world of the absolute and immutable, without a constant counterfeiting of the world by means of numbers, man could not live. We are inclined to assert that the renunciation of all the opinions which do not correspond to a being-as-such would be a renunciation of life, a negation of life (Nietzsche 1885: 9-10).

In conclusion, figurativeness is the original condition of our existence. Whatever we may conceive is therefore always pervaded by our rhetoric transcendental structures. Literature has little or no practical consequences, but for sure it teaches us to take the objective reference as another fictional construction which therefore cannot demand any privileged position in absolute. The reality of the world is objective only insofar it is unaware of the fundamental constructiveness of thought. Reference itself is not out there in an absolute way, so that it is actually very problematic and moves and changes with the aesthetic and linguistic rules we adopt. However, reference has a sort of supremacy in all the linguistic game of the enterprise of scientific knowledge, where its role is – so to say – to stand still. When we play science, we have to reduce the figural statements to the most literal ones. But when we play literature, we have only to enjoy the game.

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<sup>29</sup> It is the view of science that precedes the earthquakes of relativity and quantum mechanics, or at least that thinks these theories have almost no impact on our epistemic and practical routines. The classical view of science, therefore, is characterized by an unchanged confidence in Newton's description of the world; it is encouraged by the idea of the absolute potential improvement of measurements and determinations.

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# Features and Functions of Scientific Metaphors

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We must be clear that, when it comes to atoms, language can be used only as in poetry. The poet, too, is not nearly so concerned with describing facts as with creating images and establishing mental connections. [...] Quantum theory [...] provides us with a striking illustration of the fact that we *can* fully understand a connection though we can only speak of it in images and parables.

(Niels Bohr, Interview quoted in *Defense Implications of International Indeterminacy* by Robert J. Pranger, 1972, p. 11)

## 1. Why are metaphors useful to describe things?

The debate about metaphor and its cognitive implications has nowadays a fairly well-established tradition and continues to attract lively discussion. I will consider this topic from an epistemological point of view, addressing the function of metaphors in scientific reasoning, in order to explain why and under which conditions they can contribute to knowledge acquisition. Metaphors are ubiquitous in ordinary speech and pervade scientific discourse as well. The history of science provides a wealth of examples. Metaphors are valuable resources not only for communication and pedagogic purposes, they have epistemic import as well. Just as they are possibly useful, and sometimes indispensable, for describing things in everyday situations, they prove to be powerful devices in generating insights and promoting understanding in scientific inquiry. In this paper I review the debate on

this topic to show why metaphors can play an essential role in theory-making, without overlooking the possibility, inherent to them, of providing false sense of understanding and mere subjective comfort, rather than suggesting interesting questions and fruitful ideas. In order to determine the role and the heuristic effectiveness of metaphors in specific patterns of scientific reasoning, I will outline the cognitive mechanisms held to explain how this figure of speech works. To this aim, in this section I briefly consider some prominent theories of metaphor. Max Black's *interactive view* (1962) has been the most influential in the epistemological debate, and its development by Bipin Indurkha (1992, 2007) is particularly illuminating in this perspective. However, George Lakoff and Mark Johnson's *conceptual theory of metaphor* (1980), and the *structure mapping theory* proposed by Dedre Gentner and her colleagues (1982, 1993), shedding light on this subject matter, have also proved helpful to characterize scientific metaphors and their functions. In section 2, I turn to consider how different views about scientific theories can prejudicially affect the epistemological attitude towards metaphor. In section 3, I focus on metaphor in science, highlighting its heuristic and epistemic role as well as the possible dangerous implications of its use in science, referring finally to the case of self-nonsel self discrimination in contemporary immunology.

As a linguistic phenomenon, metaphor is commonly defined as that figure of speech whereby one thing is spoken of in terms which are usually applied to something else. This transfer of a word or phrase from one conceptual domain to another is made on the grounds of some similarity between two things. Such a linguistic strategy involves a process where some properties are selected and highlighted, while others are ignored. As there are always some similarities holding between any two things (Goodman 1976, Searle 1979, Kuhn 1979), the import of metaphor is to be found in that it suggests some relevance criteria for singling out features that otherwise, based on other conceptual frameworks, would be neglected or obscured. Such an effect has been explained by appealing to the peculiar framing conditions every metaphor brings about.

Many scholars have ascribed cognitive virtues to metaphor. The first to make this point was Aristotle, who tied cleverness in making metaphors to the innate skill for finding out similarities in what is otherwise regarded as dissimilar (*Poetics; Rhetoric*). In more recent times, Max Black (1955) put forward an interactive account of metaphor, in which he fleshes out Ivor A. Richards' insight that metaphor involves "two thoughts of different things active together and supported by a single word or phrase, whose meaning is a resultant of their interaction." (Richards 1936: 93). Black subscribes to the

idea that metaphor relates two distinct subjects, which he dubs primary and secondary subject. The juxtaposition of these two subjects, he argues, triggers an interaction between them or, more precisely, between the “system of associated commonplaces” (Black 1955: 40) each of them brings into play. The systems of associated commonplaces consist of the body of shared knowledge and assumptions commonly referred to each subject. This, Black claims, may suggest new and sometimes cognitively significant ways of organizing one’s view about both the primary and the secondary subject. In other words, metaphor induces to regard the primary subject through the filter provided by the secondary system of implicature. According to a first formulation of this view, the process should occur in *both directions*, since the meaning of words is held to emerge by way of mutual interanimation. This is why, in the long run, the metaphorical use of words should cause a shift in their meaning. In later work (Black 1977) Black addresses many criticisms raised against his first formulation. The bidirectionality of this phenomenon is deemphasized, but the primal insight that metaphor acts as a filtering process, where some attributes of one subject are illuminated and others suppressed in accordance with the structured set of attributes implied by the other subject, is maintained. Such filtering<sup>1</sup> effect is icastically instantiated by the action of looking “at the night sky through a piece of heavily smoked glass on which certain lines have been left clear” (Black 1955: 288), so that the stars that are not covered by the blackened surface will appear as organised by the screen’s configuration. A process of this sort occurs, for instance, when we conceive the spatial relations between the stars in terms of constellations.

Some have pointed out that Black does not offer a satisfactory account of how such interaction between systems of commonplaces concretely goes on. Black simply appeals to a filtering effect, but he does not describe it in detail. For instance, he does not try to explain why some implications are accepted, whilst others are left out. Moreover, he suggests that it would be more illuminating to say that metaphors create similarities between things rather than simply formulating previously given similarities<sup>2</sup>, an idea that

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<sup>1</sup> It has often been noted that Black himself resorts, here and elsewhere, to a metaphor in order to explain how metaphor works.

<sup>2</sup> “Often we say, “X is M”, evoking some imputed connexion between M and an imputed L (or, rather, to an indefinite system, L<sub>1</sub>, L<sub>2</sub>, L<sub>3</sub>, ...) in cases where, prior to the construction of the metaphor, we would have been hard put to it to find any literal resemblance between M and L. It would be more illuminating in some of these cases to say that the metaphor *creates* the similarity than to say that it formulates some similarity antecedently existing.” (Black 1955: 284-285). In a similar vein, Nelson Goodman made the point that “Similarity

many have criticised, while others have tried to develop (see for instance Indurkha 1998). Some have pointed out that this characterisation of the metaphor effect is not obviously consistent with the common representation of filtering as a process which applies to features that, for filtering to be possible, should already be there. This raises a question about the extent to which the filter metaphor is to be taken seriously and could be used as an example of the way metaphors intervene in the discourse.

Another issue many scholars have pointed out concerns Black's view on the presence of two subjects. In many cases, it has been noticed, the primary subject of a metaphor is not mentioned and can hardly be recognized. In other cases metaphors do not even come in the X-is-M form Black always refers to (e.g. *A stubborn and unconquerable Flame / Creeps in his veins, and drinks the streams of life*, used to characterize the fever<sup>3</sup>). So Black's formulation of the interactive view would somehow hide Richards' subtle insight about the different function served by tenor (i.e. the reference point, the *extensional* correlate of a metaphor) and vehicle (i.e. the sense, its *intensional* import) (Martin and Harré 1982: 93-94). In fact, oftentimes the primary subject may be neither present in the utterance nor in the speaker and hearer's minds. The distinction between tenor and vehicle accounts for the possibility of meaning creation as a process which takes place within language, even in cases where no referent can be immediately found in the field of sensory experience (Martin and Harré 1982: 97). Such cases may occur in literary texts or in everyday communication, but what is of interest to us here are especially those cases where metaphorical terms are introduced in scientific discourse about non observable or as yet unobserved entities or processes. If we assumed that the actual instantiation of both subjects is needed, we would reduce metaphor, since the beginning of its action, to (literal) comparison of given features. And if a metaphor were interpretable by virtue of features we already know about its topic, there would be no point in claiming that it is endowed with cognitive virtues (cf. Martin and Harré 1982; Gola 2005; Indurkha 2007). Still, what is peculiar to metaphor is its aptness to favour epistemic access to features that would otherwise be out of reach (cf. Hesse 1966; Boyd 1979). But this is in line with Black's view. Misunderstanding can be averted by distinguishing two

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does not explain metaphor or metaphorical truth [...]: the fact that a term applies, literally or metaphorically, to certain objects may itself constitute rather than arise from a particular similarity among those objects. Metaphorical use may serve to explain the similarity better than – or at least as well as – the similarity explains the metaphor.” (Goodman 1972: 440).

<sup>3</sup> These verses, taken from *The Tragedy of Lady Jane Gray* by Nicholas Rowe, have been used by Richards (1936) as an example.

aspects that risk to be conflated in the notion of a primary subject: on the one hand, the putative real entity a metaphor is used to describe, which representation is, typically, scarcely structured and largely underdetermined by evidence, and, on the other hand, the term or phrase identifying such entity, which might also be absent in the metaphorical utterance, but must somehow be grasped in order for the exploration of the target system to start.

Despite the critical issues Black's conception entails, it has proved appealing to many scholars. Today there is agreement at least on the idea that the interaction concerns two conceptual systems of implicature, and that the implicative secondary system provides a structured guidance frame for characterizing the primary subject. Black's proposal could be regarded as the starting point of a fruitful renewal of the debate on the cognitive virtues of metaphor. In the following years, its ideas have been taken up and furthered in different directions. On the one hand, some have found it useful to underpin their analyses on scientific metaphor (see for example Hesse 1966, Boyd 1979, Hoffman 1980). On the other hand, it has inspired further psychological investigations aimed at spelling out the cognitive mechanisms underlying the use of metaphor.

The Conceptual Metaphor Theory (CMT), proposed by George Lakoff and his collaborators Mark Johnson, Mark Turner, Rafael Núñez *et al.* (1980, 1989, 1990, 1993, 2000), is one of the most influential theoretical frameworks that have been elaborated thereafter. These scholars maintain that metaphor calls into play two systems rather two single terms, i.e. a source and a target domain, but, based on a wide-ranging series of cases and incorporating recent outcomes from psychology and neuroscience, they have been elaborating this concept within the embodied mind paradigm. This states that even our most abstract cognitive abilities are inherently dependent on low-level processes, such as synaesthesia, emotions, etc., which interface our relations as cognitive agents with both the physical and the social environment. By analysing a large number of linguistic expressions, Lakoff and his colleagues have come to identify a set of *conceptual metaphors*, i.e. systems of correspondences holding between different domains that are responsible for the way we commonly think of certain situations (Lakoff 1993: 207). Their main thesis is that this sort of large-scale *mappings* shape our language because they first of all lend structure to our conceptual system and affect our way of experiencing situations in the ordinary course of living. "The essence of metaphor is understanding and experiencing one kind of thing in terms of another" (Lakoff & Johnson



1980: 5). In other words, metaphor is not just a matter of communication, it rather concerns our thought and action<sup>4</sup>.

In short, the locus of metaphor is not in language at all, but in the way we conceptualize one mental domain in terms of another. The general theory of metaphor is given by characterizing such cross-domain mappings. And in the process, everyday abstract concepts like time, states, change, causation, and purpose also turn out to be metaphorical. (Lakoff 1993: 203)

Some examples of conceptual metaphors are LIFE IS A JOURNEY, ARGUMENT IS WAR, MIND IS A MACHINE, TIME IS MOTION, IDEAS ARE FOOD, etc. Each of these sentences in small capitals is not just a proposition, it is instead the name of a mapping, i.e. a conceptual structure rooted in our experience. In other words, they are not to be considered on the same level of any metaphorical expression met in spoken or written speech. In cases such as HAPPINESS IS UP, SADNESS IS DOWN, IDEAS ARE CONTAINERS, etc., the source is provided by “image-schemata” directly emerging from our bodily experience. Each of these mappings consists of “a set of ontological correspondences that characterize epistemic correspondences” by applying some knowledge about the source domain to knowledge about the target domain (Lakoff 1993: 207). This explains why, based on one mapping, many linguistic metaphors can be derived. In fact, the latter are just manifestations of such mappings. For example, sentences such as “Sam’s life took an unexpected direction after he met Jenny”, “Mary was at a crossroads, she didn’t know which way to go”, “You have to forget about what has happened and move on!”, “If you leave now, you’ll be burning your bridges behind you” etc. are different manifestations of the same LIFE IS A JOURNEY mapping, which governs a very common way of conceptualizing life. Conceptual metaphors are classified in three overlapping types (ontological, orientational, and structural metaphors (Lakoff and Johnson 1980)), depending on the kind of experience they are based on, but, apart from their specific nature, the cognitive mechanism they exploit is the same: a set of characterizing traits is borrowed from one domain (source) in order to conceptualize another one (target). The projection is asymmetrical, i.e. it has a direction: it is always the structure of a familiar source domain that is mapped onto a more abstract or less familiar target domain. Moreover, the structure of one domain is not mapped in full onto another, i.e. without any selection of the features to be envisaged. In other words, not all the elements of the

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<sup>4</sup> Think for example to the role that the “time is money” metaphor plays in Western civilization.

source domain have a corresponding element in the target. A criterion for selecting the elements involved in the mapping is identified in the “Invariance Principle” (Johnson 1987), which Lakoff resumes as follows:

Metaphorical mappings preserve the cognitive topology (that is, the image-schema structure) of the source domain, in a way consistent with the inherent structure of the target domain (Lakoff 1993: 215).

The Invariance Principle is to be understood as stating the regular behaviour of conceptual metaphor, which ensures that in the LIFE IS A JOURNEY mapping, for example, landscapes will be mapped onto life situations, destinations onto goals, obstacles onto difficulties, crossroads onto need for decision, and so on, while excluding conceptual inconsistencies (for example, the possibility of repeating many times the same trip does not occur in the target as a salient feature). As Lakoff puts it, it simply does not happen that a mapping violates the structure of its target domain. Indeed, Lakoff argues, “A corollary of the Invariance Principle is that [...] inherent target domain structure automatically limits what can be mapped” (Lakoff 1993: 216). This suggests us once more that cognitive mappings are not ordinary metaphors. However, as some have pointed out, since conceptual metaphors are conventional, i.e. based on mappings that have stabilized, this theory fails to shed any light on the cognitive creativity metaphor involves (Indurkha 1992, 1998, 2006, 2007, Sangoi 2012). The Invariance Principle sounds in fact as an *a posteriori* ratification of mappings that have already entered into common usage, and does not illuminate us as to how apt and insightful metaphors are produced and how newly minted metaphors are to be interpreted.

The creative side of metaphor and cognition has been properly emphasized and addressed by Bipin Indurkha, who accounts for it by employing an interaction-based approach (Indurkha 1992). The resulting view does not contradict CMT, it just goes into more detail as to certain mechanisms. Cognition is characterized as arising from an interaction between a cognitive agent and her or his environment. Both of them are equally essential to determine the structure of our conceptual system (cf. Indurkha 1992; 2006; 2007). The overall cognitive process is viewed as inherently affected by the cognitive agents’ action-oriented, goal-directed attitude towards the external world (cf. Indurkha 2006). Cognizing things or situations requires to represent them in some way. Representations are described in terms of *ontology* and *structure*. The former consists of the set of primitives that constitute a representation, while the latter is the way in which such primitives are arranged to form the representation itself. An ontology is always presupposed

by any structure (2007: 27). Black's scheme is thus recast in terms of a combined action of two basic mechanisms, *projection* and *accommodation*. These mechanisms exert their action among a number of layers, ranging from the most concrete perceptual layer, in which the surrounding situation is presented through a set of sensory data, to the more or less abstract Gestalt layers, related to cognitive agent's memory of past experiences and conceptual network (cf. Indurkha 2006). Projection and accommodation work simultaneously. Projection proceeds *top-down* by imposing a previously conceived pattern onto a set of data, attending to detect and organize them accordingly. Accommodation proceeds *bottom-up* by looking for the structures that underlie the data. Referring to *unorganized* sets of data, through which a mind-independently structured environment manifests to the subject, avoids us presupposing extra-cognitive representations of how the world is in itself. Such unorganized mess of data may be sensory stimuli as well as, in a scientific context, measurement data displayed by instruments. To say that data are unorganized is not implying that any organisation can be imposed on them; rather it is acknowledging that the data need to be organized in order for the subject to cognize the situations he or she is presented with and that, although this cannot be made arbitrarily, he or she plays an active role in this process. In fact, the framework is especially designed to explain the possibility for a cognitive agent to be creative in describing things and situations. Any state of affairs can be described in many different ways. This is of particular interest in the context of scientific inquiry. As pertains to subjective initiative, a change of representation is achieved either by revising the concept in order to fit, to the extent possible, the structures that a given ontology allows to describe or through a modification of the ontology itself, induced by the imposition (projection) of an image or a concept to the target, be the latter a concrete, perceptually present situation or an epistemically remote domain. Modifying the ontology is possible because, while the structure of a representation is constrained by the mind-independent organization of the object or situation being represented, so that it cannot be changed at will, the ontology it presupposes is subject-driven, viz. it depends upon the cognitive agent's biological makeup and attention how the datasets are constituted and which stimuli are retained to define the ontology itself. Constructive theories of perception and experiments on perceptual illusion are called to lend support to this view. It is worth noting that projection takes effect owing also to its constraints on the conceptual side, for the source representation structure (image, concept, theory, etc.) results from previous efforts to reflect the nature of the corresponding domain. So the process is constrained on both sides. In ordinary

conditions, recognizing features in the target is a matter of sorting them out of a messy and copious flow of stimuli. This process, which leads to categorization, while making possible a structured and simplified worldview, entails some loss of information (in classifying individuals, most of their properties are ignored, be them similarities among individuals placed in different categories or differences among individuals placed in the same category). The refinement of our conceptual network sometimes demands to take in information we used to ignore, as in past circumstances reckoning with certain aspects of phenomena fell outside our epistemic goals. Insofar as it depends on the cognitive agent action, discovering new features in the target amounts to create them (cf. Indurkha 1998). To make sense of this claim, which draws on Black's hint, it is crucial to distinguish two stages in the emergence of representations: a stage before the metaphor and a stage after it. The most significant case is represented by "non-monotonic metaphors" (Indurkha 2007), a strategy exploiting metaphors that are not based on known similarities between the source and the target domain. On the one hand, in the monotonic mode of metaphor, two representations are brought together and compared, and some structural similarities between them are detected (cf. Gentner 2008). Even such a comparative mode can be credited with cognitive virtues, for becoming aware of similarities is still cognitively beneficial, as long as it allows us to represent and retrieve them quickly. On the other hand, in the non-monotonic mode of metaphor the shift caused in the target conceptual framing is so radical that the inferences we are induced to draw are not compatible with those enabled by the ontology and structures in place before the metaphor was put forward (Indurkha 2007: 19). Eventually, it is the external world that endows the new ontology with a structure.

Metaphor brings new possibilities of meaning into being because it helps revealing a certain state of affairs (Indurkha 2006). We could wonder how it serves this function. It could be argued that the connotations related to its vehicle involve a tentative language-driven description, which is necessary in some circumstances. But is it firstly a way of expressing what we mean or rather a way of conceiving what we see? There is no general answer for this question. Metaphors may be used both as an expressive and an epistemic device. Lakoff and his colleagues' examples clearly show how wide the role of metaphor is in our comprehension of everyday situations. Metaphor and analogy appear to be the most common strategies to guide our inspection into unknown situations. They are part of our natural cognitive equipment indeed (Aristotle, *Poetics*; see also Fano and Panajoli in this volume, chap. VII). As such they have also a place in scientific reasoning.

However, there has been a refusal to recognize a positive role of metaphor in science, due, on the one hand, to the theory of metaphor that was adopted and, on the other hand, to the general view about what a scientific theory is. The opinion of those who favour a reductive view of metaphor can be summarized by saying that “with a metaphor we might be able to say something ‘better’; but we do not say anything ‘more’ than the corresponding literal expression” (Montuschi 2001: 278). However, as Black has shown, the mechanisms at play in metaphors are more complex than that. These mechanisms explain not only how metaphors can shape our everyday experience, but also how they can contribute to the formulation of concepts and hypothesis. As regards science, questions rather concern the conditions under, and the extent to which these mechanisms are possibly constructive or unfavourable to advance understanding of specific phenomena and, more importantly, their status within theories. The provisional sketchy representations metaphors can provide require to be refined and validated through examination of how things actually are. But this is required to any attempt at conceptualizing and explaining phenomena, whether or not it employs metaphors, and it would not be good argument if a theoretical outline were dismissed on the grounds that it contains metaphors. In order to see how metaphors can come into play in theory making, let us now shift our focus on more specific issues about the nature of scientific theories.

## **2. Different views about theorizing**

The idea of what a scientific theory is represents the background against which the role of metaphor in the context of scientific inquiry is assessed. Since different views about scientific theories have influenced scholars’ attitude towards this issue, in this section I shall review some of the most influential conceptions in order to make sense of the abundant use of metaphors in science.

For a long time the syntactic view of scientific theories has represented the paradigm that more strongly hindered a proper appreciation of the role of metaphor in scientific reasoning and theory making. A restrictive assessment of the epistemic function of metaphor has resulted from philosophical commitment to certain assumptions, while the stage for its reappraisal has been set by the recognition of the weaknesses of such conception to account for a number of issues related to theory change and the real-world scientific practice (Craver 2002: 57). On the one hand, many criticisms raised by philosophers of science against the syntactic view have served to open new

perspectives on the role of metaphor in science (Hesse 1966; Boyd 1979; Hoffman 1980). On the other hand, the emergence of a cognitive approach to science – focused on the cognitive structures and processes at play in scientists’ activities, rather than restricted to the context of justification and guided by a particular concept of rationality, which has led to downgrade certain cognitive aspects as psychological and social factors (cf. Giere 2000) – has further encouraged investigation in this direction. Yet, before the issue of metaphor in science was directly addressed, some have questioned the role of models in scientific theorizing. Though models and metaphors are not the same sort of device, they have often been associated as instantiating similar modes of analogical reasoning.

In the syntactic view theories are construed as sets of sentences closed under logical consequence. Its major tenet states that the truth of a theory is ensured by its ability to entail the evidence. This idea is reflected in the “saving of phenomena” precept. Such view has a long-standing tradition, which could be traced back at least to the ancient astronomy. Logical empiricists, such as Carl Hempel (1942) and Paul Oppenheim (1948), have drawn on this idea and recast it in a formal framing. They construe theories as sets of logico-linguistic expressions linked together by a deductive apparatus. Hempel holds both explanations and predictions<sup>5</sup> to issue from deductive inferences drawn from the laws and the general hypotheses of a theory, along with some auxiliary premises related to factual circumstances. In accordance with this scheme, an explanation consists of two parts: on one side, a set of statements describing certain phenomena provide the *explanandum*; on the other side, laws and general hypotheses, along with the description of some related factual conditions, constitute the *explanans*. Now, if these two parts were connected by a strictly deductive relation, then models, and a fortiori metaphors, should be ascribed no constitutive function within theories. Models and metaphors would turn out to be dispensable once the propositional structure of a theory had properly been rendered; they would admittedly serve an illustrative or, at most, a heuristic function, but they would have no epistemic status. Such claims rest upon a clear-cut distinction between the context of discovery and the context of justification<sup>6</sup>, a

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<sup>5</sup> The implication of a symmetry between explanation and prediction has encountered many objections; see for example Scheffler 1963, Salmon 1966, Hanson 1978, Woodward 2011.

<sup>6</sup> Although a sharp distinction between the contexts of discovery and the contexts of justification was widely agreed among neo-positivist philosophers, it is Karl Popper, in *The logic of scientific discovery* (1934), the one who has most emphasized this dichotomy, stating that the issues of invention and discovery are to be left to empirical psychology, for dealing with them “is irrelevant to the logical analysis of scientific knowledge”. For an

distinction that, on the one hand, does not accommodate the extended process of theory construction – which often results in a number of different partial theoretical accounts of specific phenomena (Craver 2002) – and, on the other hand, does not help to make sense of the wide use scientists make of models and metaphors in their practice.

One main tenet of logical empiricism, to which one might appeal to deny any cognitive value to metaphor, is the verificationist conception of meaning. It identifies the source of propositions meaning with sensory experience. Accordingly, the only true statements would be either analytic propositions or synthetic verifiable propositions. Synthetic propositions that cannot be empirically verified are deemed of no epistemic value and hence meaningless. Indeed, whereas the terms belonging to the observation language are held to be directly pegged to experience and therefore the statements involving them to be verifiable, theoretical terms, which require interpretation, should be reduced to the observable through a set of correspondence rules. As an unintended consequence, while the constitutive symbolism of a theory and the terms belonging to the observation language are taken as literal, theoretical terms cannot: they turn out to be somehow in the same condition as metaphors, as far as their reference can only indirectly (and partially) be referred to the evidence by interpretation (cf. Montuschi 2001).

Related to the empiricist view is the assumption of meaning invariance of observation language terms. This assumption has been called into question by Mary Hesse, who counters the idea with the so called *Thesis M*, stating that all language is primarily metaphorical and hence subject to change over time. “Metaphor is a fundamental form of language and prior (historically and logically) to the literal” (Hesse 1993: 54). Based on a family-resemblance conception of categorisation, Hesse regards language as a

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overview of the debate and a critical analysis of the topic, see Hoyningen-Huene (1987). The indispensable role of analogy in the context of justification and after justification of a theory being given is defended by Itkonen (2005: 176-197) (metaphor is seen as a subtype of analogy, with additional constraints; *ibid.* 41). Summarizing his remarks, he states that “analogy is important at least in the following three ways. First, even assuming that there is a distinction between ‘discovery’ and ‘justification’, analogy surely plays a role in discovery. Second, analogy must also play a role in justification, because there is, as a matter of fact, no (clear) distinction between discovery and justification; rather, only that is discovered which can be justified. Third, even after a theory has been discovered and justified, analogy continues to play a role: every theory achieves a *generalization*, either within one domain or across (what has previously been regarded as) several domains; and it is analogy which, being synonymous with generalization, keeps all this body of knowledge together” (2005: 194).

network in which any term is related to the others, so that the meaning of any expression, far from being given once and for all, is affected by the transformations the network undergoes, locally or on a more extended scale, to fit our experience and our practical and theoretical goals<sup>7</sup>.

The verificationist view of meaning has also a bearing on the distinction between theoretical and observation language, which has also been criticised from a different angle. In the wake of Quine and Sellars' analysis, Hesse notes that because the same terms (e.g. wave, current, collision, spin, transcription, etc.) can be used in different contexts to refer either to observable or to non-observable entities, the theoretical-observational distinction cannot be construed as an ultimate epistemic or logic dichotomy; it must rather be regarded as pragmatic in its nature (cf. Hesse 1966). This finally affects the distinction, maintained by the logical empiricists, between a partial and a complete interpretation of terms, which is also a crucial point for the debate concerning the role of models in scientific theories, and involves metaphor as well.

In response to these considerations, Hesse famously suggested to regard explanation as a metaphorical redescription of the domain of the *explanandum* (cf. Hesse 1966). Her main point is that models and metaphors provide the possibility to extend theories through analogical inferences. For this to be possible, the condition is that theories are open. This would not be the case if theories were strictly deductive systems, closed by their constitutive principles. If so, any interaction with other theoretical fields<sup>8</sup> would be a merely extrinsic juxtaposition, which does not describe the real dynamics of scientific evolution. It is through the investigation of the function of models that light has been shed on certain aspects of theories that the formal framing has overlooked or even obscured.

Norman Campbell (1920), who brought the issue of models to prominence in the philosophical debate, identified several components of a theory: the *calculus*, the *dictionary* connecting the formal system to the experimen-

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<sup>7</sup> For an overview of Hesse's theory of language, see chap. V, Favrin and Storari, in this volume.

<sup>8</sup> Typically, scientific breakthroughs are not obtained in isolation from ideas coming from other fields of research. Models and metaphors are often based on representations and formalisms borrowed from other fields. As regards methodology, certain theoretical frameworks have sometimes deeply influenced the way problems have been settled in different fields, as well as the expectations as to how the adequate solutions should look like. For instance, all along the western history, Euclid's axiomatic method has been regarded as a model of scientific thinking in different domains, and Darwin's evolutionism has become the paradigm for a variety of disciplines. It goes without saying that this has not been invariably tied with scientific success.



tal language, the *experimental laws*, which can be deduced from the hypothesis plus the dictionary and are susceptible of empirical tests, and the *analogy*, provided by models and serving to link the theory to the physical system it aims to describe. In this perspective, models serve two functions: first, they provide an interpretation of theories; second, offer either a simplified representation of the target system or a formalism or a set of equations to be applied to it. In so doing, models enable the inquirer to link a theory to the appearances it is designed to explain. Taking into consideration the Kinetic Molecular Theory of gases, Campbell shows that Dutch physicist Van der Waals (1873), pursuing the analogy between the model and the target system as to the properties of motion and elastic collision, could introduce new assumptions and thereby extend the original theory to account for its discrepancies *vis-à-vis* the experimental behaviour of gases. This case, as well as others, show that models enable theories to grow. It should not be underestimated that theories, far from being static structures, are rather composite arrangements, constantly modified and extended to better explain certain regularities or events.

Scientists make use of models (scale models, diagrams, maps, systems of equations, mental representations and the like) because they are more familiar, or more manageable,<sup>9</sup> than the investigated phenomena. Their function in the constitution of theories depends on that they give impulse and direction to scientific inquiry and guide researchers in their choice of formalisms. Moreover, since the interpretation they provide makes intuitive sense of theories, they cannot be set aside and are instead to be treated as constitutive parts of them. To illustrate this point, Thomas Kuhn and others highlight the role that the planetary model of the atom plays even once the theory has been given a mathematical formulation. When Bohr resorted to this model, depicting electrons and nucleus as tiny charged corpuscles interacting under the laws of mechanics and electromagnetic theory, he replaced the metaphor-based representation, but the relation between the new model and the investigated physical system remains dependent upon a “metaphor-like process” insofar as the resemblance between them is only approximate.

Furthermore, even when that process of exploring potential similarities had gone as far as it could (it has never been completed) the model remained essential to

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<sup>9</sup> In this context, it is worth remembering that Newton reversed this rule and applied the concept of inertia as unending rectilinear motion of heavenly bodies, such as the planets, to motion of terrestrial bodies, thus extending to the sublunary region some principles that were thought to be peculiar of the superlunary region. This way, he came to explain certain familiar phenomena by analogy with *less* familiar circumstances.

the theory. Without its aid, one cannot even today write down the Schrödinger equation for a complex atom or molecule, for it is to the model, not directly to nature, that the various terms in that equation refer.<sup>10</sup>

Unpacking all possibly fruitful implications of a model or a metaphor is a task that can engage scientists for years or generations (Hoffman 1980: 415). In many cases this sustains the extension of theories by way of making them predictive (Hesse 1966), a function that cannot be reduced to the formal isomorphism<sup>11</sup> between a model and the logical structure of the theory in which it is introduced. A formal reduction does not necessarily capture the traits whereby a model applies to something in the world. By focusing on formal isomorphism, the relevant properties of a model would be selected as compared to the formal structure of the theory, rather than to the material constitution of the things it points to. Hesse refers to the kind of similarity that explains the predictive import of models and metaphors as “material analogy”. On her view, material analogy should be analysed into three factors: the *positive*, the *negative* and the *neutral* analogy. The positive analogy identifies the respects under which the model and what it represents are recognized as being alike. The negative analogy identifies those respects for which they are held to differ from one another. The neutral analogy concerns those features which status, whether positive or negative, is still unknown. It is through the neutral analogy that models set the inquirer on the track of new, explanatorily relevant aspects of a domain. The reduction of similarity to isomorphism, far from justifying the *substitution* of models by a fully formalized system, misses a crucial point: Because such a formal approach focuses on the positive analogy, at most it allows a synchronic reconstructions of theories, whereas a proper epistemological reassessment of models contributes to explain the dynamics of their evolution.

The shortcomings of a formalist picture of theories are even more evident if we set ourselves in pursuit of a general view of the overall scientific enterprise. The strictures of the logical framing leave it ill-suited to account for a variety of scientific fields other than physics, such as life and social

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<sup>10</sup> Kuhn (1979: 538). Few lines below, Kuhn adds: “Though not prepared here and now to argue the point, I would hazard the guess that the same interactive, similarity-creating process which Black has isolated in the functioning of metaphor is vital also to the function of models in science. Models are not, however, merely pedagogic or heuristic. They have been too much neglected in recent philosophy of science”.

<sup>11</sup> “The relevant similarity or ‘analogy’ between a model [...] and the modeled type of a phenomenon consists in a *nommic isomorphism*, i.e. a *syntactic isomorphism between two corresponding sets of laws*.” (Hempel 1965, *Aspects of scientific explanation*, New York, The Free press, p. 436. Quoted by Ikonen 2005: 191).

sciences. In fact, not all the important aspects of theories in those fields can be captured by first-order predicate calculus. Moreover, genuinely exceptionless laws of nature are hard to come by even in physics (Cartwright 1983, Giere 1999). So, without diminishing the merits of having reconstructed the logical patterns of scientific reasoning, we should take into consideration other attempts at clarifying what theories are. Approaches that appeal to the notion of representation and include nonformal patterns of explanation aim at coming closer to science as it is made “in the wild” (Craver 2002: 58) in order to elaborate an empirically adequate account of theory construction and change.

Different proposals have been made which go in this direction. Some of them, generally labelled semantic views (cf. Hesse 2000; Craver 2002; French 2008), are due to Suppes (1967), Van Fraassen (1980), Giere (1988), Suppe (1989). They contrast the syntactic view by stating that scientific theories are collections of models, rather than sets of sentences.

Let us consider Ronald Giere’s cognitive approach. His conception, which he calls “Constructive Realism”, ascribes to models a major role in the constitution of scientific theories. Similarity is viewed as “the basic relationship between models and the world” (Giere 2010: 269). Science is characterized as a complex of fundamentally pragmatic practices aimed at providing the best possible representations of nature. To this purpose, scientists use a variety of means, such as natural and formal languages, equations, graphs, pictures, physical objects, computer programs, etc. Understanding how these means intervene in the constitution of theories, which is their function, requires a shift of focus from the syntactical structure of theories to their semantic counterpart, and more fundamentally from language to the activity of representing the world. “If we wish to understand these practices, we should not begin with the language itself, but with the scientific practices in which the language is used.” (Giere 2004: 743).<sup>12</sup> Defining this activity in terms of a binary relation holding between statements (i.e. linguistic entities) and aspects of the world leads to neglect some important factors involved in it. Instead, argues Giere, we need to characterize representation as a four-terms relation, including the agents (S), the aspects of the world being represented (W), the medium (M) used to represent them, and the purposes (P) the agents aim at. Such relation could be formulated like this: the agents S use M, meaning to represent W for purposes P (cf. Giere 2004: 744; Giere 2010: 274). This way of approaching the problem goes

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<sup>12</sup> In the same vein, Richard Boyd (1979) has insisted on the appropriateness of relativizing linguistic precision to an overall concern for methodological precision.

along with the conviction that focusing “on the activity of representing fits more comfortably with a model-based understanding of scientific theories” (Giere 2004: 743-744). Giere also describes the process by which models are introduced. The laws and principles of theories are not applied to real systems in the world directly, but via models of them. Based on general principles, serving as templates (e.g. Newton’s laws of motion), plus specific conditions (e.g. Newton’s gravitational law), scientists construct models (e.g. models that represent interactions between bodies in three dimensional space, such as those between the Earth and the Moon). The attempt to apply these models to the world urges scientists to generate hypotheses claiming that a specific model fits certain things in the world. Hypotheses may also be generalized to include other objects (e.g. the application of a model to the interactions between the Earth and the Moon may be extended to other planet-moon systems) (Giere 2004: 744; Giere 2010: 271). As a protracted cooperative enterprise, science generates a “hierarchy of models” (Suppes 1962), some of which are abstract and define the most general frameworks, while others are more closely related to the data. In any case, since science cannot avoid interpretation and idealisation, theories are always confronted with “models of data” (Suppes 1962)<sup>13</sup>, rather than directly with the world (cf. Hesse 2000: 302; Giere 2010: 271).

Central to this view is the notion of similarity, held to characterize the relation between models and real systems in the world. Similarity serves as a surrogate of truth, allowing for some looseness of fit between a theory and the phenomena in its domain (this makes sense of approximation and verisimilitude). Similarity is notoriously an intransitive relation that must be assessed according to respects and degrees, which relevance is relative to context and current concern. Some qualification is thus required to ground representations on similarity, as some similarities can always be found between any sorts of things. Additionally, whereas similarity is a symmetrical relation, representation is asymmetrical, meaning that it cannot be reversed (e.g. a globe represents the Earth, but the Earth does not represent a globe, though each of them is similar to the other)<sup>14</sup>. In the wake of some cognitive

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<sup>13</sup> Models of data are derived from raw observation data, after having cleaned them up through “data reduction” (i.e. elimination of errors that are supposedly due to experimental inaccuracy) and curve fitting. It is interesting to note that background theory has a bearing on the way raw data are treated to form the models of data.

<sup>14</sup> Incidentally, it is worth noting that directionality is also an inherent feature of metaphor. In fact, it provides a clear diagnostic of literal versus metaphorical comparison; e.g. whilst one can sensibly state both “Lynx are like cats” and “Cats are like lynx”, the reverse of “My lawyer is a shark” would seem nonsense, at least at first glance (psychological ex-

scientists and linguists' conception,<sup>15</sup> Giere appeals to intentionality to account for this character of representation.

On these basis, the dynamics involved in the extended process of theorizing – which includes a variety of tasks such as conceiving, learning, communicating and refining concepts, inventing and applying new instruments and methodologies, designing experiments and so on – are made more accessible to explanation. In turn, this should help to account for the role of metaphor in science. Giere does not directly tackle such problems, as he focuses on the ontology of theories (he aims at clarifying what theories are), rather than on “dynamic epistemology” (where questions are about how theories change, and how models are chosen and justified) (cf. Giere 2010: 271; Hesse 2000: 301).

Concern for dynamic epistemology underlies instead another paradigm that has recently emerged in philosophy of science, that is the mechanistic view of explanation (Machamer *et al.* 2000). This view provides us some other hints to carry on our discourse about metaphor in science. As for Giere's Constructive Realism, the mechanistic movement presupposes a departure from the syntactical view to envisage a model-based account that focuses on the objects and practices involved in the construction, evaluation and revision of theories over time, rather than on a regimented reconstruction of their inferential structure. Most of the advocates of the mechanistic movement have devised their own conception by studying how molecular biology and neuroscience have developed, but the scope of this framework has been extended to other fields, such as the social sciences and physics.<sup>16</sup> One major claim of this view is that a shift from a nomological-deductive to a mechanistic conception of explanation allows to recognize exception-ridden or *ceteris paribus* generalisations – which strictly speaking cannot count

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periments have showed that subjects can come up with fanciful, yet somehow meaningful interpretations even for metaphors casually generated by machines); in any case, the reversal of metaphors produces different meaning effects, leading to the highlighting and the alignment of different sets of properties.

<sup>15</sup> Giere refers in particular to George Lakoff's cognitive linguistics (Lakoff 1987) and Michael Tomasello's usage-based theory of language (Tomasello 2003). The point in common is that language, like the other cognitive capacities, is to be thought of as an ability that humans have developed in the course of evolution by interacting with their environment. Accordingly, syntax is no longer seen as a primitive feature of language, as in generative linguistics, but rather as emerging through practice (Giere 2010: 277).

<sup>16</sup> For a discussion of the limitations on the scope of this paradigm, see Glennan (2008: 382-383).

as laws<sup>17</sup> –, qua they occur in many legitimate theories as viable explanatory means. Thereby, this view is claimed to provide a more accurate rendering of (at least some) real-world scientific theories.

Mechanisms are meant as producers of regularities. Explaining phenomena comes to trace their underlying productive mechanisms. Peter Machamer, Lindley Darden and Carl Craver (2000) characterize mechanisms as being “composed of both entities (with their properties) and activities. Activities are the producers of change. Entities are the things that engage in activities” (Machamer *et al.* 2000: 3). Stuart Glennan (2005; 2008) defines a mechanism as a composite system that produces a behaviour “by the interaction of a number of parts, where the interactions between parts can be characterized by direct, invariant, change-relating generalizations” (Glennan 2005: 445). These two definitions are consistent with one another. The notion of “direct, invariant, change-relating generalizations” on which Glennan relies is meant to replace the appeal to laws in the nomological-deductive account of explanation. On the mechanistic view, processes such as photosynthesis, digestion, blood circulation, synaptic transmission, protein synthesis, cellular respiration, planetary motion, gas kinetic, etc. are all explained in terms of mechanisms. Explaining a phenomenon consists in showing how, possibly, plausibly or actually, it has been produced by a mechanism (Machamer *et al.* 2000: 21). “Mechanisms are entities and activities organized such that they are productive of regular changes from start or set-up to finish or termination conditions.” (Machamer *et al.* 2000: 3). In this perspective, behavioural regularities provide the *explanandum*, while the description of the entities and activities that are responsible for their production constitute the *explanans* (Machamer *et al.* 2000: 21). Describing how the transition from set-up to termination conditions takes place generally requires the description of several intermediate stages (e.g. digestion begins with the mastication of food, which successively passes through different parts of the digestive apparatus and undergoes processes involving different organs and functions). Moreover, mechanisms are nested, meaning that any mechanism can be viewed as a component of a broader mechanism, as well as it can be viewed as composed of lower level mechanisms<sup>18</sup> (Glen-

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<sup>17</sup> “Many generalizations that have earned the honorific “law” (e.g., Mendel’s laws, Kepler’s laws, Hooke’s law) are in fact generalizations describing the regular but not exceptionless behavior of mechanisms” (Glennan 2008: 378).

<sup>18</sup> For instance, digestion is part of the composite mechanism of metabolism; the explanation of specific functions involved in digestion requires sub-cellular and molecular processes to be taken into account; but digestion can also be addressed as a part of the food chain and this one as a part of the ecosystem; so this embedding of mechanisms can be de-

nan 2008: 378). Entities and activities are conceived in realistic terms as being part of the furniture of the world: Discovering and describing those entities and activities amounts to explain regularities by revealing the generative mechanisms. This is done by supplying representations of them. Machamer and his colleagues call those abstract and idealized representations “mechanism schemata”. Others refer to them as “models” (Glennan 2005). Schemata or models may yield either explanations or predictions. They also serve to run experiments, to interpret their results and to devise new ones. For example, once having set up the initial conditions of a system, one could let the mechanism work and intervene to alter certain factors in order to observe how these alterations affect the overall behaviour of the system itself (Machamer *et al.* 2000: 16-17).

All these possibilities are not reducible to drawing deductive inferences from the general principles of a theory. The mechanistic representation of the world is a “gradual and piecemeal construction, evaluation and revision of multi-level mechanism schemata” (Machamer *et al.* 2000: 23). As the above example suggests, schemata are by their nature partial representations of mechanisms, constrained not only by the causal structure of the real systems, but also by perspective concerns (having to do with scientists’ purposes) and intelligibility requirements (having to do with economy, coherence and consistence with the body of knowledge accepted up to date; they are usually referred to as “theoretical virtues”). Indeed, from an ontic point of view, mechanisms are not closed systems. Their representation requires to isolate them for reasons of simplicity and to sort out those features that are held to be relevant at the appropriate level of analysis. Scientists approach mechanisms after identifying the overall behaviour of a system. In their progressive work of analysis, they use to combine a top-down strategy (moving from an overall view of the functions of a mechanism to understand which parts and processes affect the observed behaviours) with a bottom-up strategy (moving from the identification of parts and processes and trying to figure out how they could be significantly related to the overall mechanism), in order to eventually come up with a description of the entities and activities involved in the production of a phenomenon (Glennan 2008: 380). Machamer and his colleagues call “sketch” the first tentative description of the putative structure of a mechanism (e.g. Watson and Crick’s “central dogma”, describing the one-way flow of genetic information from DNA to RNA to protein). A mechanism sketch is “an abstraction

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scribed by moving either downward, upward or outward relatively to a certain level of analysis.

for which bottom out entities and activities cannot (yet) be supplied or which contains gaps in its stages” (Machamer *et al.* 2000: 18). Such sketchy representations help scientists make their way into poorly understood domains in order to discover the structures responsible for the production of certain phenomena and describe them in greater detail. As to the epistemic status, there is no difference between mechanism sketches and mechanism schemata. The difference between them is just a matter of accuracy. In any case, when a tentative description fails in some respect or when new discoveries let arise issues that were previously ignored, the inquirers may need to revise a schema or replace it altogether, until they come up with a different one which satisfies the explanatory requirements.<sup>19</sup> This comes to making phenomena intelligible, which alone justifies the mechanistic account from an epistemic point of view. Indeed, intelligibility arises from a relation between the explanans and the explanandum, no matter whether the explanation is correct or not<sup>20</sup>, given that it shows how a phenomenon might be produced by the activities that sustain certain regularities (cf. Machamer *et al.* 2000: 21).

Descriptions of mechanisms render the end stage intelligible by showing how it is produced by bottom out entities and activities. To explain is not merely to re-describe one regularity as a series of several. Rather, explanation involves revealing the *productive* relation. (Machamer *et al.* 2000: 21-22)

The proponents of this view emphasize that the extensive multi-level character of explanations in sciences cannot be accommodated by a deductive model, as it could not account for how certain bottom out entities and activities rise to a privileged explanatory role.

What is taken to be intelligible (and the different ways of making things intelligible) changes over time as different fields within science bottom out their descriptions of mechanisms in different entities and activities that are taken as, or have come to be, unproblematic. This suggests quite plausibly that intelligibility is historically constituted and disciplinarily relative (which is nonetheless consistent with there being universal general characteristics of intelligibility). (Machamer *et al.* 2000: 22).

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<sup>19</sup> “Elimination or replacement should be understood in terms of the reconceptualization or abandonment of the phenomenon to be explained, of a proposed mechanism schema, or of its purported components. This contrasts with the static two-place relations between different theories (or levels) and with the case of logical deduction” (Machamer *et al.* 2000: 23).

<sup>20</sup> This means that the epistemic criterion is independent from the criteria of adequacy (see footnotes 21 and 22).



The foregoing overview of the mechanistic conception is to hint at the affinities between the kind of fragmentary process of approximation described there, which is held to characterize the way advancement is mainly achieved in any field of scientific research, and the possibilities related to the use of metaphors for representing things and situations. Here again the relationship between schemas and mechanisms is one of similarity rather than of precise correspondence. Schemas, like metaphors, are not simply true or false as statements are. In order to accommodate observation and experimental results, researchers may elaborate and adjust representations to increase their similarity to the modelled system or otherwise discard them. Still, there is a difference between mechanical models and models as they are generally characterized. It lies in that, whilst the latter is a general concept, not subject to specific requirements, so that a model in this sense can also refer to local features of a whole system or describe just an aspect of it, mechanical models are built to provide a detailed and integrated description of the productive factors (components organized with respect to space, time, action and hierarchy) that underlie phenomena. For this to be possible, the resemblance of a mechanical model to the system it represents must be assessed with regard to both its behaviour<sup>21</sup> and causal structure<sup>22</sup> (Glennan 2005: 457). If a metaphor were to assume a constitutive role in a theory, this would be on condition that it is, at least temporarily, our best resource to provide intelligibility about a specific phenomenon. Whether there is good reason to resort to a specific metaphor in a given inquiry situation, it depends on that such metaphor either hints at some substantial features of the system under investigation or, at best, it describes it properly – though in the latter case we would be dealing with a kind of description that has little in common with what we usually call a metaphor; rather we would have discovered (by its means) that two systems, the source and the target, share the same structure. This is an ideal situation that expectedly we will rarely meet (but see for example Darwin’s metaphor of the “cosmic breeder”).

This leads us, in conclusion of this long digression on the nature of scientific theories, to take a look at two other main issues that philosophers have emphasized: *theory-ladenness* of observation statements and *underde-*

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<sup>21</sup> Glennan enunciates a criterion of behavioural adequacy, which requires a mechanism schema to describe and predict the whole range of possible behaviours of the modelled system. This comes to “save the phenomena”.

<sup>22</sup> The criterion of mechanical adequacy requires a schema to identify all the components of a mechanism and to supply a qualitatively and quantitatively accurate description of them as to their spatial and temporal position, properties, functions, and so on.

*termination* of theory by data. Both of these issues reflect the impossibility for theories to be anchored, firmly and exclusively, in the data we can collect through our sensory apparatus (cf. Sellars' (1956) critique of the "Myth of the Given"). The first issue affects the possibility of sharply distinguishing between theory and observation, although a pragmatic distinction must be maintained in so far as what counts as observation is never completely determined by the same theoretical assumptions that need to be tested. Given this epistemological situation, since metaphor draws on previous experience and familiar conceptualizations, involving projection of a conceptual framework onto a different domain of investigation, it intervenes here quite naturally and can be viewed as a strategy for, say, turning theory-ladenness to the advantage of the inquirer. As regards the underdetermination problem, while focusing on the issue of justifying our beliefs,<sup>23</sup> it implies a concern for the adequacy of our theoretical representations. The available evidence alone does not always enable us to decide between different competing theories. That many rival theories may be empirically equivalent raises a problem as to how our theoretical claims are to be justified when the evidence does not make the difference.<sup>24</sup> Were direct observation the only way to epistemically access real entities and processes, any theoretical claim, as ultimately underdetermined, would be at least problematic. On this point, Sellars (1963) argued that, to the extent that theories achieve their explanatory goal, the existence of unobservables, to which science typically reduces observable phenomena (e.g. macroscopic objects

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<sup>23</sup> The underdetermination problem can be formulated as follows: our beliefs concerning the propositions of a class T are justified on the grounds of our knowledge of the proposition belonging to a class E; but E underdetermines T, then we are not justified in believing any proposition of T.

<sup>24</sup> While some have contended that the logical formulation of the underdetermination problem overstates its practical import, pointing out that there are no or few interesting historical cases of empirically equivalent theories – some mentioned the special relativity and Lorentz-Fitzgerald-Poincaré's version of the ether theory, but one single example is not enough to support the claim that a significant number of theories have empirically equivalent rivals –, it is easily put into proportion by noting that scientists generally make use of inference to further determine their models. In some cases they can use direct inference for improving the description of mechanisms, what would lead to discard the inadequate rival models. Even though certain explanatorily relevant features of a system may not be immediately apparent, in many cases they can be indirectly accessed through special devices and experiments. In other cases, scientists can rely on indirect inference. They can try to test the mechanism in non-standard conditions by expanding the range of phenomena that an explanation must save. For more detail about direct and indirect inference, see Glennan (2005: 458-459). For a discussion about the strategies scientists employ for tracking the unobservable, see Psillos (2004).

are identified with swarms of molecules), should be accepted. In other words, the ontological commitment to unobservables derives from the explanatory effectiveness of the theories which posit them.<sup>25</sup> Even though the great deal of idealization and abstraction involved in theoretical representation of the world has induced some skepticism about the degree of confirmation that theories can actually obtain (Cartwright 1983), instead of rejecting a priori the existence of unobservables, we should rather ask how the causal structures of the world can be accessed otherwise than by observation. Given the epistemic constraints which lead to empirical underdetermination of theories, metaphor is potentially one viable way, among others, to work around this issue in order to track the real. At least its use can safely get along with the methodological precautions that are typically applied in the empirical sciences (cf. Boyd 1979: 222; Machamer 2000: 36-37).

In this section I analyzed the epistemological conditions under which metaphor can intervene in the making of scientific theories, acting as a pointer towards putative yet undiscovered features of the world. In the next paragraph, I shall spell out the connection between the inquisitive process described in the mechanistic view and the use of metaphors in science.

### **3. Metaphor in science**

The role of metaphors in scientific reasoning is commonly associated with that of models. The affinity between these two devices is usually referred to the process of aligning the elements of a source and a target domain (mapping). Models, as well as metaphors, allow the projection of a conceptual structure from one domain of experience to another, so that the investigation about a given phenomenon, which aspects might be permanently or provisionally beyond the scope of sensory experience, can be oriented by our knowledge of a different, better understood or simply more familiar object, situation or theory. To mention just a few well-known examples, the billiard-ball model suggests that gases are collections of randomly moving massive particles within an enclosed space; the wave model describes sound and light as propagating by undulatory motion; other examples are

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<sup>25</sup> Quine (1960) also made this point. On his view, the unobservable entities – such as electrons, antibodies, magnetic fields, etc. – postulated to explain observable regularities or events and the macroscopic bodies we encounter everyday – such as trees, chairs, dogs, etc. – are ontologically on a par. So, as regards our ontological commitment, again there is no reason to consider observable objects as opposed to unobservables, despite that the descriptions of the former may be detailed and strongly supported by evidence, while the latter may be largely underdetermined by the evidence.

Rutherford's planetary model of the hydrogen atom, the hydraulic models of electric circuits, and many others could be mentioned.

Metaphors and models should be distinguished as different kinds of cognitive device. Metaphors are first of all identified as linguistic utterances. Several studies have shown, however, that the same cognitive mechanisms that govern linguistic metaphors are also at work in non-linguistic modes of relating representations borrowed from separate domains of experience. So, for example, there are visual metaphors, musical metaphors, etc. that are formed combining information obtained from different sensory fields. On the other hand, different kinds of non-linguistic entities can be used as models to represent certain aspects of a target domain. Among these kinds of entities there are physical objects (e.g. scale models), mental representations, sets of equations, computer programs, diagrams, set theory structures and so on. The literature on models in science emphasizes the irreducibility of these devices to a single kind of entity (cf. Bailer-Jones 2002; Frigg and Hartmann 2012). In some cases metaphors can be based on models, as when we speak of "electrical currents" or "braking bonds". In such cases, metaphors are a sort of spin-off of a model. In other cases, a model may be brought into play as a whole by a metaphorical utterance as a basis for a more systematic exploration of the target domain. Hoffman (1980) referred to them as "metaphor themes" (see below).

Material models *instantiate* the features and structure of the objects of investigation, while theories, as sets of sentences, *describe* them. In their elliptical formulation, metaphors evoke a set of implications as to the properties of their topic. Scientific metaphors "have long lives because of their thematic inclusiveness" (Hofmann 1980: 415). Paraphrasing them is potentially an interminable task and recognizing all their relevant implications can easily keep scientists engaged for decades. "It is only after the analysis, perhaps when it all is put down in linguistic form (i.e., after the original insight) that what come to be labeled as the 'unacceptable' or 'anomalous' aspects of a metaphor can possibly be singled out to have their way over the useful aspects." (Hofmann 1980: 415). Of course, for a metaphor to play any epistemic role within a scientific theory, it is not enough that it occurs in the discourse of a scientist describing the object under investigation. Indeed, it might just be a mere descriptive shorthand ultimately referring to more detailed available descriptions. Rather it must have some part in the structuring of the explanatory pattern (Hoffman 1980: 399). As Hoffman argues:

The utility of a metaphor shows up when it suggests ('new') properties in the Vehicle that were not attributed to the Topic on the basis of the theory and that could not be attributed to the Topic on the basis of the theory alone. (Hoffman 1980: 413).

The least that can be said is that metaphor influences the way in which scientific problems are formulated and situations are conceptualized. Metaphors can act at a general level influencing the theoretical frameworks, meaning the approaches that define a particular way of looking at the world. Theories, as ways of looking at the world, rely on a springboard of ideas and representation devices that persist throughout their change. Models and metaphors are to be included among them. As a major example of such influence on the scientific worldview, Turbayne (*The myth of metaphor*, 1962) has considered Descartes' world-as-a-machine metaphor, which "has worked its way so subtly into all of the Western sciences since his time that most scientists and nonscientists alike are no longer consciously aware of it" (Indurkha 2007: 17). Here we have to do with what Hoffman has called a "metaphor theme", deemed responsible for giving rise to a worldview owing not just to the comparison of some limited aspects of two domains, but also to the assimilation of the target domain as a whole to the source domain. "A metaphor theme provides a bunch of related little metaphors, in which a concept or phenomenon in the theory is used as the topic in a metaphor" (Hoffman 1980: 405). Analyzing its implications, the inquirer gets his hypothesis and principles about some aspects of the target domain. Philosopher Stephen Pepper (1942) suggested that Mechanism, Atomism and Organicism are all instances of metaphor-induced worldviews. Another salient example of metaphorical theme is that which brings together the domains of mind and computer. Turing has explicitly compared a machine to human mind. But this metaphor has also been taken in the reversed sense (mind is a computer<sup>26</sup>), and today psychology employs many terms – e.g., encoding, retrieval, storage, etc. – borrowed from language of information processing. As Hoffman states:

It is *not* a way of making vague generalisations, but a way of introducing specifications or constraints on the definitions of theoretical concepts (e.g., *Short-term memory is a push-down stack*). The vagueness is only apparent and occurs as an epiphenomenon of the search for explanation rather than because of the use of

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<sup>26</sup> This can be mentioned as a rare case in which the interaction between two implicative systems has resulted epistemically fruitful in both directions, but most of the times reversing the terms of an apt metaphor does not produce an apt metaphor.

metaphor. [...] [Actually], there is as much detail derivable from the metaphor theme as the analysis cares to look for (Hoffman 1980: 405-406).

Machamer and his colleagues' considerations are particularly interesting for our purposes. They remark that "what we take to be intelligible is a product of the ontogenic and phylogenetic development of human beings in a world such as ours" (Machamer *et al.* 2000: 22). Our senses shape the way we experience the world and access, directly or indirectly, mechanisms. It is widely acknowledged that, among our senses, sight is the one that influences our theoretical approach more deeply. However, there are other approaches to conceiving activities. Our kinesthetic and proprioceptive senses also enable experiential grounds of intelligibility for activities such as pushing, pulling, rotating, etc. Moreover, emotional experiences allow us to conceive activities such as attraction, repulsion, and the like. Such concrete experiences constitute the basis of meanings that can later be extended beyond primitive sense perception, and this connection with experience is what guarantees intelligibility to our concepts and guides our explorations into unfamiliar fields (cf. Machamer *et al.* 2000: 22).

In principle, we should recognize in which respects a metaphor implies false assumptions. However, as long as it suggests to focus on respects that are important for understanding a phenomenon, appealing to its falsehood would be one-sided and of no benefit to the inquiry. There are good reasons for doubting that, *de facto*, it is always possible to discern the false implications of a metaphor from the possibly fruitful hints it provides. Even though in certain cases the prevalence of a metaphor might negatively bias our approach to certain problems, we should beware of faulting metaphor when it is really the depth of theorizing that is defective (cf. Hoffmann 1980: 402). Theories, in any case, are not entirely true. When it comes to the assessment of theoretical representations, it is always a matter of verisimilitude. This depends on the occurrence of abstraction and idealisation in any form of representation. Just as the imposition of a precise mathematical formalism on a real system (where the former fits the latter only approximately) is unanimously considered essential to natural sciences, it should come as little surprise that scientists resort to metaphorical projection in order to impose different conceptual structures on phenomena. Both strategies respond to the need for idealisation to represent selected parts of the world. In both cases, one is called to abstract both from some properties of the system being represented and from some properties of the medium used to represent it. As regards mathematics, for instance, some properties of the real-number continuum does not (seem to) have a correspondent in the

physical world, and some have even suggested that it might ultimately be misleading as to the fine structure of space-time (cf. Ladyman 2008: 360). Therefore abstraction concerns any form of representation, and metaphor is no exception.

When an alleged real structure (a mechanism) lies beyond the scope of direct experience, there is no possibility of verifying each correspondence in a structural mapping. Nevertheless, in most cases, even if the conditions for immediate verification are not given, the inquirer can resort to direct or indirect inference (cf. Glennan 2005: 458-9). Indeed, it is precisely this possibility that metaphor provides. It allows to introduce theoretical terms that, despite empirical underdetermination, are intelligible and ensure an intentional content. The question that looms large is whether metaphors are essential to the construction and argumentation of theories or they are dispensable heuristic aids. Martin and Harré claim that metaphors are necessary because in the course of scientific theorising “we can conceive more than we can currently say” (Martin and Harré 1982: 89). They argue that theoretical terms are like metaphors in that they often refer to unobservables. The issue of approximate or metaphorical reference becomes crucial for those entities for which direct evidence is hard to come by. As we have seen, the most important aspect concerning models is their predictive function: they allow drawing analogical inferences. A purely deductive theory would have no possibility of being extended, it could only be replaced by another one. Analogical inferences may be drawn from an embedded model, taking its predicates as theoretical terms. In order to be predictive, a theory must contain predicates describing features and mechanisms which have not yet been observed in the reference domain. On this issue, Martin and Harré point out that “Comparisons are essentially rooted in experience. But most sciences are [...] inclined to include assertions about those features of the world that are beyond all possible experience” (Martin and Harré 1982: 90).

We can thus agree with Richard Boyd when he argues that metaphors, just as theoretical terms, are prone to provide “epistemic access” to the deep structure of reality (cf. Boyd 1979; Machamer 2000). Metaphors “express theoretical claims for which no literal paraphrase is known. Such metaphors are *constitutive* of the theories they express.” (Boyd, 1993: 486). Metaphors provide terms with reference – i.e. establish a link between the terms themselves and the objects they point to –, even without a precise definition being given. According to Boyd, this idea saves the basic insight that led Kripke (1975) and Putnam (1980) to put forward a causal theory of reference. Indeed metaphors, while involving an extension of the common use of terms, ensure a certain continuity of use as well (cf. Goodman 1968), which

in general (not only for metaphorical language) makes communication and practice possible. This sort of flexibility in the use of terms allows approximate accommodation of our language to the world. The use of a term for referring to some aspect of a phenomenon is relative to our degree of cognitive awareness. Boyd suggests that metaphors provide an alternative to ostension for fixing reference. In response to this, Kuhn acknowledges that metaphor provides us the means to refer to something even when we cannot previously define it, but he disputes that this way of connecting language with the world has anything to do with the causal theory of reference<sup>27</sup>. Kuhn notes that the notion of epistemic access to which Boyd appeals does not extend the causal theory of reference, it instead makes it unnecessary. In fact, epistemic access can be provided by metaphors in the absence of any ostension of the object it points to, even if it would take place as a contextual juxtaposition of several examples and counterexamples. It is precisely this possibility that explains the utility of metaphor in science. If some continuity is preserved, it concerns the usual meaning of terms (cf. Davidson 1978) rather than their link with an original act of dubbing. Boyd's answer to the question of how the link between language and the real world is locally determined, implicitly assumes that the speakers somehow know what the terms newly introduced refer to. In fact this is what happens when we use metaphors, but Boyd's assumption leaves the question of how epistemic access can be gained by means of metaphor unanalyzed. The answer lies in the fact that metaphors can fix reference because the terms used metaphorically have a well-established use in other contexts, either in scholarly discourse or in everyday language.

In some cases the debate about the role of metaphors in science has come across disagreements about the metaphorical status of specific patterns

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<sup>27</sup> Problems with the causal theory of reference arise if it is extended to natural kind terms: "When one makes the transition from proper names to the names of natural kinds, one loses access to the career line or lifeline which, in the case of proper names, enables one to check the correctness of different applications of the same term. The individuals which constitute natural families do have lifelines, but the natural family itself does not" (2000, 199). Kuhn gives us an example of a case in which the causal theory works and of another in which it does not. A single act of ostension is enough to fix reference to 'Richard Boyd'. The situation is entirely different when one is presented the deflected needle of a galvanometer and simultaneously told that the cause of the deflection was 'electric charge'. Kuhn claims that with natural kinds "a number of acts of ostension are required." Further, in regard of natural kind terms (e.g., 'swan', 'goose', 'electric charge', etc.), an establishment of reference requires exposure not only to "varied members of that kind but also to members of others – to individuals, that is, to which the term might otherwise have been mistakenly applied" (2000: 200).



of reasoning. Pylyshyn (1993) contends that what is almost unanimously considered as a basic metaphor in computer science and psychology, i.e. the mind-computer assimilation, is not a metaphor at all, but rather a set of terms that refer literally to certain functional systems. Pylyshyn proposes to distinguish the literal from the metaphorical through pragmatic criteria. Maybe the distinction is too subtle and seems to rely on the factual/normative distinction. Clearly, the fact that we use a metaphor cannot justify an explanatory hypothesis: it is just a fact, indeed! If the explanation is satisfactory does not depend so much upon whether it is metaphorical or not as on the accuracy of the functional analysis leading to recognize certain connections between the behaviour of a system and the underlying mechanisms. Moreover, the incomplete and provisional nature of our descriptions does not depend on whether they are metaphorical or not. Rather it rests on the limitations of our knowledge. When a description is judged accurate enough, what was introduced as a metaphor tends to be considered as a literal description. For example, the cognitive processes are considered as “computations” and some scholars do not regard this as metaphorical any more. This could be the case for many other concepts customary used in science such as process, mechanism, etc.

Metaphor, through its interactive mechanism, allows to highlight some features of the target which are associated with the source, generating new insight into the former. This can occur even in cases where the nature of the target does not allow ostension, e.g. because instances of the target are distant in space-time or because inaccessible to perception. In cases where the putative referent is something observable, a procedure of multiple paradigmatic exemplification meets the conditions for fixing the reference of a term by dubbing (Kuhn 1979). And if the common features of both domains can be easily identified, metaphor, though possibly useful, is not necessary. But this is just the possibility at one extreme of a continuum of cases ending with the case of an expression referring to an object or situation completely indeterminate by data which determination entirely depends on the conceptual content of the terms employed to mention it.

Which is then the difference between literal and metaphorical comparison? Since comparison requires observation, unobservable objects (or unobservable features of observables) can at first be approached metaphorically, whilst explicit alignment of elements takes place only afterwards as a refinement of the initially loose epistemic access. This should be one of the crucial points to be made in order to account for scientific metaphors. In a best-case scenario, the juxtaposition of representations (the target being empirically underdetermined or unobservable) that metaphor brings about

partially compensates the impossibility of comparing different instances of the target. In fact, an ostensive fixation of reference is not feasible in the case of many theoretical terms. However, Hoffman notes that in scientific metaphors some features related to the vehicle can be literally applied to the topic, while others are only figuratively applicable to it (Hoffman 1980: 412). This is because, Hoffman argues, for a metaphor to work, the system of features associated to its vehicle must fit at least in part with the theory (or with our sketchy conception) of the target, be it based on few elements derived from observation or on previous knowledge. In other words, there must be a partial preliminary compatibility between the representation of the target domain and the representation of the source domain.

As Hesse has suggested, if we were to espouse the syntactic view of theories, any extension of a theoretical system should be seen as unrelated to rationality. On the metaphoric view, however, theory change is regarded as responding to a rational need, since “rationality consists just in the continuous adaptation of our language to our continually expanding world, and metaphor is one of the chief means by which this is accomplished” (Hesse 1966: 176-177; cf. Indurkha 2007). This view allows to overcome the issue of concepts incommensurability among different theoretical frameworks, emphasised by the “new philosophers of science”, and to account for a certain progressiveness in knowledge acquisition through the paradigm substitution. In the transition from one theory to another, a term does not necessarily maintain univocally its meaning, as supposed by Carnap, but on the other hand it does not give rise to a pure misunderstanding, as pretended by Feyerabend. There is in fact a constancy of meaning, even when in the new theory the term points towards new properties, functions and relationships.

Thanks to metaphors we are therefore able to anticipate to some extent the conditions under which a term gets its referent, even in the absence of direct observation. A metaphor is heuristically useful because, thanks to its cognitive guidance, it invites to explore a poorly understood target, while promising a better determination of its properties. Whether such a promise is kept or not is a question to be answered on a case-by-case basis, since it concerns the evolution of knowledge in a particular field. The power to guide attention makes metaphors potentially dangerous: they can also divert attention from the essential features of a system. Moreover, some metaphors are so deep-rooted in scientific discourse that it might be controversial to decide whether they are to be taken as provisional representations of a domain rather than as appropriate functional descriptions of its structure. See for example the mechanistic view of nature (Descartes), the self-nonsel

discrimination in contemporary immunology (De Donato-Rodríguez and Arroyo-Santos 2011), or the mind-computer parallelism (Pylyshyn 1993).

In many cases the identification of the metaphor that has guided researcher's creative process would require detailed historical descriptions. Considering the self-nonsel self discrimination within the *Clonal Selection Theory* (CST), a wide accepted paradigm in contemporary immunology, as a significant case of scientific metaphor<sup>28</sup>, it has been pointed out that such a discrimination is so fundamental for the theory that it is generally regarded as a physiological function rather than a metaphorical description. "However, historical reconstruction shows how the term was introduced as a rhetorical device used to talk about things that were not yet known." (De Donato-Rodríguez & Arroyo-Santos 2011: 90). Its epistemic success has resulted in forgetting its metaphoricity until being taken as a proper description of physiological mechanisms. Indeed, a few years after its introduction, the notion of self – standing for the set of antigens that have had continuous presence in the history of an organism – was characterized in physiological terms (De Donato-Rodríguez and Arroyo-Santos 2011: 91). Yet it has never ceased to fulfil different theoretical, epistemic and cognitive tasks owing to its rhetorical force, e.g. "as a heuristic device used to imagine, propose and characterize immune mechanisms, as a means to discuss the medical implications of the new immune theory or as a means to discuss individual identity" (De Donato-Rodríguez & Arroyo-Santos 2011: 91-92).

This notion of self allows to project a conceptual framework having to do with protection and identity onto the domain of physiological mechanisms and medical issues, inspiring a whole range of inferences that have proved apt to highlight some relevant connections in the latter. As a result, the self-nonsel self discrimination has become a major tenet of the CST, "the crux of the immune system", since then promoting the discovery of mechanisms and suggesting experiments.

For example, in 1959 Lederberg imagined a stochastic mechanism that could produce the large number of antigens necessary for a true elective theory. He imagined the random assembly of the DNA of the globulin gene during certain stages of cellular proliferation. This idea seemed so far-fetched at the time, that Lederberg himself considered it ad hoc. However, in 1983 Tonegawa came up with the definite antibody producing mechanism. He argued that antibody diversity is the result of the random shuffle of individual gene segments that together codify the antibody's recognition site. There is a certain resemblance between Tonegawa's mechanisms and Lederberg's intuition: in 1959 Lederberg knew

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<sup>28</sup> For a detailed analysis of this case, see De Donato-Rodríguez and Arroyo-Santos 2011 and Tauber 1994.

little about genetic processes so he could only propose likely mechanisms that would nonetheless set the stage for future advances. (De Donato-Rodríguez and Arroyo-Santos 2011: 92)

Besides the notion of self, other metaphors have been introduced in the CST to characterize the mechanisms that govern immunological tolerance. So, for instance, reference is made to processes such as debilitation, decision, learning, etc. which imply some assumptions as to why and how the immune system has evolved to its current stage. What today is called into question about the CST are not so much the mechanisms that have been discovered thanks to the introduction of the self-nonsel self discrimination, as the ability of this metaphor to further guide the research towards the solution of problems that have emerged within the paradigm based on it. In other words, scholars debate whether in this stage of research this metaphor still has the epistemic force that made it possible to explain certain behaviours, and respond to this concern proposing new metaphors, such as danger, homunculus, continuity, etc.

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# The Role of Metaphor in Mary Hesse's Language Theory

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## 1. Metaphor, first of all

Looking at the historical and philosophical context in which Mary Hesse's thought took shape, the "revolution" she brought about in the contemporary epistemological debate is immediately striking.

Since the 1960s, Hesse has been developing a theory that moves away from the positions of logical empiricism and from the necessity, peculiar to this current of thought, to turn language into a calculation, in order to use it as a reasoning instrument. This concept of an "ideal language", perfectly able to mirror the world, as Mary Hesse claims, "has a philosophical pedigree going back at least to Aristotle" (Arbib & Hesse 1986: 149). Indeed, for him, scientific knowledge provides an image or a representation of the ontological structure of reality, symbolically expressed in apophantic speech, appropriate to scientific discourse, where the determinations of true and false take place.

Aristotle conceives of nature as a hierarchy in which entities are divided into genera. Such a hierarchy is held to reveal the ontological structure of nature. In accordance with this view, knowledge would be acquired through the identification of the inner essences of entities (which is defined by giv-

ing its genus and specific differences). The ideal language view, maintained by the logical empiricists, perfectly suits this kind of ontology.

Every ideal language contains a finite number of general terms and an ideal language contains enough of it to “mirror” the fixed number of natural genera that have to become isomorphic to them in the ideal science. The correlations between natural genera are expressed in natural laws, which, therefore, agree with the semantic rules of the ideal language and are guaranteed as universally applicable ones (Arbib & Hesse 1986: 230-231).

From this point of view, with the logical frame of knowledge in the foreground, the historical dynamics of scientific undertaking have been considered of minor importance. The emphasis on the context of justification has led to the idea that epistemology simply should analyze the logical form of propositions, the syntactic structure of theories and the abstract patterns of explanation, rather than studying their transformations in the historical context. In this sense, the neopositivist philosophers’ work “was with the construction of adequate formal representation of scientific expression in general, rather than with the details of particular scientific work (and much less with past scientific work)” (Shapere 1966: 59). The hypothesis that the whole dynamics of knowledge acquisition and scientific inquiry could be rendered through a formal system, relies on the assumption that the logical structure of theories is inert and does not interact with the contents it represents, as well as on the belief (critically emphasized by Kuhn in his *Structure of the scientific revolutions*, 1962) that there is a theoretically neutral observation language in which the formal structure of theories could find their expression. Now, as Kuhn further claims, since at least the Seventeenth century, the availability of such language has been postulated by many philosophers, who took for granted the neutrality of the sensation reports and tried to identify a *characteristica universalis* that could express the whole set of languages as if they were just one. “Ideally the primitive vocabulary of such a language would consist of pure sense-datum terms plus syntactic connectives” (Kuhn 1970: 266).

The neopositivist perspective went into crisis in the 1960s, along with an increase of awareness of the importance of taking into account the historical dynamics of scientific enterprise.

If we consider the development of scientific theories, it becomes quite clear that there is no neutral observation language, and that the phenomenon of theory change cannot be explained by simply appealing to different interpretation of a set of shared evidences. Instead, as Thomas Kuhn has claimed, different theories can be built on separated and, sometimes, con-

flicting sets of empirical observations. To give an example, Dalton's atomic theory "implied a new view of chemical combination with the result that the line separating the referents of the terms 'mixture' and 'compound' shifted" (Kuhn 1970: 269). The transfer of metals from compounds to elements was due to the introduction of a new theory shedding light on combustion, acidity and the difference between physical and chemical combination (Kuhn 1970: 269-275). In similar cases, the name of the sets remains the same, but the new classification affects the entire network of interrelations among sets. And the last claim has critical effects in scientists' vocabulary.

In the transition from one theory to the next, words change their meaning or conditions of applicability in subtle ways. Though most of the same signs are used before and after a revolution – e.g. force, mass, element, compound, cell – the ways in which some of them attach to nature has somehow changed. Successive theories are, thus, we say, immeasurable (Kuhn 1970: 266-267).

As a result of a critical approach to the history of science, the thesis that different theoretical accounts of phenomena are incommensurable – which claims the impossibility of finding a common measure serving as criterion of choice between different competing theories –, has been opposed to the acritical reliance on a theoretically neutral observation language. In fact scientific practice mostly depends on our capacity to group objects and situations in classes of primitive similarity, that is in groups that are settled without having to answer to the question "similar to what?" The change of explicative models and language occurring in the historical development of science involves a reclassification and a reorganization of the objects in classes of different similarities, and the lack of a common observative language implies that the criteria of such redistribution cannot be made fully explicit.

When such a redistribution of the objects into different classes of similarities takes place, the shared reference that used to ensure successful communication among the scientists disappears. "Just because neither can say, 'I use the word element (or mixture, or planet, or unconstrained motion) in ways governed by such and such criteria', the source of the breakdown in their communication may be extraordinarily difficult to isolate and by-pass" (Kuhn 1970: 276). Thus, the non-neutrality of observation language would imply both the incommensurability of the theories and the interruption of communication, and hence the impossibility of coming to a rational assessment of different theoretical solutions.

Hesse was fully aware of the problems the history of science brought up to the neo-empiricist view. Nevertheless, she was neither inclined to adopt

the relativist perspective implicit in the idea of an interruption of communication among scientists who have assumed different theoretical points of view, nor to regard the impossibility of rational assessment of different theoretical options as necessarily ensuing from the non-neutrality of observation language.

In order to cope with these issues, a theory of language should allow for categorization based on the recognition of family resemblances and account for the possibility, given in practice, of effectively communicate and rationally discuss about experimental results and theoretical hypotheses. Trying to meet these requirements, Hesse elaborates a conception of language in which metaphor plays a fundamental role, and scientific language is characterized as a dynamic system that grows through metaphorical extension. In doing so, Hesse brings to prominence some issues that have been addressed in depth by scholars such as Eleanor Rosch (1978), George Lakoff and Mark Johnson (1980).

In the light of Hesse's proposal, getting the meaning of a term is not just a matter of recognizing its referent, but it also and foremost involves concern for the "family resemblances" that are commonly associated with it, as well as requiring that the meaning is kept open beyond literal immediacy. In this way, meaning becomes a function of the connections developed within a dynamic semantic network, and of further connections between this network and the world.

## **2. Shaping concepts**

In developing her theory of language, Hesse starts from Wittgenstein's notion of "family resemblance".

Instead of showing what is common to whatever we call a language, I say that these phenomena have nothing in common, on which basis we use the same word for all of them, but they are connected each other in many different ways. And thanks to this connection, or connections, we call "languages" all of them. (Wittgenstein 1953: § 65)

In this passage, Wittgenstein suggests an alternative to the conception of meaning as an entity underlying all the occurrences of a word. Following Wittgenstein's analysis, the table below (Fig.1) approximately represents the process of concept shaping as based on family resemblance.

Object	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	P <sub>5</sub>
Properties	ACD	ABDE	BCD	BCE	BD

Fig. 1

Let us see how certain properties A, B, C, D and E are attributed to some objects P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub>, P<sub>4</sub> e P<sub>5</sub>. Taking into account the similarities and the differences between these objects, we can recognize them as being part of the same class P, although they do not share exactly the same set of properties (indeed classification always involves a loss of information due to neglecting individual features). Summing up Wittgenstein's thought, Hesse states

We assume that in a family resemblance class (for example "game"), the members of enough pairs of objects in the class resemble each in some respects relevant to P, and are appropriately and sufficiently different from objects put in the class not-P, without assuming that there is any universal "P-ness" realized by the object (Hesse 1993: 60).

Family resemblance-classes (hereafter referred as FR-classes) rest upon similarity between objects. Similarity is stated with regard to a bunch of properties that are recognized as relevant and important for the sake of classification. This implies that their selection is conditioned by the conceptual framework one adopts, because "relevance and importance will be functions of the theoretical system accepted up to date" (Hesse 1993: 68). For instance, though color is an important property of flowers, it is of little use for scientific classification of plants. On the other hand, the number of stamens, which are hardly visible to the naked eye, provides the botanist with a better criterion for an economical and comprehensive taxonomy.

### 3. The resemblance connections

As Hesse points out, one essential property of the resemblance connections is *non transitivity*. Following the schema represented in figure 1, if we recognize a certain degree of similarity between, say, the objects P<sub>1</sub> and P<sub>2</sub> with respect to an FR-class, and, at the same time, some similarity between P<sub>2</sub> and P<sub>3</sub>, we cannot conclude that the same kind of similarity holds



between P1 and P3. As an example of FR-class, let us consider chairs. The most paradigmatic members of this class are objects consisting of a backrest, a seat, four legs, and (optionally) two armrests. But the class includes also other types of chair, such as beanbag chairs, hanging chairs, and swivel chairs, contour chairs, barber chairs, etc., that possess different features as compared to the most paradigmatic members. Now, we use to regard all these types of chair as belonging to the same FR-class “not because they share some fixed set of defining properties” with the central one, “but rather because they bear sufficient family resemblances” to it (cf. Lakoff and Johnson 1980: 122-123). Referring to the above represented schema, we can say for instance that the position of P2 within the FR-class is more central than the position of P1, while P5 is quite peripheral. This also implies that “The resemblances can form a chainlike structure through a given class in such a way that there are relatively clear cases of objects falling within it, and relatively clear cases of those that do not” (Hesse 1993: 61).

Recognizing similarities between objects allows us to rank them among the members of a FR-class, and so to include them in the same FR-concept. Still, an FR-class is constitutively open, since it owes its structure to an intricate interweaving of similarities and differences. As a matter of fact, it is not possible to specify all the constitutive similarities of a class, because the relation of similarity objects that are classified together, but also among whatever single property involved in the classification (Hesse 1974: 49). This is the reason why categorization always implies some loss of information. In any case, the attempt to define an FR-concept by enumerating all the resemblances between the objects included in its extension would lead to infinite regress, as the concepts introduced for clarification should in turn be characterized by calling into play further resemblances. According to the above table (Fig. 1), an attempt to enumerate all the properties of an object included in P, would require first mentioning A, B, C, D, E etc., but then each of these properties should be characterized by mentioning further properties, such as F, G, H etc. So, if P1 and P2 resemble each other, for example with respect to D, we might still wonder in virtue of what D is predicated of both. To avoid falling into a variation of the third man argument, we can only accept a relative degree of characterization (Hesse 1974: 49). “This potential regress must be stopped by some predicates whose application involves loss of information which is present to recognition but not verbalizable” (Hesse 1970: 40).

Although Hesse acknowledges that observation is theory-laden, and claims that similarities are recognized through our “theoretical glasses”, she

also points out that in pre-theoretic contexts our ability to detect certain similarities rather than others is biased by other factors as well.

If we have little or no information about any theoretical system [...] similarities may be determined just physiologically. [...] We may even regard such recognition of similarity as incipient theory, where the "theory" is a physiologically innate determination of perception (Hesse 1974: 68-69).

In such cases, it is "the physics and physiology of situations" (Ibid. p. 39) that provides us with some criteria for appraising whether two situations are similar in more obvious respects than others, and deciding the salience of one respect for establishing similarity or diversity between different situations. This simply means that our cognition is anchored in "the physics and physiology of situations", at least in some respects, and that the basic open-endedness of concepts does not imply their arbitrariness. The apparent lack of motivation of the observative language and its reliance on theoretical background depend on the loss of information we inevitably experience while building our conceptual system upon sensory impressions. Therefore, while arguing that the relevance of the shared properties depends on the accepted theoretical framework, Hesse recognizes that, due to this loss of information, the dependence is only partial.

The analogical character of cognition, and the fluctuation of meaning it entails, suggest that we cannot define a final set of instructions about the use of words and the shaping of similarity classes. We must accept the impossibility of using the elements of language in a stable and strict form, fixed once and for all. This idea is a major tenet of Hesse's *Network theory of meaning*, as we shall see in the next section.

#### **4. The network theory of meaning**

The semantic flexibility, Hesse claims, demands that

one does not ask "What is *the meaning* of a linguistic term?" but rather "How does this term relate to others in the language and to its empirical reference, in such a way that communication becomes possible?" The answer has to be in terms of a complex network of *meaning relations* (Hesse 1988: 324).

In other words, in order to understand and clarify the meaning of a term, we must consider the grammatical rules allowing its public use. This is made by linking the term to the other terms of the language. From this point of view, the language records the connections between the terms used in different

linguistic communities. The semantics of a word covers a set of uses that range from the logical-formal definition to the recognition of similarities.

Following this train of thought, meaning is to be conceived as a function of the connections in a dynamic semantic context linking each word with other words, and the whole language with the world. Then the meaning of a term is not only defined by its correspondence to the world, it also depends on the whole network of connections. However, language learning and communication depend also on the fact that the language network is connected to the extralinguistic world (Hesse 1988: 324).

Words are not subject to the same degree of regulation. We could draw a contrast between cases in which words have clear meanings that regulate their functioning in every particular case of attribution and cases in which words have only vague meanings, which functioning is connected to peculiar associations in different empirical situations (Wittgenstein 1958: 40).

Words get the meaning we have given to them. And we give them meanings through clarifications. I may have defined a word and used that word consistently with its definition, or those who taught me that word may have explained it to me in that way. Or, by the clarification of a word, we may mean the clarification that, on demand, we are ready to give to it. If we *are* ready to give a clarification, in most cases we are not. Many words, in this sense, have no strict meaning then. But this is not a flaw. Considering it a flaw would mean that the light of my lamp is not a real light because it does not have a clear limit (Wittgenstein 1958: 40).

In sum, we cannot expect to list a set of rules for each use of a word and we must accept that words do not always have strict meaning and never have a fixed meaning. This is a crucial point concerning the way predicates work in language. It is this way they become signifiers. “The network theory of meaning” “contemplates controlled indefiniteness of the boundary of “what we want to mention”“ (Hesse 1986: 47).

As a further specification of this view, it should be noted that according to Hesse FR-classes are not purely extensional, as they are not defined simply by reference to the objects they include. “They involve also what I shall call *intensional reference*, that is, they depend on recognitions of similarities and differences in producing the initial classification in a given language” (Hesse 1974: 62).

The concept of intensional reference plays a central role in Hesse’s theory of language. It should be distinguished from the notions of extension and intension used in formal semantics. It is rather related to the issue of “meaning variation” discussed in philosophy of science. According to her, the peculiarity of FR-classes is that they “are not adequately described as

extensional, for they are not defined merely by the objects contained in them” (Hesse 1974: 62). To say that any FR-class involves an intensional reference means that it is related to the recognition of similarities and differences the original classification in a language is based on. In Hesse’s words, “intensional reference is the relation which subsists between a descriptive predicate in a given language and a property of an object when the statement ascribing that predicate to that object is true” (Hesse 1974: 62). Any statement is held to be true against the background of the best theory available at the time and based on coherence conditions. When theories change, the intensional reference of terms accordingly changes. However, this does not necessarily modify the extension of classes. For instance, we might improve or modify the criteria allowing the recognition of Vermeer’s paintings, without modifying the comprehensive catalogue of his artworks.

Thus, same extension does not entail same intensional reference, but same intensional reference does entail same extension, since that any object has an intensional property is a sufficient condition for placing that object in the extensional class corresponding to that property (Hesse 1974: 62).

Basically, the intensional reference linking any predicate P to a property of an object establishes the conditions for the attribution of P to the object itself, which is thereby included in the extensional class of P.

According to this analysis, the relevant change of meaning takes place when the conditions causing the attribution of a predicate are modified. “The ‘meaning of P’ changes when all or some empirical situations to which we have conventionally learned by recognition of similarities and difference to assign the predicate P, are deliberately ascribed the predicate -P, according to some rule derived from the coherence conditions” (Hesse 1974: 63). In other words, if the similarity defining the class of Vermeer’s pictures changed, or if some works first included in that class had eventually been excluded from it (for instance, because critics have come to distinguish the master’s paintings from his best pupil’s ones), the meaning of “Vermeer” would change as well. Therefore, we have no authority, though facing different theories, to ascribe a meaning change to P. “If the physical conditions under which recognition of a property as P is correct are unchanged, the meaning of P is unchanged, no matter what changes of theory may be dictated by all the evidence and the coherence conditions” (Hesse 1974: 64). For instance, the use of the telescope changed both the physical conditions to ascribe the predicate “planet” to celestial bodies and the empirical situations under which that term could be learned by scientists. Thanks to the new instrument, Galileo was able to see the similarities between the Earth

and Jupiter and, more in general, between heavens and sublunary world. The physical conditions for the ascription of astronomical predicates changed so much that the entire framework of Aristotelian cosmology broke down shortly after.

No change of meaning takes place unless the physical conditions allowing the attribution of P have changed. According to the network theory of language “similarity and difference are irreducible primary relation, prior even to application of the simplest predicate: they are *shown* not *said*” (Hesse 1984: 33). Now, as the recognition of similarities and differences is the basis of metaphor, the whole language turns out to be metaphorical.

The shifts of meaning undergone by predicates applied in FR classes are also like metaphoric shifts of meaning, for they depend on similarities and differences in some respect and in given context between the objects to which a given FR predicate is applied (Hesse 1984: 2).

Starting from Wittgenstein’s analysis of concepts genesis through the notion of family resemblances, Hesse comes to take account of Max Black’s “interactive view of metaphor” which, she claims, “fits our network model of meaning like a glove” (Hesse 1984: 6).

In the tradition of logical empiricism, metaphors are held to be inappropriate to express an original cognitive content and deemed to represent a deviant use of language. Such a position rests on the assumption that, as far as metaphors are meaningful, their meaning can be rendered by an equivalent literal paraphrase. From this perspective, only literal formulations can express a cognitive content properly. As an alternative to this account, Black proposed his “interactive view of the metaphor”, where he rejects the substitution view and recognizes the cognitive value of metaphor.

Black draws a distinction between two subjects in a metaphor: the primary and the secondary subject. In a metaphoric sentence such as “man is a wolf”, “man” instances the primary subject, and “wolf” the secondary subject, which functions as metaphor frame. The crucial point here is the idea (firstly suggested by Richards 1936) that the juxtaposition of the subjects metaphor brings together generates some meaning effects that cannot be inferred from the single words taken separately. In other words, new meaning arises from the interaction that metaphor triggers between two domains. This, Black claims, results in reshaping of the concepts related to both domains. The interaction suggests the selection of a subset of properties commonly associated to the secondary subject. Such a “system of associated commonplaces” acts as a focus on the properties of the primary subject, whereby a set of implications is sorted out from it. In this way, the primary

subject is “seen through” the secondary subject. Indeed, according to Black, metaphor works as a filter that allows us to recognize and organize the features of the primary subject by emphasizing some of them and ignoring others (cf. Black 1954: 286). Furthermore, this process, while promoting a change in our primary subject representation, is supposed to create mutual parallel changes in the secondary subject representation. Then, from a semantic point of view, the interaction process results in “shifts in meaning of words belonging to the same family or system in the metaphorical expressions” (Black 1954: 292).

As we have seen, perception of similarities and differences plays an essential role in defining linguistic reference. Now, Hesse's idea that FR-classes have metaphorical genesis finds also support in Black's claim that metaphor is “an instrument for drawing implications grounded in perceived analogies of structure between two subjects belonging to different domains” (Black 1979: 31).

As a matter of fact, analogies develop through a complex system of implications within a range of linguistic uses shared by the speakers' community, and create the holistic network of language. It is important to underline that the predicates of a natural language do not have a clearly determined extension, which strongly depends on the analogy recognized in the specific cases. As a consequence, the FR-classes cannot be considered as purely extensional, since they imply an intensional reference as well. In other words, meaning is constituted by a network and metaphor forces us to look at the intersection and interaction of different parts of the network (Arbib and Hesse 1986: 156). In Newton's theory, for example,

both “force” and “mass” were used metaphorically, that is, not in accordance with contemporary custom, but the extensions and corrections of meaning involved were implicitly *shown* within the structure of theory itself - the theory was a recommendation to reclassify, to reject the necessary connection of force with push-pull, and to recognize all material bodies in the universe as “masses” within the meaning of theory (Hesse 1993: 64).

This shift of meaning was produced by Newton through experiments and theoretical hypotheses. In this way he managed to indicate new physical conditions for the use of those terms and changing their reference as well as some inherited related ideas (Arbib and Hesse 1986: 154). By the way, the metaphors often are not immediately understood and accepted so that they require negotiation between speakers to draw out their possible meanings (Hesse 1993: 64-65).

This general conception of language is effectively resumed in Hesse's words:

Understanding the meaning of a descriptive expression therefore does not mean just being able to recognize its referent (in a given context, in a given reading) and not even just using words correctly in the expression, but also calling back to mind the ideas, both linguistical and empirical, included in the mental frames and commonly considered associated to the referent in that given linguistic community [...]. As far as an intersubjective understanding is concerned, most of the connected ideas must be assumed as common to all speakers of that language (Arbib and Hesse 1986: 154).

On these grounds, the Network Theory of meaning highlights the basic metaphoricality of language. All this has been properly summarized in what Hesse has called "Thesis M": "metaphor is a fundamental form of language, and prior (historically and logically) to the literal" (Hesse 1993: 54).

Hesse's conclusions about the intensional character of categories and metaphorical functioning of language have crucial epistemological implications. In fact, the epistemological concern proves to be as central as the aim at clarifying the nature of language, rather, the two aspects are inherently interwoven. "Suggesting [...] that metaphor has, after all, a cognitive status means debating the basis of most of the applied logic and of the semantics" (Arbib and Hesse 1986: 144). However, even if logical consistency turns out not to be the essential element of language, this does not imply abandoning logic and deduction in science. While relying on some secondary known analogies and hinting at new unsuspected ones, scientific metaphors, may allow us to deal with logical difficulties or real formal contradictions arising from models. In any case, the question about the truth conditions of scientific metaphors is not the most appropriate and fruitful. Metaphors should not so much be appraised for their truth or falsity, as for their aptness or inefficacy, for being illuminating or misleading, useful or useless. Their import should be assessed compared to the context of application and "their coherence with evaluative judgments made about particular situations" (Arbib and Hesse 1986: 156). Scientific activity involves also pragmatic aspects, where prediction and control are as essential as abstract theorizing, where theories must stand experimentation and testing, and the experimental results can affect theory retroactively (Arbib and Hesse 1986: 10).

On philosophical grounds, scientific models are a prototype of fantasy creations or frames based on natural language and on experience; however, thanks to the metaphorical extension, they go beyond this attempt to build symbolic worlds that can represent certain aspects of the empirical world, either properly or not. All these metaphorical worlds share the function of describing and redescribing

the world through scientific models; and for any of them it is not appropriate to ask for a literal truth as a direct correspondence to the world (Arbib and Hesse 1986: 161).

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# ***Gaia* Hypothesis: The Metaphor of Planet Earth as a Living System**

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## **1. James Lovelock's *Gaia***

At the end of the 60s, a British scientist involved in the NASA project searching for life on Mars, James Ephraim Lovelock, had a kind of illumination: it is possible to infer the presence of *life* on a planet just looking to its atmosphere, because life *interacts* with the environment in order to preserve itself. With the help of the American biologist Lynn Margulis, he formulates the *Gaia hypothesis*, which became famous in 1979 with the book *Gaia. A New Look on Life on Earth*: “the hypothesis that the entire range of living matter on Earth, from whales to viruses, and from oaks to algae, could be regarded as constituting a single living entity, capable of manipulating the Earth’s atmosphere to suit its overall needs and endowed with faculties and powers far beyond those of its constituent parties” (Lovelock 1987: 9). The “improbable”<sup>1</sup> (1987: 7) composition of Earth’s atmosphere clearly shows why it could be considered a “dynamic extension of the biosphere itself” (1987: 7). Oceans, ices, vegetation, animals, rocks and humans, all interacting with the atmosphere, contribute to the actual planetary conditions which are made fit and comfortable by the presence of life itself. In Lovelock’s account, life and the environment, the so-called *biotic* and *a-biotic* elements, together evolve as a single living organism which tends to provide optimal conditions for its own survival through dynamic relations among its parts. This does not mean that there is a sort of “final-

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<sup>1</sup> Lovelock uses this term in order to emphasize the fact that actual Earth’s atmosphere composition is not in a static equilibrium but in a steady state far from equilibrium.

ism” in nature; all can be explained in strictly scientific terms referring to the vocabulary of *Cybernetics*, *Information Theory* and *Complexity*. Intuitively, *Complex Systems*, like Earth, are interesting because they typically react to external variations in a *non-linear* way so that even the smallest perturbation in boundary conditions can have large effects; this is why they exhibit complex features – the so-called *emergent properties* – like *morphogenesis*, *auto-organization* and *auto-regulation*<sup>2</sup>. According to Lovelock’s account, Earth – more precisely the global earth-ocean-atmosphere-biosphere system, *Gaia* – is a complex system which developed the present variety of living organisms (the so-called *biodiversity*) in response to changes in astronomic conditions, in particular in solar irradiation which gradually increased during the life of the planet and is now in a relatively stable phase before starting to decrease with the gradual death of its star, the Sun (which is predicted to become a *red giant* in approximately 5 billion years, and, finally, a *white dwarf*).

Being the Earth *as a whole* that interacts with the environment (namely the Solar System) developing a great number of different forms of life, it is reasonable to consider the *whole* planet as a *single living entity* which makes use of the complex dynamics between its parts as a mean to preserve itself through changes in boundary conditions (*homeostasis*): “By now a planet-sized entity, albeit hypothetical, had been born, with properties which could not be predicted from the sum of its parts. [...] We have since defined *Gaia* as a complex entity involving the Earth’s biosphere, atmosphere, oceans, and soil; the totality constituting a feedback or cybernetic system which seeks an optimal physical and chemical environment for life on this planet” (Lovelock 1987: 11). We have now good mathematical theories supporting this view (e.g.: Dynamical Systems Theory, Cybernetics) and we can perform computer simulations to “see” how complex systems evolve in time, but, in 1967 there were already good reasons to develop such an hypothesis: (i) fossils showed that Earth’s climate had changed very little since life first appeared about 3,500 million years ago despite important changes in solar irradiation, surface properties and atmosphere composition; (ii) the chemical composition of the atmosphere is far from the expected steady-state chemi-

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<sup>2</sup> An *emergent property* is a property which is manifested by a complex system but which the individual members do not have. This is due to the peculiar structure of the system which is typically open to external fluxes of energy or information and composed of several highly self-interacting parts. Famous examples are: the typical structures known as *Bénard cells*, the collective intelligence manifested by populations of not-so-intelligent individuals like ants or bees, even our brain activity which comes from the interaction of a huge number of non-thinking neurons.

cal equilibrium; *(iii)* the climate and the chemical properties of the Earth now and throughout its history seem to have always been optimal for life.

The reason why the *Gaia* hypothesis is so controversial is that it invokes the concept of *life* which is not well defined by science, perhaps because – as Lovelock (1987: 4) says – “our automatic recognition system [of living entities] appears to have paralyzed our capacity for conscious thought about a definition of life” (Lovelock 1987: 4). The traditional distinction between *biotic* and *a-biotic* elements which takes the presence of heritable genetic information as a principle for detecting life, is rejected by Lovelock which prefers to adopt a broader approach inspired by the work of physicists like Bernal, Schrödinger and Wigner who define life as “a member of the class of phenomena which are open or continuous systems able to decrease their internal entropy at the expense of substances or free energy taken in from the environment and subsequently rejected in a degraded form” (Lovelock 1987: 4). Lovelock himself admits that this definition is far from being conclusive, being equally well appropriated “to eddies in a flowing stream, to hurricanes, to flames, or even to refrigerators and many other man-made contrivances” (Lovelock 1987: 4). Something else might be introduced to discriminate genuine life from merely emergence of qualitatively new properties. Klinger (2004) makes a step ahead in clarifying this concept talking about *fractality* in different kinds of complex systems, so-called: *ordered*, *critical* and *chaotic*. According to this account, Earth was able to develop life, in the ordinary sense of the term, because it is a highly complex system in a critical state in which there is a *moderate* degree of symmetry, neither too high (like in ordered systems) nor too low (like in the chaotic ones) and a *discontinuous but regular* fractality, neither continuous (order) nor completely irregular (chaos). Earth is in the famous “edge of chaos” where living systems can born and develop being equally affected by strong evolutionary (*symmetry-breaking*) forces and strong stabilizing (*symmetry-building*) forces which prevent the system from being chaotic. This fundamental *duality* of nature was already there – as Klinger points out – in the ancient Eastern culture with the principles of *Yin* and *Yang*.

### 1.1. Hypothesis, Theory or Metaphor?

As I pointed out, *Gaia* hypothesis is highly controversial. From 1988 (at the University of Massachusetts) to 2006 (in Arlington VA), four main *Gaia conferences* took place; many of the papers presented appeared in the books *Scientists On Gaia* (Schneider and Boston 1991) and *Scientists Debate Gaia*

(Schneider et al. 2004). In the Preface of the latter we read that “Gaia is exiting its ‘revolutionary’ phase – of vociferous controversy and ostracism from the scientific establishment – and is entering its phase of ‘normal’, puzzle-solving science”. In fact – as Lovelock himself states in his contribution (Lovelock 2004) – “the science of Gaia is now part of conventional wisdom and is called Earth system science; only the name Gaia is controversial” (Schneider et al. 2004: xiv).

Actually, the *Gaia* hypothesis is now accepted in the so-called “weak” version maintaining that Earth is a self-regulating system: in fact, (i) it is consistent with well established theories like *Cybernetics* and *Dynamic System Theory*, (ii) it has a lot of *indirect confirmations* being able to predict a number of future discoveries<sup>3</sup>, (iii) it is confirmed by computational models that are more sophisticated and empirically realistic than *Daisyworld*, a simple model introduced by Lovelock (Watson and Lovelock 1983) in order to demonstrate that the *biota* could lead to *homeostasis* without any teleology involved; the model shows how in a simple world with only black and white daisies, temperature is controlled through the self-regulation of the populations of the two species of flowers.

Despite being well accepted in its “weak” version, problems still remain with the so-called “strong” version – recently denied by Lovelock<sup>4</sup> – claiming that Earth is somehow alive. This is neither a scientific hypothesis nor a theory, but a *metaphor* as Lovelock himself says: “Self-regulating systems are notoriously difficult to explain, and it was natural to use the metaphor of a living Earth” (Lovelock 2004: 2). We can find the same idea in one of the most authoritative commentators of Lovelock’s work, James W. Kirchner, who clarified the difference between “weak” and “strong” *Gaia* hypotheses in terms of more circumscribed claims entailed by the theory (Kirchner 1991): the “weak” variants of the *Gaia* hypothesis hold that life collectively has a significant effect on Earth’s environment (“*Influential Gaia*”), and that therefore the evolution of life and the evolution of its environment are intertwined (“*Coevolutionary Gaia*”); on the other hand, the “strong” variants, in which the concept of life is more clearly invoked, claim that biosphere can be modeled as a single giant organism (“*Geophysiological Gaia*”) or that life optimized the physical and chemical environment to best meet the biosphere’s need (“*Optimizing Gaia*”); somewhere between the strongest and the weakest versions is “*Homeostatic Gaia*” which holds that

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<sup>3</sup> See Lovelock (2004: 3) for a complete list.

<sup>4</sup> “It was easy for them to demolish the strong, which I have never claimed, and leave me with the weak *Gaia* hypothesis, doomed to ignominy by the adjective ‘weak’” (Lovelock 2004: 2).

atmosphere-biosphere interactions lead to the stabilization of environmental conditions. Despite being controversial, this is the last *testable* (or *falsifiable*) hypothesis entailed by Lovelock's account: "the strong forms of *Gaia* – Kirchner says – may be useful as metaphors but are unfalsifiable, and therefore misleading, as hypotheses" (Kirchner 2002: 393). So, let's ask what kind of metaphor *Gaia* is.

## 2. What kind of metaphor?

In philosophy there are two main views about the essence of metaphors: the first one, which goes from Aristotle's *Poetics* to Black's "interactive" view, attributes a *cognitive* role to metaphors; the second one, which is typical of classical rhetoric, underlines the *decorative* function of calling something with a different name. In the former approach metaphors are considered as *thought events* (Vico 1744, Richards 1936, Black 1962); in the latter they are mere *language events*.

The way *Gaia* metaphor was born – that is from a hint by Lovelock's neighbor, the Nobel Prize laureate novelist William Golding<sup>5</sup> – immediately suggests the *esthetical function* it is supposed to perform; nevertheless I think it would be reductive to look at *Gaia* as a mere rhetorical device: it is an extremely inspiring idea in its strong versions and a genuine source of knowledge too, at least in its weak variants. The taxonomy of functions of metaphors in science proposed by Michael Bradie (1999) helps us to explore all aspects of *Gaia* metaphor, including the *rhetorical* one which is crucial to understand the richness as well as the limits of Lovelock's controversial proposal.

### 2.1. *Gaia* as a scientific metaphor

Following Bradie (1999) we can distinguish three distinctive, though overlapping, functions for metaphors in science: the *Rhetorical* one, which involves the use of metaphors in pedagogy and communication (partially resembling the classical metaphor mentioned above); the *Heuristic* one, operating in what the positivists called the "Context of Discovery"; and the *Cognitive* (or *Theoretical*) one, performing an active role in the so-called "Context of Justification". While it is uncontroversial that metaphors could be powerful communicative and pedagogic as well as heuristic tools, it is

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<sup>5</sup> Golding's notable work is *Lord of the Flies*, Faber and Faber, 1954.

questionable whether they can perform a real cognitive function in the scientific enterprise. In order to affirm the centrality and indispensability of metaphors in science, Bradie defends Black's "interactive" view (Black 1962) in which metaphors are not mere substitutions of names or comparisons, but, referring to analogies and similarities between different subjects, they make us aware of something we were not aware of before, thus creating genuinely *new* knowledge. To put it briefly, what happens is that the principal subject *P* acquires a set of new attributions in virtue of our looking at *P* through the lens of the secondary subject *S*; in Black's famous example "*Man is a Wolf*", the juxtaposition of man (*P*) with wolf (*S*) made us aware of lupine features of man and his behavior. In our case, referring to our planet with the proper name *Gaia* enables us to see traits of living in something we usually consider as inanimate matter.

### **2.1.1 The *Rhetorical* function**

"Self-regulating systems are notoriously difficult to explain, and it was natural to use the metaphor of a living Earth": this quotation from Lovelock (2004: 2) clearly shows how much the pedagogic value of *Gaia* hypothesis was central for its author himself. Homeostasis, morphogenesis, adaptation, self-organization, emergence of complex properties from aggregates of simple parts: in a single word *Gaia* makes comprehensible something that requires nothing less than *Complexity Theory* and *Cybernetics* to be understood. Unfortunately, as I said above, this represents the depth as well as the limit of this idea: the name of the ancient Greek Goddess led a lot of people to embrace the ideas entailed by the theory while leaving puzzled the majority of scientific community. This is why only the so-called "weak" version of *Gaia* has been gradually accepted while the "strong" one had a larger *cultural* and *political impact*, inspiring artists (like Alex Grey, Edith Egger, Sandra M. Stanton, Oberon Zell and Josephine Wall among others), New-Age religion and philosophy, ethics (with the introduction of "green" values based on respect of nature) and politics (with the rise of environmental movements and green parties). "Perhaps the greatest value of the *Gaia* concept – Lovelock said in 2007 – lies in its metaphor of a living Earth, which reminds us that we are part of it and that our contract with *Gaia* is not about human rights alone, but includes human obligations".<sup>6</sup>

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<sup>6</sup> The draft of the speech given by Professor James Lovelock at the Royal Society on 29th October 2007 is available on <http://www.jameslovelock.org/page24.html>.

### 2.1.2 The *Heuristic* function

The strength of Gaia metaphor inspired *science* as well as culture, religion and politics, giving rise to a new scientific discipline: *Geophysiology*. A new broader-based general science that helps to overcome the divorce of the earth and life sciences providing an environment within which separate disciplines – like chemistry and biology, geophysics and physiology – could interact in order to better analyze planetary-scale problems for which it postulates that emergent properties (e.g. homeostasis) exist. The idea is that approaching *system-control problems* like temperature regulation, it is useless, if not theoretically wrong, to adopt different techniques for studying physical and behavioral properties. This is the case for Earth studies where “For practical purposes it may be useful to consider the earth as if it were a living organism” (Lovelock 1991: 3), thus exceeding the division between *earth sciences* (e.g. Geophysics), studying the evolution of *a-biotic* elements through the deterministic laws of physics and chemistry, and *life sciences* (e.g. Biology), who analyze the development of *biotic* organisms as described by Darwin’s natural selection mechanism. Following *Gaia* hypothesis, in no way do organisms simply adapt to a dead environment determined by physics and chemistry alone; life itself affects the environment instead. These feedbacks between life and its environment cannot be ignored if we want a deeper understanding of our planet, of the life it hosts, and finally, of our planet’s life. The so-called *biological pumps*<sup>7</sup>, which are likely to be responsible for keeping *Gaia* conditions good for life, are more and more studied by the pioneering branch of ecology called *Global Ecology*.

### 2.1.3 The *Cognitive* (or *Theoretical*) function

The force of the *Gaia* metaphor as communicative, pedagogic and heuristic device is strictly linked to its major limit: in fact, despite being a good scientific theory *Gaia* does not perform a strong *Cognitive* or *Theoretical* function in Bradie’s meaning. *Gaia evokes* pretty well what this “new look

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<sup>7</sup> An example of biological pump is the effect of the ocean-atmosphere interaction on Carbon Dioxide concentration: ocean productivity affects atmospheric CO<sub>2</sub> by the export of both organic carbon and calcium carbonate (CaCO<sub>3</sub>) from the surface ocean to depth; the downward transport of organic carbon extracts dissolved inorganic carbon from the surface ocean and atmosphere, sequestering it in the deep sea. Scientist are currently trying to clarify the complex mechanism which regulates the extremely stable concentration of Oxygen in atmosphere.



on life on Earth” (Lovelock 1979) is giving rise to a number of pioneering research in systemic ecology, but it *does not prove* in any way the necessity of this radical change; this is why *Gaia* had a great cultural as well as political impact while remaining a scientific hypothesis and not a demonstrative tool. It’s this lack of demonstrative power that pushed Lovelock himself to introduce another powerful scientific metaphor – the computational model *Daisyworld* – to provide a stronger justification of his theory. *Daisyworld* is an elementary computational model simulating how in a simple world, seeded with black and white daisies and exposed to a constant increase in solar irradiation, global temperature is maintained optimal through this external change by means of the regulation of the density of the two populations. This is possible because dark and light daisies have different *albedos*, that is reflectivity power: black-colored daisies are dominant in the first phase of planet’s life, the cold one; they absorb solar irradiation since temperature achieve above 22.5 °C when white-colored daisies begin to flourish; their ability to reflect solar radiation results in a global cooling. Changes in number of black and white daisies help to maintain an optimal temperature for a wide range of solar luminosity: this is *homeostasis* at work.

Models are traditionally considered the better metaphorical way of doing science in virtue of their representational nature and they are particularly useful when dealing with complex systems whose study unavoidably involves computer simulations. The problem with *Daisyworld* is that it is too simplistic, and that it only proves, at best, the “weak” version of *Gaia* hypothesis plus the so-called “*Homeostatic Gaia*”; the “strongest” idea that Earth is to be considered as a living system basically remains untestable.

### 3. Conclusion

The richness of the *Gaia* hypothesis makes it very difficult to shed light on its complex meaning: in its so-called “weak” variant the controversial hypothesis became a well accepted theory while its “strongest” (unfalsifiable) version seems to bring the major cognitive contribution providing a real *new* way to look on life on Earth. The idea that Earth is a living system inspired art, philosophy, religion and politics as well as sciences, making us aware of what is our place in the world: we are a part of the *superorganism* Earth whose evolution is affected by our behavior. After an entire life spent as a scientist, Lovelock himself stated: “Perhaps the greatest value of the *Gaia* concept lies in its metaphor of a living Earth, which reminds us that we are

part of it and that our contract with Gaia is not about human rights alone, but includes human obligations”. This extremely inspiring idea comes neither from the scientific hypothesis nor from the theory, it comes from the metaphor. This is the strength of *Gaia*.

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# Metaphors and the Ontogenesis of Universals\*

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## 1. Premise

In the wake of the studies, first, of Max Black (1954) and, later, of Lakoff and Johnson (1980), many scholars have focused their attention on the cognitive status of metaphors. Roughly speaking, metaphor should not be considered, in this perspective, as a purely linguistic phenomenon, but also as an intellectual process embodied in, or related to, our higher cognitive competences such as categorization and representation of the world.

Actually, even Aristotle, and some of his commentators, were fully aware that a metaphor is not merely a rhetorical device, a matter of “style”. Indeed Aristotle (Guastini 2005) highlighted the cognitive and ontological status of metaphorical expressions, dealing with these in the context of *Rhetoric* and *Poetics*, but going – with his usual analytical power – beyond a conventionalist and ornamental interpretation of rhetoric figures.

Starting from the above-mentioned contemporary authors, and from the interpretive work of Aristotle’s writings, an extensive literature on the concept of metaphor was developed over the last decades; at first involving lin-

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guistics and philosophy, metaphor has now become the subject of a broad area of research in the fields of cognitive science and neurosciences.

We are aware of the complexity and richness of these studies but in this paper we will attempt to illustrate a more restricted philosophical hypothesis on the relationship between metaphor and concepts. We will focus our analysis on a particular kind of metaphor related to perceptual concepts (like colours and physical sensations).

It is our intention to suspend judgment on two issues concerning “universals”, or as they are called today, “concepts” (we will use the two terms as synonyms)<sup>1</sup>. So, we will make an “*epoché*” on the problem of the reality of universals, and we will also ignore the question of whether they are innate or learnt. Even though this *epoché* could be problematic, we will not take any stance on these two issues; we would like to propose an interpretation of the relationship between metaphors and concepts that could be assumed as plausible for the following four combinations of philosophical positions: realism-innatism (Plato, Leibniz), empiricism-realism (Aristotle), nominalism-innatism (Chomsky), empiricism and nominalism (Lakoff).

The problem we face concerns the ontogenesis of universals, that is, how we come to discover or invent them (depending on whether we are realists or nominalists).

The idea that metaphor may play a role in the genesis of universals, particularly in the field of perception, can be suggested by some relations that psychologists and linguists have established between cognitive processes and the use of figurative language. Among the many examples, we can highlight the studies dealing with synesthetic experiences. According to some psychological researches (see Marks 1996), synaesthetic experiences derive from similarities between different perceptual channels, which are embodied in the nature of perception and in the common structural basis of sensibility. Thus, according to these studies, the bases of non-literal expressions are non-linguistic processes in our cognitive and perceptual system (see also Cacciari 2005); nevertheless, only in the context of an interaction between linguistic phenomena, perception and higher cognitive processes we can understand the most complex human intellectual skills like metaphorical thinking. The work of Lakoff and Johnson (1980) has shown, quite convincingly, that our intellectual experience is shaped by the use of metaphorical language and thus metaphor is a phenomenon tied to the conceptual framework through which we understand and categorize the world. The analysis delivered by the two American scholars is in fact well suited to all

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<sup>1</sup> This synonymy is only for practical purpose, it is not a thesis.

the examples reported in their seminal work, which mainly covers the more abstract concepts (love, discussion, time, emotional states and so on).

Here we are interested in the most basic level of categorization, which concerns perceptual experience. We note that, although the issue should be treated empirically, i.e. through the psychology of learning, there remains a philosophical core: the conscious procedure we use to understand concepts. “Conscious”<sup>2</sup> in this context means that anyone can interrogate himself and try to investigate the path followed in the formation of concepts (Pedrini 2009). In other terms we will not bring actual arguments favouring the thesis according to which metaphor is relevant in the apprehension of perceptual concepts, since these arguments should be mostly of an empirical nature. On the other hand, we aim at a clear and rigorous formulation of such thesis, however providing some hints favouring its plausibility.

## 2. Conceptual behaviour: a definition

To address the problem we are interested in, we must first define what we mean by “universals” or “concepts”. To do this we distinguish different kinds of *behavioural learning*. Our classification is primarily a sort of heuristics and is used just to identify a sufficiently precise definition of conceptual understanding or competence.

I. *Discriminatory*: the living being X learns to distinguish the stimulus<sup>3</sup> *a* from the stimulus *b*. For example, looking at the experiments in Tolman’s “*Purposive Behaviour*” (1932), a mouse in a maze goes to the left because he knows that there will be food.

II. *Analogical*: the living being X learns to recognize the similarity between the stimulus *a* and the stimulus *b*. For example, the mouse goes to the left at different angles of the junction. Taking again the case of Tolman (1932), when the starting point of the maze is changed, the mouse is able to reach the food by adapting its response to an altered environmental situation.

III. *Signaletic*: the living being X learns to recognize the meaning of the stimulus *a*. For example, a flash of light stands for the presence of food in a certain place.

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<sup>2</sup> “Conscious” does not mean “aware”, but only accessible in the first person.

<sup>3</sup> From now on we refer to types and not tokens.

IV. *Signaletic-analogical*: the living being X learns to grasp the meaning of a class of similar stimuli. The light in the previous example could be of a different, yet similar, kind.

V. *Signaletic-discriminatory*: the living being X learns to distinguish between the meaning of the stimulus *a* and that of the stimulus *b*. For instance: if the light is red, the food is on the left, if it is green it is on the right.

VI. *Instrumental*: the living being X learns to modify the environment in order to achieve his own aims. Think, for example, of the chimpanzees in Köhler's experiments, (in *The mentality of apes*, 1925) moving boxes to reach a hanging banana or the recent ethological observation of monkeys using a stick to chase ants.

VII. *Instrumental-analogical*: the living being X learns to modify a set of similar environmental conditions in order to achieve a goal. In the previous example, different types of objects could be used to achieve the same purpose.

VIII. *Instrumental-discriminatory*: the living being X learns to distinguish between two different environmental situations and apply in both cases the appropriate behaviours.

IX. *Absence-oriented*: the living being X learns to modify the environment by using something that is not present. For example, the chair or the box of Köhler's monkey could be in another room.

X. *Classificatory*: the living being X learns to gather all the objects that have a certain perceptual feature in common.

XI. *Pseudo-conceptual*: a behaviour that is classificatory and absence-oriented.

XII. Propositional and pseudo-conceptual or simply *conceptual*: the living being X learns to give the order<sup>4</sup> to a co-specific living being to gather all the objects – including those not present – that are perceptually similar to one another in a certain feature.

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<sup>4</sup> “Giving an order” or uttering some other locution asking to accomplish a task sufficiently abstract.

Let us observe something about this classification. Here, we are not interested in which species are able to learn certain behaviours (see for instance Vallortigara 2000). In addition, in all cases we are dealing with learning, so that we are trying to neglect instinctive, non-conscious behaviours. It should be noted that it is not always clear whether different living beings<sup>5</sup> dealing with these tasks use the same procedure. We must also say that the chosen order is ideal and we have followed just a general principle of epistemic priority: as the order number increases, there is also an increase in the difficulty of the task. For instance, it seems that II (Analogical) presupposes I (Discriminatory) and needs a more sophisticated cognitive elaboration of the stimuli. However, in nature there may be beings that can learn *unconsciously* higher behaviours in the scale without mastering the previous ones.

Even though it is plausible, as some people claim, that there is a non-linguistic learning of concepts, here we refer only to a linguistic learning, since our definition in XII presupposes a sufficiently articulated common language. Indeed, “giving orders” or “asking” are based on the use of a propositional content: “make *this and this*”. Perhaps there are other behaviours having propositional content which are not linguistic, but we will concentrate only on linguistic ones. Finally, we note that we have always referred to the learning of a behaviour, and not to behaviour in itself, in order to identify those concepts that are learnt. The fact that they are learnt does not say anything about the problem whether they were innate or acquired; they might be simply remembered. Nonetheless if they are learnt, it is more probable that they are conscious.

That said, we can formulate the following definition:

The living being X has understood the perceptual concept *y* if X is able to learn the conceptual behaviour relative to *y*, that is, if X is able to learn how to prompt another living being to gather all the objects that are similar in *y*, including those not present.

We note that we have referred to the understanding of a concept. This means that although the definition of a concept is based on competence, there is always an involved mental representation too. Therefore we embrace a sort of minimal psychological realism: if X is able to learn the conceptual behaviour for *y*, he also has a mental representation of *y*. The best way to represent the concept *y* in a *scientific* manner is a function that

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<sup>5</sup> “Living beings” means humans as well as animals.



assigns the value 0 to the not-to-be-gathered objects and 1 to the ones to be gathered, that is, by a kind of “Fregean” sense.

We talk about similarity in  $y$ , not identity, because, although the similarity is perceived before the identity, a behaviour that assumes the resemblance is more difficult from the mental point of view, inasmuch as this deals with a relation between concepts. For example, if one takes a quick look at two objects that are similar in colour, let’s say yellow, we notice the similarity even before we realize that they are both yellow. However, if we need to gather all the objects that are more or less yellow, it means that we are able to conceptualize the yellow as compared to its brightness, texture, etc. So this kind of order testifies to a more complete mastering of the concept  $y$ .

The meaning of the absence-related clause we have included in the definition – “objects not present” – is to make explicit the potentially infinite extension of a concept.

Last but not least, it is important to underline that the transition from pseudo-conceptual to conceptual behaviour regards not only the cognitive mastery of a certain concept but also a linguistic understanding and awareness, which is represented, for instance, by the ability to give an order based on a certain quality  $y$ . Therefore the so defined characterization of understanding of a concept presupposes a conscious use of language.

In this way, it should be noted, we have established a sufficient, not-necessary, condition for the individuation of conceptual understanding.

### **3. Genesis of universals: some philosophical positions**

At this point we raise the issue that interests us. Considering the living beings that are able to understand concepts and recalling that the understanding of a concept is always a learning, the question is: what conscious procedure is followed in learning a conceptual behaviour, i.e. in understanding a concept?

In order to learn the conceptual behaviour about  $y$  (henceforth “the concept  $y$ ”) one must be able to express linguistically the action of gathering all the objects similar in the perceptual quality  $y$ .

The first possible answer is the one developed by empiricists like Hume (1748) and Brentano (1916)<sup>6</sup>. The transition from individual to general is

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<sup>6</sup> It is well known that Hume assumed an empiricist stance on universals, which were based on a psychological attitude referring to something individual. Brentano as well was an em-

based on a shift in the focus of attention. According to this point of view, perceiving “a red table” is different from perceiving “a table as red”. In the second case a subject X pays attention to the *red* of the table rather than to the *red table*. This perspective has been acutely criticized by Meinong (1877) and Husserl (1901), who noted that the red of the table is not an actual part of the table, so a focus on it has to be related to a very special process that must be adequately investigated.

The solution envisaged by Husserl (1901 and 1948) is based instead on the fact that red is a *non-independent* part<sup>7</sup> of the table, i.e. a part of an entirely different type, for example, from the leg of the table which is a *separable* part. In this perspective, the transition from the red table to the “red” could be mediated by a material essence of things themselves in the world of perception, namely by the fact that red is a non-independent part of the table. Husserl’s solution certainly contains a partial truth, but it does not deal with the linguistic aspect, which is an essential element of the mediation that allows the passage from individuals to concepts.

It could be that X proceeds as follows: he first sees the object 1, after a while he sees the object 2, and comparing them he realizes that they are similar. X then builds an equivalence class of the relation of similarity for every different feature. This is the procedure followed by Carnap (1928) in the *Logische Aufbau der Welt*. Over and above the evident unreality of this suggestion, we know that it does not work, as shown by Nelson Goodman (1951), since the relationship of similarity is not transitive and therefore it is not an equivalence relation. The problem can be connected with the so-called argument of the “imperfect community”, analogous to the problem of family resemblances we find in Wittgenstein. There could be, for example, three things with dyadic relationships of mutual similarity, which do not share any common property. So it seems impossible to obtain abstract properties through a similarity relation between individuals.

Quine in *Word and Object* (1960) outlined a more realistic hypothesis on the formation of concepts. The great American philosopher argued that a child, before grasping the divided reference of general terms and after he has learnt to produce occasional sentences, uses different terms such as “mom”, “water” and “apple”, which are semantically different for us, as “mass terms” in the sense of Jespersen, namely as terms whose reference is spread without being completely divided. It is important to distinguish

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piricist who posed all the burden of universality on the act of referring to objects and not on objects themselves.

<sup>7</sup> Today ontologists would call it “trope”.

between the mass term “milk” and the concept “Milk”. It is clear that in adulthood we use the term “Milk” as a complete abstract universal, whereas the mass term “milk” is a step toward generalization. The mass term “water”, for instance, can act as both a subject in “the water is safe to drink” and as a predicate in “the sea is salt water”. That is why mass terms can be the main intermediate in the difficult task of climbing from singular terms to general ones. This hypothesis is very fascinating and considers language seriously, but attempts are needed to test it empirically. The main objection to this idea is that mass terms, as singular terms, have a reference, which is, so to speak, merely perceptual, so they do not seem to be able to act as a bridge to the concepts. The reference of the proper name “John” and the mass term “milk” is always concrete, so it is not clear how it can convey the speaker to mastering concepts which are related to perception without being sensible intuitions.

Now, after a brief discussion of metaphors, we propose an answer to this question built on their basis.

#### **4. Features of metaphors**

We do not believe that there is such a thing as “metaphor” and we must give an explication of its essence. Nor – we believe – should one give too much importance to our pre-analytical insights about what a metaphor is; these, as is known, are a bunch of beliefs that can be contradictory and have a mainly practical relevance. It is better for our purposes to provide a definition of what, for us, is meant by metaphor, without attaching too much importance to cases we would call metaphorical but that are not included in the proposed definition.

Following Aristotle (*Poetics*, 57b 6ff.), by metaphor we mean an “inappropriate” use of terms. We talk about metaphor when we are in the presence of an attributive use of a term in a communicative context in which such use is not common. For Aristotle, the metaphor

is a violation of proper usage, yet a violation that unlike other misuses can make things clearer. And it can do that, because it is based on a different kind of adequacy [...], not related to the certain order of identity, which is also tautological, but to the more complex and subtle order of similarity (Guastini 2005: 3, our translation).

If we say “you are fire”, it is clear that this does not mean that our interlocutor is burning, but that he is red like fire or hot like fire. So meta-

phorical utterances are, in principle, all false, but a subject who is competent (cognitively and linguistically) can quite easily recognize when a sentence should not be interpreted literally. This perspective is not the only one available. Let us briefly review other points of view, even though we can assume that our hypothesis fit into different conceptions on what a metaphor is and on how it works.

Black argued that it is a sort of violation of strong metaphors' "philosophical grammar" to attribute them truth or falsity; here "strong" refers to metaphors that are irreducible, not merely decorative, and they cannot be replaced by a literal expression without loss of something (Black, 1979). In these cases, metaphor does not work as a purely factual statement – whose truth we can judge – even though it aspires to reveal us something of the world. From this point of view – Black notes – metaphor is similar to models: explanatory models, used in various fields, do not represent statements about facts – about how things are – but they are structural similarities whose correctness or appropriateness one can evaluate (Black 1979).

A different view is held by Eco (2005), according to whom the so-called "alethic" test is a first step, though not sufficient, to identify a metaphor. Other figures of speech, however, such as metonymy, appear to be false and as such they require, like a metaphor, a non-literal interpretation.

Davidson (1978) claims that a metaphor is trivially false, while a similitude is always true, and this feature – the philosopher says – is part of the very functioning of a metaphorical expression. However, in his analysis of metaphor, Davidson strives to prove that we are still not justified in believing that there is a special kind of meaning, different from the literal one: it is in the "purpose" and in the use that the peculiarity of a metaphorical expression lies:

I think metaphor belongs exclusively to the domain of use. It is something brought off by the imaginative employment of words and sentences and depends entirely on the ordinary meanings of those words and hence on the ordinary meanings of the sentences they comprise. [...]

Metaphor makes us see one thing as another by making some literal statement that inspires or prompts the insight. Since in most cases what the metaphor prompts or inspires is not entirely, or even at all, recognition of some truth or fact, the attempt to give literal expression to the content of the metaphor is simply misguided (Davidson 1978: 33, 47).

However, even if one can agree with Davidson or Black, things are somewhat different in the perceptual field, where one can talk about learning to use metaphorical language precisely because we learn to distinguish

between sentences that are based on intrinsic similarities in the perceptual world and others that are not. Indeed some sentences are, so to speak, “materially” based. For example, “you are a Ferrari” means that the interlocutor is very fast. Generally speaking, there must always be something behind the appropriateness and strength of a metaphor and this can be seen in analogy. Aristotle himself pointed out that analogy is a fundamental tool for knowledge and it makes a metaphor not only intelligible and appropriate, but also rooted in the essence of things (Guastini 2005).

Following this line of reasoning, metaphor always presupposes a proportion like “A is to B as C is to D”. For example, “you are a Ferrari” is based on conversational implicature like, “you are to your walk, like a Ferrari is to its darting”.

Someone who runs fast is not always said to be “a Ferrari”. Moreover it may even be that the use of a metaphorical term becomes non-metaphorical: for example, in “speak fluently”, or in “the leg of the table” almost nobody still recognizes a metaphor. The latter are examples of “dead” metaphors, or metaphor with little emphasis: in these cases it is easy to imagine a substitution of the metaphorical term without losing anything in the content. It is also clear that the distinction between metaphorical and non-metaphorical is matter of degree so that the two stand in a relation of contrariety rather than contradictoriness. To sum up, the novelty of Max Black and Mary Hesse (1972), compared to Aristotle, lies above all in the awareness of the historical and conventional character of language which affects metaphors too.

From now on we will refer to metaphors such as “you are a pepper” or “your face is a sheet”<sup>8</sup>. These metaphors are implicit analogies such as “x is to you, as x is to the sheet.” It is important to leave out the unknown variable, as in the metaphor we have not yet understood the white colour, which is the basis of this linguistic expression. If we already had the term “white”, then the metaphor would be reduced to a comparison. But a good metaphor, as Aristotle (*Poetics*, 59a 7-8) says, shows a similarity, or brings before our eyes (Ibid. 58a 24-25) or even fosters learning and knowledge through the genus (*Rhetoric*, 1410b, 14-15). When metaphor has accomplished its role of abstraction, expressions such as either “your face is a sheet” or “you are a pepper” become “your face is *white* as a sheet” and “you are *red* as a pepper”. The latter are comparisons completely explicated, and they are no

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<sup>8</sup> We are using here examples drawn from the Italian language that can sound weird to non-Italian speakers. We must also admit that these metaphors are based on perceptual qualities but they draw attention to more abstract qualities like feelings and states of mind (shame, fear and so on). These metaphors are still useful examples for explaining the relationship between perceptual concepts and metaphorical thinking.

more metaphors, since, as it will be clearer in the following, metaphor is not a comparison. Certainly, expressions without the abstracted terms sound weird to our linguistic sentiment, because we have already grasped the underlying abstractions. These expressions without universal terms tell us the actual working of a metaphor and not its cognitive result, that is concepts. For this reason they appear uncommon.

Reducing metaphor to a comparison, to an unstated similarity, would deprive metaphorical expressions of their peculiarities compared with those statements that should be taken literally. The point highlighted by Black is that reducing metaphor to a comparison would require an understanding of what is similar in the two terms compared: it is not clear how this can happen when the two terms are associated in a metaphorical way, which is often so creative and unconventional. This is how metaphor can help to reconstruct the genesis of concepts, without assuming a naïve and problematic notion of similarity. According to Black, following Aristotle, the metaphor creates or discovers this similarity, without presupposing it conceptually, so acting as a persuasive and emphatic instrument that cannot be reduced to a simple simile<sup>9</sup>.

Furthermore, metaphor does not have reversibility that a simile, i.e. a literal comparison, usually has. The relationship established between terms in a metaphor (“you are a pepper”, “Richard is a lion”, “love is a war”, etc.) has a specific “direction” that, if reversed, would become trivially false, uninformative or meaningless. Some have argued that because of this feature, metaphor should be interpreted rather as a kind of implicit class-inclusion assertion (Glucksberg and Keysar 1990). For instance Richard and the lion belong to the same genus as “very courageous living beings”. Insofar as a metaphor is a sort of inclusion of something in a category of a higher order, a metaphorical expression would present a precise order in the relation between subject (topic) and predicate (vehicle), which cannot be reversed. A metaphorical analogy, such as those based on perception that we are here referring to, cannot be reversed as a simile, precisely because it establishes an asymmetrical relationship as the inclusion of the subject in a superordinate class. To save the comparison theory one could account for this irreversibility in terms of a “salience imbalance” between properties of topic and vehicle. If for instance we say “sermons are sleeping pills”, the property of inducing sleep is salient in the vehicle (the pills), not in the topic, so this property is stressed by the metaphor and it makes the reverse statement uninteresting or empty (Glucksberg and Keysar 1990: 6-7). How-

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<sup>9</sup> On this issue see also Ricoeur (1975).

ever, this peculiarity inherent to a relevance relationship of certain properties of the terms involved in metaphorical statement can also apply to a non-metaphorical simile, which may well lose its informative value if reversed (Ibidem). Consider for instance an Italian context in which someone states “Italy is like Greece”. It is clear that “Greece is like Italy” is true as well, but it is also non-informative. The point is that the Greek economic situation is problematic and the statement “Italy is like Greece” informs us that the same holds for Italy. The theory of metaphor as a class-inclusion assertion of the subject in a class solves this difficulty. It should be noted that from the point of view of this interpretation one can also speak of the truth of a metaphorical expression, as long as one understands properly the type of categorization that this produces. This categorization is not an entirely new way of understanding a metaphor. On the contrary, the explanation in terms of Aristotle’s theory and Porphyry’s trees reduces some metaphors to an inclusion of a species in the genus, thus appealing to a typical non-reversible logical relation (see Eco 2005). Nonetheless it is important to emphasize that this subordination is altogether implicit: only the full understanding of the concept will make the categorization explicit.

Beyond the structural irreversibility of a metaphorical statement, some of these studies highlight another important issue. The vehicle of a metaphor, as opposed to a literal interpretation, should be interpreted as a prototype concept, not as a single instance of an object (Glucksberg and Keysar 1990: 8).

In the statement “my job is a jail” the vehicle refers to a prototype, an emblematic object of a category that includes both terms of the metaphor: the set of things that are involuntary, forced, unrewarding, unpleasant, and so on (Glucksberg and Keysar 1990: 8).

The function of metaphor is to create or find an unknown similarity between two things, at a first sight unrelated, discovering or establishing a higher category through one exemplification (in this case, the prison), claiming at the same time the inclusion of the topic itself. Therefore, it would be the categorization process – that we see as indirect, as almost unconscious – that establishes the similarity between two objects, not *vice versa*.

In this regard, the ideas of Black, Lakoff and Johnson are important to understand how an interaction between the two terms is involved and a projection of a set of meanings and implications related to the vehicle on the subject of the metaphor is accomplished. Although this may not be perfectly consistent with the idea expressed by Glucksberg and Keysar of metaphors as a categorization process, it allows us to understand how a commonality is

either established or caught, appealing to the exemplarity of a prototype. So the interaction between vehicle and topic could make some properties of the first more salient, delineating its “exemplarity” and highlighting the features involved in the recognition of similarity. Having established the relationship between the two terms, the metaphor works partially as a model and, as Lakoff, Johnson and Black argued, the subject can share some of the implications pertaining to the vehicle.

Before passing on to our proposal, a brief digression on the importance of prototypes in psychology of universals is in order.

An alternative view about the nature of concepts is the theory of prototypes elaborated by Eleanor Rosch (see, for example, Rosch 1975). This conception is opposed to what is called a “classical theory” of concepts, which assumes that they have a clear identity and an unambiguous definition under necessary and sufficient conditions for membership.

Rosch highlighted the asymmetry between members of a category: among them there is a variable degree of representativeness or exemplarity. In other words, some members have properties more characteristic of that particular category and are thus defined as “prototypes”. The prototypes represent “cognitive reference points” (see also Lakoff 1987: 45), that are the basis for inference and categorization. From these studies derives also the important discovery that in a hierarchy of categories (e.g. animals, mammals, dogs, retriever), there is a basic level whose role is prevailing in the organization of knowledge; basic categories are the main reference in common knowledge and in communication and they coincide with the set of members that are more easily identified through perceptual and functional properties, iconicity, and whose language expression is mastered at an earlier stage (in the example, dogs). This level is therefore the one that is closest to physical and perceptual experience (Lakoff 1987: 48).

This more realistic theory of categories (concepts) can provide some insights into a “cognitive” analysis of metaphor. Let us note some points (Lakoff 1987: 56) which are important in understanding the relationship between concepts and metaphors.

- In the constitution of a concept there are important prototypical effects related to most exemplary members.
- The properties that define a category are sometimes interactional, which means that they arise from the interaction between subject and environment; for example, there are several cases of functional, or teleological properties, or cases of properties that depend on the contexts of reference.



- Some concepts are the result of interaction between the physical world, the biology of the individual and the cultural context, and are therefore “embodied”<sup>10</sup>.

## **5. Metaphors and concepts**

It seems plausible for us to affirm that the metaphorical use of language is a milestone in learning and mastering concepts, not only those of an abstract nature but the perceptual ones as well. The cases of metaphors dealing with more abstract, not physical nor perceptual, concepts are more evident and easy to find in common language. We point at the analogy between the more abstract metaphorical thinking and the cognitive competence that is more anchored to the perceptual and physical realm.

With regards to the examples we have considered, at a first sight one could argue that in the categorization of “white” it would be much better to compare milk with snow, rather than someone’s face with a sheet. That can be plausible unless it brings us back to the empiricist’s thesis, according to which we identify the white colour by looking at a number of white objects and by paying attention to the qualities they have in common. The point is that metaphor allows us to bring that similarity into our linguistic competence, so that we can represent it; without metaphor we would not know where to focus our attention.

We think that metaphorical thinking has the peculiarity and the cognitive strength involved in the act of abstracting from particulars and in the formation of concepts. That peculiarity relies on the metaphorical competence, which consist on being able to “bring-together” different things and to discover similarities. Our conviction is that metaphor has a preeminent role in this kind of intellectual processes, but we leave open the issue about the function of other rhetorical devices, as simile, in the formation of concepts. What is probably crucial in the relation between metaphor and conceptual behaviour is the fact that a metaphor says much more by leaving inexplicit the relation of likeness, whereas a comparison, even though could play a similar role in the understanding of concepts, is less demanding on subject’s ability to establish similarities and to abstract qualities.

Here it could be useful a comparison with the points of view we have listed above. In a certain sense both Brentano-Hume and Carnap do not place the process of generalization *a parte objecti*. On the other hand, both

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<sup>10</sup> On this point, we must admit, it becomes more difficult to maintain our neutrality, stated at the beginning, about the ontological status of concepts.

Quine and Husserl individuate an intermediation between particulars and universals: the former from a linguistic point of view – mass terms – the latter from a strictly perceptual perspective – dependent and independent parts of perception. In other terms, the empiricist stance leaves completely unexplored the actual process of generalization, hence it seems to us incomplete. On the other hand, both Quine and Husserl enucleate at least partially the process. From this point of view their investigations are better than those of empiricists. But none of them is able to explain how it is possible the passage from a perceptual content to a linguistic structure, since Quine's hypothesis is already linguistic, whereas Husserl's is altogether phenomenological. Metaphor could be the bridge between language and sensation we are looking for.

Another important objection to be considered is this: words like “pepper” or “sheet” are already concepts of an even more complex nature than “white” and “red”. How can we use what is more complex to learn what is simpler? There are two answers to this argument: first, one can imagine a primitive language of names and objects that are more basic compared to the abstract concepts of properties, and secondly, “pepper” and “sheet”, as everyday objects, are probably caught earlier than the concepts of “white” and “red”, which are genuine abstractions. Similarly, the perspective of Lakoff and Johnson is based on the idea that “mappings are not arbitrary, but grounded in the body and in everyday experience and knowledge” (Lakoff 1993: 245). As we have seen at the end of section 3, the role of certain categories is anchored to perception, to the definition of a function and to an image-like nature: stronger is this role more basic the categories are.

Following Aristotle again, we can say that a metaphor is appropriate when it is based on a similarity. At this point, we can offer our thesis:

The key step in the ontogenesis of universals is the learning of appropriate perceptual metaphors. That is, the ability to understand the meaning and the use of universal properties such as perceptual qualities could be connected with learning metaphors.

The relationship between concepts and metaphors remains problematic and presents a sort of circularity: we understand some metaphors because these are founded on an actual analogy, for instance on a perceptual similarity that is highlighted, yet, on the other hand, it is the same metaphorical understanding that allows us to find a similarity through an analogy, an isomorphism that is revealed by the metaphorical relationship established between different objects.

It remains, therefore, a core empirical question to determine what ontogenetic relationship exists between the cognitive-linguistic mastering of abstract terms and the ability to understand and produce appropriate metaphors.

The problem is still quite open in terms of psychological research and we are not yet able to “see whether the understanding of perceptual metaphors originates in the perception itself and then undergoes a linguistic-conceptual mediation or whether the latter prevails from the start [...]” (Cacciari 2005: 341, our translation).

From an epistemological point of view, however, we believe that the acquisition of a conceptual behaviour goes hand-in-hand with the understanding of metaphorical expressions that are based on perceptual qualities. In simple terms, we could say that this idea requires a close relationship between perception and language in the constitution of universal terms like those pertaining perceptual qualities. The perceptual experience is clearly fundamental in grasping the sensible qualities and finding similarities, yet this, as we said, is not sufficient to derive abstract concepts. Therefore, the role of language and the (cognitive) mechanism of metaphorization are crucial for a bootstrapping process of abstraction from experience and for extending our power of categorization.

The idea of the relationship between concepts and metaphors, unlike Quine’s hypothesis about mass terms, creates a bridge between perception and language. And unlike Husserl’s phenomenological explanation, it takes into account the role of language in the formation of concepts. Referring to metaphor, this relation has the hybrid nature<sup>11</sup>, which a mental procedure that connects “two worlds” must have. However, this perspective does not exclude a role of mass terms and non-independent parts in the ontogenesis of universals. In contrast to Brentano’s purely empirical stance, our aim is to explain the passage – to fill the gap – between the individual and the general; it cannot remain hidden in the simple act of moving one’s attention.

From the point of view of the constitution of concepts, what seems fundamental in the metaphorical mechanism, is the effect of prototypicality. The established relation between a prototype and a property *y* contributes to the definition of *y*, even though this quality does not have a homogeneous and monolithic identity. Indeed, in the case of colour or other perceptual properties, it is quite evident that the processes of conceptualization struggle to domesticate the variety we find in experience. Prototypical members and

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<sup>11</sup> In the *Timaeus* Plato says that space is a “mongrel” concept, as it is both an ideal and sensible mean.

relationships between these and other exemplifications are involved in this intellectual process.

Looking at the relationship between universals and sensibility, it is interesting to return to the general perspective within which the Aristotelian theory of metaphor lies.

In Aristotle, insofar as metaphors are based on analogy, and the latter is something different from homonymy and synonymy (Guastini 2003: 94), they represent a bridge between things and words. The nature of analogical knowledge is, however, approximate. That is why for Eco (2005) metaphor requires an abductive reasoning, since the characterization in metaphoric terms of something is not unique. From this peculiarity derives the role of imagination and creativity in the production, as well as in the understanding, of metaphors.

Metaphor is thus an “immediate learning” based on approximate similarities that we find (or build) in appearances. In the Aristotelian *corpus*, in fact, metaphor lies in the field of *doxa* and *praxis*, rather than in *epistème* (Guastini 2003: 87, 88), in the field of argumentation and action, rather than in science. From this point of view, the difference with a modern approach is crucial: we have here placed metaphor in connection with the construction of universal concepts, the only ones that can be the real objects of certain knowledge in Aristotle’s philosophy. Nevertheless it seems that the core of the Aristotelian perspective allows the mediating role of metaphor to be clarified. If metaphor is the true mean to “speak in universal terms of what is not universal” (quoted in Guastini 2003: 90), it may represent the link between sensibility and universal concepts, between perception and

a substantial reality (*ousia*), which, for the becoming beings, that have matter and also form, can never get rid of appearance. *Ousia* lies in appearance, the knowledge of which cannot be achieved except through ways of universalization whose adequacy comes from a previous inadequacy [...] (*Ibidem*).

The analogical mechanisms of approximation, intuitive knowledge and creative expression (the metaphor) would therefore be the basis of the ability to abstract from experience, to universalize the qualities that in appearance are presented to us as disparate and unrelated. The abstraction requested by universal concepts may perhaps make use of the same approximation that regulates the metaphorical process and the categorization it can produce.

Following this reasoning, we can say that even the more general theoretical and philosophical background of Aristotle’s account of metaphor, not only its definition – to which only few elements have been added, according

to Eco – can play an important role in current theories of the relationship between language and experience, between metaphors and knowledge.

The interplay between metaphors and concepts we have addressed, however, suggests the idea, developed from an interpretation of the Aristotelian philosophy, of a relation between universals and less determined processes of cognition, based, as Lakoff (1987) and Johnson (1987) have also tried to show, on imagination and the “embodied” nature of knowledge.

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# Fallacious Analogical Reasoning and the Metaphoric Fallacy to a Deductive Inference (MFDI)

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## 1. Introduction

In this article, we discuss Lightbody and Berman's proposal to introduce a new fallacy of analogical reasoning (Lightbody and Berman 2010): the *Metaphoric Fallacy to a Deductive Inference* (MFDI), which, in the authors' opinion, should be seen as a special case of *false analogy fallacy*.

We view the introduction of the MFDI as only partly justified. We argue that, in some relevant cases, the kind of fallacy involved can be more aptly (and more simply) described as an *equivocation fallacy*, that is, *quaternio terminorum*. Consequently, as far as these latter cases are concerned, there are no sufficient grounds to introduce a new fallacy.

Given our purposes, we also present a formalisation of *fallacious analogical reasoning* that uses a set-theoretic framework.

Our exposition is self-contained: in Section 2 we summarise some basic notions. In Section 3, we describe the structure of *analogical reasoning* and *fallacious analogical arguments*, whose examination is crucial for our purposes. In Section 4 we discuss *quaternio terminorum*. In Section 5 we address Lightbody and Berman's proposal and set forth our full argument.



## 2. Some preliminaries

In this preliminary section, we briefly summarise some terminology, in order to provide the reader with all the notions required for the understanding of this work. All readers knowledgeable about logic may entirely skip this section.

The first, fundamental notion is that of *argument*. Arguments are made of *declarative* sentences, that is, sentences which *assert* something. The classical definition of declarative sentence dates back to Aristotle's *De Interpretatione*, 4:

Every sentence (*logos*) signifies, but not every sentence is declarative (*apophantikos*): only those sentences in which one can be right or wrong are declarative. For example, a prayer may be a sentence, but it is neither true nor false (Needham and Harbsmeier 1998: 182).

Hence, a sentence is a declarative statement which can be assigned a truth-value. Arguments are collections of a certain number  $n$  of sentences ( $n-1$  premises and one conclusion). In particular, as Epstein and Kernberger explain,

[...] an argument is an attempt to convince someone that a particular statement, called the conclusion, is true. The rest of the argument is a collection of claims called premises, which are given as the reasons for believing that the conclusion is true (Epstein and Kernberger 2006: 5).<sup>1</sup>

Logicians are especially interested in checking that an argument is *valid*, that is, that the conclusion really follows from the premises. If the premises are also true, the argument is said to be *sound*. In other terms:

- an argument is *valid* if its conclusion is true, whenever its premises are true;
- an argument is *sound* if it is valid and all its premises are true.<sup>2</sup>

The argument in footnote 1 is both *valid* and *sound*, as the reader can easily realise. One can also verify the *formal validity* of a certain argument by checking that it fits a valid *argumentation scheme*.<sup>3</sup>

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<sup>1</sup> For the uninitiated, consider the following trite example of a two-premise argument (a syllogism, to be precise): (P<sub>1</sub>) Socrates is a man; (P<sub>2</sub>) All men are mortal; hence (C) Socrates is mortal.

<sup>2</sup> See, e.g., Walton (2005: 49).

The notions of validity and soundness are crucial for evaluating arguments, but they also have some shortcomings.

On the one hand, mere reliance on the *semantic* definition of *validity* expounded above may lead to the acceptance of unintuitive arguments (consider, for example, the cases of *a fortiori*, or *ex falso sequitur quodlibet*-style arguments). On the other hand, it is not uncommon to come across *fallacious* arguments which are only *prima facie* valid (see Tindale 2006: 2 or Walton 2010).

Furthermore, *validity* and *soundness* are too strong for the purposes of the ordinary language. In particular, since we will be concerned with analogical reasoning, it can be shown that validity and soundness are too restrictive for the purpose of assessing the *legitimacy* of analogical arguments.

For all these reasons, we propose introducing weakened versions of these notions. For a start, consider the following argument:

(P<sub>1</sub>) John is 80 years old

hence

(C) John will be dead within 40 years

Strictly speaking, the argument is not *formally* valid (nor is it valid *tout court*, for that matter) since it is not an instance of a valid argumentation scheme: in principle, it might happen (although it is quite unlikely) that John will die at the age of 121 years. Yet, one feels some pressure to concede that, if the premise is true, the conclusion should also be held to be true. In other terms, one would feel that the mentioned argument, although not *valid*, is fully *legitimate*. But, if its legitimacy amounts to its validity, then the argument is not legitimate.

To fix this uncomfortable state of affairs, we introduce the notion of *strength* (see Groarke and Tindale 2004: 134, or Epstein and Kernberger 2006: Ch. 3), which is a weakening of that of validity:

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<sup>3</sup> However, this is a *sufficient*, but not *necessary* condition for an argument to be valid. *Formal validity* is a stronger form of validity (see Groarke and Tindale 2004: 144-150), as an argument can still be *valid*, even if it is not *formally valid*. For example, consider the following argument: (P<sub>1</sub>) John is a bachelor; hence: (C) John is unmarried. This is not a *formally valid* argument, since it is not an instance of any known valid *argumentation scheme*. However, it is obviously a valid argument, since the premise and the conclusion contain equivalent assertions.

- an argument is *strong* if it is very *likely* that its conclusion is true, whenever its premises are true.

By the definition just given, the argument above is *strong*. The concept of *strength* pairs with that of *goodness*, in the same way as *soundness* pairs with *validity*. We say that:

- an argument is *good* if it is *strong* and all its premises are *plausible*.<sup>4</sup>

An argument can be *strong* and not *good*. Consider one last example:

(P<sub>1</sub>) Rio de Janeiro is covered with snow

therefore

(C) it must be quite cold in Rio

Although, conceding the truth of the premise, the conclusion is likely, such a premise is definitely not plausible.

In the next section we will introduce and discuss the features of analogical reasoning.

### 3. Comparisons and Analogical Reasoning

Comparisons are very frequent in everyday language, and play an important role in our reasoning. Analogical reasoning is based on comparisons, in particular on statements such as: “A is *like* B”, “A is *analogous* to B”, or “A is *to* B as C is *to* D” etc.<sup>5</sup>

Epstein and Kernberger propose the following definition of analogical reasoning:

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<sup>4</sup> Epstein and Kernberger 2006: 37. We refer the interested readers also to Turner 1984, Bonissone 1987, and Borwein and Bailey 2008.

<sup>5</sup> However, in recent years there has been a debate about whether similes and/or metaphors are best defined in terms of *comparisons* or *categorisations* (see, e.g., Bowdle and Gentner 2005, Glucksberg 2001, 2008). The debate has especially focussed on similes and metaphors of the form “T *is/are like* S”, and “T *is/are* S”.

A comparison becomes reasoning by analogy when it is part of an argument: on one side of the comparison we draw a conclusion, so on the other side we should conclude the same (Epstein and Kernberger 2006: 37).

Let us briefly consider an example. Let us assume that

(P<sub>1</sub>) Yesterday was very cold and today is very cold too

and

(P<sub>2</sub>) Since yesterday was very cold, I came home with a headache

hold.

Given the premises (P<sub>1</sub>) and (P<sub>2</sub>), we derive the conclusion:

(C) *Chances are that* also today I will come home with a headache

This is an example of analogical reasoning. It should be noticed that the argument is *strong*. Furthermore, according to our *personal experience*, the statements (P<sub>1</sub>) and (P<sub>2</sub>) are plausible, hence, the aforementioned argument can also be considered *good*. However, the argument is far from being *valid*. If (P<sub>1</sub>) and (P<sub>2</sub>) are true, it does not follow that (C) is necessarily true. This shows that *strength* and *goodness* are particularly suitable for assessing the *legitimacy* of analogical arguments.<sup>6</sup>

Analogical arguments may have different forms, each corresponding to a particular way of creating analogies. However, all analogical deductions have the same structure: the comparison of two cases, A and B, that yields an argument with two premises, the *similarity*, and the *base premise*, respectively, and a conclusion containing an inference from the premises (Walton 2005: 96). More precisely:

- the *similarity premise* asserts that A and B share certain features *a*, *b*, *c*...;
- the *base premise* asserts that A presents an additional characteristic *x*;

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<sup>6</sup> For the sake of precision, following the terminology of Govier (Govier 1987: § 4, Govier 1999: § 9), one may say that the argument is an instance of *inductive analogical reasoning*, i.e. an argument containing a prediction based on our knowledge of an analogous situation which has previously occurred.

- the *conclusion* states that, by virtue of the similarity established by the premise 1, B also possesses the quality  $x$ .

In the previously mentioned argument, A and B are, respectively, “today” and “yesterday”; the feature  $a$  which A (today) and B (yesterday) have in common is “to be cold”, and the additional characteristic  $x$  is “to come home with a headache”. The *similarity premise* is (P<sub>1</sub>); the *base premise* is (P<sub>2</sub>); the statement “Today I will come home with a headache”, in which the additional characteristic  $x$  is transferred by the argument from A to B, is the *conclusion* drawn by analogy.

In order to understand what a *weak* or *fallacious* argument consists in, we now proceed to introduce a formalisation of analogical reasoning which will help us elucidate these two notions.

As said, analogical reasoning is based on the use of comparisons. Although comparisons resemble standard declarative sentences, they are not declarative sentences. When we assert that “A is *like* B”, we are not committing ourselves to stating that all the features of A are *also* features of B. A comparison only implies that *some* features of A are also features of B.

In other terms, whereas “A is B” implies that whatever is predicated of A is also predicated of B, “A is like B” implies that there exist some features of A which can also be predicated of B. A comparison, therefore, is not a *class-inclusion statement* of the form:  $(\forall x)(x \in A \rightarrow x \in B)$ , but rather a *class-intersection statement* of the form:  $(\exists x)(x \in A \wedge x \in B)$ . By asserting that “A is like B”, we, thus, take it for granted that the intersection of A and B is non-empty. Now, *what* and *how many* properties are shared by A and B, whenever we assert that they are analogous?

Unfortunately, there is no other way to respond to this the question but to check, each time a property of A is taken into account, that also B has it.

Let  $|A|=i$  and  $|B|=j$  be the cardinality of the sets A and B, whose members are, respectively, the properties of ‘A’ and ‘B’. We claim that, when we assert “A is like B”, intuitively we are fixing a threshold  $T$  such that the sentence “A is like B” is true iff  $T \leq |A \cap B| < i, j$ .<sup>7</sup>

Let us, now, resume the model of analogical reasoning which we have described above, which consists of a base premise, a similarity premise and a conclusion. Let us suppose that the similarity premise asserts that “A is

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<sup>7</sup>  $T = \min(n)$ , where  $n \geq 1$ , is the smallest number of properties shared by A and B, such that “A is like B” is true. The existence of a *threshold* is a necessary condition in order for the *truth-functionality* of analogical statements to be defined. It turns out that, in most cases,  $T = 1$  and  $|A \cap B| = T$ .

like B”, that is,  $A \cap B \neq \emptyset$ . This means that there are at least as many features as posited by  $T$ , which A and B share. However, as said, we do not know *what* these features are, and, at some point, we may stumble across features which are not shared by both sets. In other terms, the *similarity premise* does not guarantee that, if we find any additional characteristic of A, say  $x$ ,  $x$  also always belongs to B. In this latter case, the analogical argument is *weak* (that is, *non-strong*).

We are, therefore, ready to give the following definition of *weak* analogical argument:

**Weak Analogical Argument.** An analogical argument is weak iff the *similarity premise* does not guarantee, for a particular  $x$  in A, that the conclusion: “ $x$  is in A implies that  $x$  is also on B” is true (or, in other terms, that  $x \in A \cap B$ ).

In the argument examined above, the additional characteristic = “I came home with a headache” is likely to belong to both A = “cold day<sub>1</sub> (yesterday)” and B = “cold day<sub>2</sub> (today)”. This is the reason why the argument is strong. As we said, in many cases the set of *properties* which account for the truth of “A is like B” has cardinality equal to 1. Any argument whose similarity premise implies that  $|A \cap B| = 1$  will, of necessity, be *weak*. The reason is, no additional characteristic will be shared by the two sets.

Let us now proceed to examine *fallacious* analogical reasoning. It is generally assumed that

a fallacious argument, as almost every account from Aristotle onwards tells you, is one that seems to be valid but is not so (Hamblin 1970: 12).

Hamblin’s definition, although very appropriate, is unsuited for our purposes, as we do not care about the validity, but rather about the strength of analogical arguments. The following one seems more adequate:

A “fallacy” is a particular kind of egregious error, one that seriously undermines the power of reason in an argument by diverting it or screening it in some way. But a more precise definition is difficult to give and depends on a range of considerations (Tindale 2006: § 3).<sup>8</sup>

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<sup>8</sup> Tindale also distinguishes between *structure* fallacies (which fall under Hamblin’s definition) and fallacies related to *language problems* (Tindale 2006: § 4), such as fallacies of equivocation and vagueness (also known as *informal fallacies*).

In what follows, we have tried to summarise “the range of considerations” Tindale mentions in the quoted passage. Basically, we claim that, since we do not know much about  $A \cap B$ , we may be *deceitfully* led by the analogies used in the argument to ascribe to it a certain  $x$  that, for instance, could be in A, but not in B, and *vice versa*. In that case, we may say that the argument is fallacious: it is *prima facie* strong, but, in fact, it is weak. A fallacious analogical argument is, therefore, one which is made in such a way as to lead us astray in evaluating the *strength* of the argument.

We can summarise this through the following definition:

**Fallacious Analogical Argument.** An analogical argument is said to be *fallacious* if and only if it *seems* strong, but *is*, in fact, weak. Any such argument is fallacious, inasmuch as it leads us to ascribe to  $A \cap B$  a property which is not in A, but is in B and *vice versa*.

A fallacious analogical argument can also be described as one which establishes a *faulty analogy* as its conclusion. Fearnside and Holther explain the notion along the same lines as ours:

Faulty analogy consists either in assuming that shared properties will continue indefinitely to be found in new members, or in assuming that it is highly probable there will be some other shared property in a class so wide that there is only a low initial probability of finding any other shared properties relevant to the purpose at hand (Fearnside and Holther 1959: 4).

In our opinion, the formalisation we have presented helps clarify some crucial points concerning analogical reasoning and we will use it in what follows to elucidate further aspects of the question.

Before examining in depth Lightbody and Berman’s arguments, let us briefly review the fallacy named *quaternio terminorum* and its features.

#### 4. A fallacy of equivocation: quaternio terminorum<sup>9</sup>

Ambiguity may affect single words, statements, or even entire arguments (see, for instance, Kroeger 2005: Subsection 3.1 and Quine 1960: §§ 27-31). Statements or arguments can be ambiguous in two main different ways. A sentence (argument) will be:

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<sup>9</sup> Readers with some training in logic may skip also this section.

- *lexically ambiguous*: if it contains terms whose usage is ambiguous;
- *structurally ambiguous*: if it is the structure of the sentence (argument) itself that yields ambiguous interpretations.

In other words, lexically ambiguous statements and arguments are ambiguous in virtue of the terms that they contain, whereas structurally ambiguous arguments “create” their own ambiguity.

As an example, the ambiguity of the sentence:

“The Rabbi *married* my sister”

depends on the double meaning of the single word ‘married’ (which means both ‘celebrating a marriage’, or ‘getting married’).

On the other hand, the ambiguity of the statement:

“The man saw the boy *with the binoculars*”

is due to the fact that the expression ‘with the binoculars’ may be interpreted as referring either to the man’s or the boy’s using the binoculars.

In the former case, ambiguity is a property of a term in the statement; in the latter, ambiguity is a global (*holistic*) property.

Arguments affected by equivocation fallacies may appear *prima facie* strong. Quite often, deductions of this sort also seem *formally valid*. Closer inspection reveals their concealed weakness, in that they are based upon either form of ambiguity (lexical, or structural).

*Quaternio terminorum* is based on lexical ambiguity. Here follows a simple example of an argument containing the fallacy:

(P<sub>1</sub>) A star is a massive luminous ball composed of plasma in hydrostatic equilibrium

(P<sub>2</sub>) George Clooney is a star

hence

(C) George Clooney is a massive luminous ball composed of plasma in hydrostatic equilibrium



As one quickly realises, the reasoning involved in this argument hides a trap. The term ‘star’ has different meanings in the premises. While in the first premise it is assumed to refer to the *celestial body*, in the second one it means *movie celebrity*.

Historically, the name of this fallacy, *quaternio terminorum*, was coined in the context of the Aristotelian syllogistic theory (see Smiley 1973: 136-154). More precisely, as is widely known, according to Aristotle, the basic syllogism consists of three sentences: two premises (*major* and *minor*, respectively) and a conclusion, which, in turn, contains three terms: the subject, the predicate of the conclusion, and a third term (*the middle term*), which connects the subject of the first premise to the predicate of the second premise. If the third term assumes different meanings in the premises (like ‘star’ in the aforementioned argument), then the syllogism contains a fourth, hidden term: this fact gives rise to the fallacy.

To summarise:

A valid standard-form categorical syllogism must contain exactly three terms, each of which is used in the same sense throughout the argument. [...] If a term is used in different senses in the argument, it is being used equivocally, and the fallacy committed is that of equivocation [*quaternio terminorum*] (Copi - Cohen 1990: 206).

However, it should be noted that, although historically this fallacy is related to Aristotle’s theory of syllogism, it is by no means necessary that the argument containing the fallacy actually be a syllogism.

## **5. The Metaphoric Fallacy to a Deductive Inference**

We finally proceed to discuss the *Metaphoric Fallacy to a Deductive Inference* (MFDI) proposed by Lightbody and Berman. In their article, the authors define the MFDI as follows:

The MFDI is [...] committed when the following two conditions are fulfilled: (i) a faulty comparison is made between two things (false analogy); and (ii) this faulty comparison is then used as premise in a sub-argument that is supposed to prove some conclusion which is believed to follow deductively (Lightbody and Berman 2010: 191).

The MFDI would be a special case of the *false analogy fallacy*. The authors’ treatment of this notion is fairly similar to ours, except that we call

it *fallacious analogical reasoning*. Let us consider the argument presented by Lightbody and Berman in order to illustrate it:

- (P<sub>1</sub>) Human communities are analogous to beehives
- (P<sub>2</sub>) All beehives need a queen

hence

- (C) All human communities need a queen

The argument can be re-translated in the following way, according to our formal template:

- (P<sub>1</sub>) Human communities (A) are like beehives (B) [*similarity premise*]
- (P<sub>2</sub>) Beehives need a queen (the additional characteristic *x* is ‘to need a queen’) [*base premise*]
- (C) Human communities need a queen (also B has *x*)

The authors say that (C) is a *faulty analogy*, as the fact that  $x \in A$  is not sufficient to guarantee that  $x \in B$ . All this is in accordance with the results of our examination of fallacious analogical reasoning.<sup>21</sup>

Now, the MDFI would be a variant of the false analogy fallacy and would occur in a wider and more articulated reasoning context. In order for the fallacy to take place, one does not only require that a *faulty analogy* is created, but also that 1) the analogy be used as a premise in a further sub-argument, and that 2) the faulty analogy derives from relating *metaphors*. According to the authors, the invalidity of the whole argument would, then, be specifically *dependent upon* the use of *metaphors*, a fact which would warrant the use of the label ‘metaphoric fallacy’.

In order to illustrate the MDFI, the authors use the following example (Lightbody and Berman 2010: 189-190):

- (P<sub>1</sub>) The *heart* is like a *mechanical pump*

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<sup>21</sup>However, it would seem that Lightbody and Berman are not keen on distinguishing, as we have done, between *weak* and *fallacious* arguments. In view of our definitions, the argument proposed above may simply be viewed as *weak*. However, given the patent blurredness of the notion of *fallacy*, one can still say, as the authors do, that it is, in fact, fallacious. Note that the authors define fallacious analogical arguments as “*those wherein the similarity between the two components being compared is questionable or irrelevant*” (Lightbody and Berman 2010: 187).

(P<sub>2</sub>) The *heart* is like a *red, red rose*

From (P<sub>1</sub>) and (P<sub>2</sub>), we conclude that

(C<sub>1</sub>) A *mechanical pump* is like a *red, red rose*

Then, we use (C<sub>1</sub>) in a sub-argument, whose other premise is:

(P<sub>3</sub>) A *mechanical pump* can be *fixed*

Hence, from (P<sub>2</sub>) and (P<sub>3</sub>), we infer that

(C<sub>2</sub>) A *red, red rose* can be *fixed*.<sup>23</sup>

The argument above is also formally translated by the authors as follows

(P<sub>1</sub>) *Hx* is analogous to *Px*

(P<sub>2</sub>) *Hx* is analogous to *Rx*

(C<sub>1</sub>) *Px* is analogous to *Rx* (Inferred from 1 and 2)

(P<sub>3</sub>)  $(x)(Px \rightarrow Fx)$

(C<sub>2</sub>)  $(x)(Rx \rightarrow Fx)$  (MFDI)

where: the domain is unrestricted, and *Hx*= “*x* is a heart”; *Px*= “*x* is a mechanical pump”; *Rx*= “*x* is a symbol of love”; and *Fx*= “*x* is a fixable entity”.

Let us pause a moment to examine the argument and the authors’ claim that it represents an example of a new fallacy.

First, let us see what the authors themselves say about the first bit (P<sub>1</sub>-C<sub>1</sub>) of the aforementioned argument:

The structure of MFDI proceeds from analogously relating two metaphors and then claiming that a property (quality or function) from one compared predicate of the analogy is contained by the other predicate. That is, the predication is treated as being transitive across an analogy between metaphors (Lightbody and Berman 2010: 185).

We agree with the authors that incorrect analogical reasoning is at work in (P<sub>1</sub>-C<sub>1</sub>). However, it is far from clear that the reason is that some sort of

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<sup>23</sup> The italics throughout are all ours.

‘analogical transitivity’ across the terms in  $P_1$ ,  $P_2$  and  $C_1$  is fallaciously assumed.

To begin with, if  $P_1$ ,  $P_2$  and  $C_1$  were not analogical statements, the whole argument would simply be an *invalid syllogism*, and it is precisely because there would be no transitivity across the terms in the three statements that the syllogism could not possibly work. ‘The heart is a red rose’ and ‘The heart is a mechanical pump’ obviously do not imply that ‘A red rose is a mechanical pump’. However, the authors think that  $P_1$ ,  $P_2$  and  $C_1$  would deceive us into thinking that there might be some sort of ‘analogical transitivity’ across the terms involved. In particular, some property, let us say  $x$ , belonging to ‘red rose’ would also be predicated of ‘mechanical pump’ as a consequence of relating the metaphors contained in  $P_1$  and  $P_2$ . But it seems to us that, in the example proposed, there is no necessity to view the faulty analogy as the product of an invalidly assumed ‘analogical transitivity’. One could simply relate the weakness of the analogy to the invalid syllogistic structure of  $(P_1-C_1)$ .

Coming to the second part,  $(C_1-C_2)$ , this bit is clearly an instance of *fallacious analogical reasoning*, and our formalisation helps us establish this fact very easily.

Let us assume that:

$A$  = the set of properties of mechanical pumps

$B$  = the set of properties of red roses

Similarity premise: ‘Mechanical pumps are like red roses’

Base premise: ‘Mechanical pumps can be fixed’

Conclusion: ‘Red roses can be fixed’.

The argument is fallacious according to our very definition, since, although it does not seem that there is any  $T \geq 1$ , shared by ‘mechanical pumps’ and ‘roses’, which satisfies  $|A \cap B| \geq T$ , the analogy drawn in  $(C_1)$  would deceive us into inferring the opposite.

Therefore, as far as  $(C_1 - C_2)$  is concerned, we agree with the authors that this bit is affected by faulty analogical reasoning. However, there is no *special analogical fallaciousness* at work here. It is irrelevant for the fallaciousness of the argument whether  $C_1$  is a faulty analogy derived from relating metaphors. Any analogy may lead to a *fallacious* argument, since the requirements for the *strength* of an analogical argument can be very easily violated.

These considerations lead us to view the introduction of the MDFI as dubious.

However, let us concede that the authors are right and that the fallacy in the invalid analogical syllogism (P<sub>1</sub>-C<sub>1</sub>) is specifically related to assuming an ‘analogical transitivity’ across P<sub>1</sub>, P<sub>2</sub> and C<sub>1</sub> induced by metaphors.

The crux of the authors’ argument is that (C<sub>1</sub>) is a peculiar faulty analogy, inasmuch as it results from relating two *metaphors* (‘the heart is like a red rose’ and ‘the heart is like a mechanical pump’). We wish to argue, instead, that the kind of fallacy committed in the example proposed would be *quaternio terminorum*.

In other terms, what would happen is that one of the terms involved in the statements has two different meanings.

Let us resume for a moment steps (P<sub>1</sub>-C<sub>1</sub>). In particular, let us examine the two premises:

- (P<sub>1</sub>) The heart is like a mechanical pump.
- (P<sub>2</sub>) The heart is like a red rose.

The ‘heart’ to which the two premises refer seems to be the same object. However, the two hearts (heart<sub>1</sub> and heart<sub>2</sub>) are clearly different *denotata*. Heart<sub>1</sub> is the ‘muscular organ that pumps the blood through the circulatory system’, whereas heart<sub>2</sub> is ‘the center of a person’s thoughts and emotions’.<sup>25</sup>

Heart<sub>2</sub> is already the result of a process of *metaphorisation*, which has been so strong and successful as to create, as it were, a *new entity*: a metaphorical heart, which does not share any feature with the physical heart. In our interpretation, the speakers who use ‘heart’ in the aforementioned argument, are clearly aware of the differences between heart<sub>1</sub> and heart<sub>2</sub>, and, are, in principle, able to tell them apart. Thus, if they use ‘heart’ in its two different meanings but, at the same time, assume ‘analogical transitivity’ across the terms in P<sub>1</sub>, P<sub>2</sub> and C<sub>1</sub>, they might inadvertently fall upon an equivocation fallacy, that is, *quaternio terminorum*.

However, even accepting our interpretation, there would still be cases where metaphors are mutually related in such a way as to produce *faulty analogies* wherein there is not even the least hint of equivocation. For instance, consider the following argument:

- (P<sub>1</sub>) The swordfish is like a fencer

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<sup>25</sup> Oxford English Dictionary, s.v. ‘heart’.

(P<sub>2</sub>) The swordfish is like a serial killer

hence

(C) A fencer is like a serial killer<sup>26</sup>

In the argument above, the term ‘swordfish’ is totally unambiguous and, thus, cannot engender equivocation. If we use (C) in a sub-argument with one more premise, we might now commit the MDFI in the following way. Assume:

(P<sub>3</sub>) Fencers can win or lose games.

hence

(C<sub>2</sub>) Serial killers can win or lose games

What was, maybe, lacking in the authors’ discussion of metaphors is a distinction between two relevant kinds of metaphors. The distinction has been crucial for us. The authors say:

[...] a metaphor can indicate a transferring of information from one particular (predicate) to another particular (subject), that is, the ascription of some property, quality or function to the target occurs. [...] The MDFI also assumes that a metaphor is the description of one thing as something else. It need not be taken as a factual claim insofar as such is subject to truth conditions. Rather, a metaphor can provide an expression of insight which elicits or prompts thought in new directions (Lightbody and Berman 2010: 188-189).

We agree with the opinion expressed above, but we also distinguish between metaphors that are so strongly lexicalised as to give rise to different *denotata* and, thus, to ambiguities which lead to *quaternio terminorum*, and *live* metaphors that really provide new insights concerning the relationships between two different items (see Ervas and Ledda 2014, in this volume). Whether or not words like ‘heart’ or ‘swordfish’ give rise to live metaphors depends upon their *degree of lexicalisation*. In the authors’ example, the degree of lexicalisation of ‘heart’ is so high that the equivocation is unavoidable. In the argument about the ‘swordfish’, on the contrary, live

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<sup>26</sup> The objection above, that this is simply an invalid syllogism, may also apply to this argument, but can be ignored for our purposes.

metaphors are created and, therefore, fallacious analogical reasoning may really be at work.

To conclude, we claim that, even conceding that certain analogical arguments are specifically fallacious in virtue of: 1) relating two metaphors via the assumption of a sort of ‘analogical transitivity’ which creates a *faulty comparison*; 2) using the faulty comparison in a fallacious sub-argument, that is, even conceding that there is a point in the introduction of the MFDI, we would encourage a re-consideration of its range of application: it seems to us that the MFDI would only be at work whenever metaphors really induce a *faulty comparison*. Whether or not this happens depends upon their satisfaction of the following principle:

**Principle of Lexicality** A metaphor is a *live metaphor* iff it is not an already established *lexical item*. In simpler terms, it is live iff it is not listed among the different meanings of a dictionary item.

All metaphors satisfying the Principle of Lexicality may, therefore, be good candidates to give rise to *faulty analogies*. Metaphors which do not satisfy the Principle of Lexicality would, instead, engender equivocation and, in particular, fallacies such as *quaternio terminorum*.

## 6. Concluding Remarks

In this paper, we have tried to examine whether fallacious analogical reasoning based on metaphors can lead to what Lightbody and Berman have identified and described as the Metaphoric Fallacy to a Deductive Inference (MFDI). We have presented three main objections. The first two concern the relationship between *standard* and *analogical reasoning*, and the last one aims to bring to light that some arguments based on metaphors which seemingly lead to faulty analogies are, in fact, affected by *quaternio terminorum*. We have also presented a formalisation of fallacious analogical reasoning which, in our opinion, helps elucidate the topic significantly.

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# Metaphors in *Quaternio Terminorum* Comprehension

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## 1. Semantic ambiguity and fallacious arguments

Many advertisements consist of a statement where a metaphor occurs. An example is the advertisement proposed by “Vacanze romane” Italian bar and restaurant chain: “Coffee is balm for the heart and the spirit”. This sentence is clearly false: coffee is not a balm. However its context of use might cause it to be perceived as true, or at least plausible. From a literal point of view, it is false, but from a non-literal point of view it seems true. This might be the reason why metaphor is used in advertising: for its highly persuasive nature. In an argument used to persuade someone, a sentence containing a metaphor might then facilitate the desired effect.

Following this intuition, we aim at understanding the effect of metaphor in arguments, such as those having the structure of a *quaternio terminorum*, where the nature of the middle term plays a fundamental role in the comprehension of the overall argument and might influence its persuasive force. Actually, this particular kind of fallacy can be considered in the class of the so-called lexical ambiguity fallacies (for another example, cf. Åqvist 1960). Fallacies of this sort inherit their ambiguity from the terms composing them, which can be polysemous in a broad sense, i.e. they may permit several dif-

ferent meanings. Lexically ambiguous arguments are to be distinguished from structurally ambiguous ones, which contain no polysemic terms, but whose ambiguity stems from the argument syntax (Fearnside and Holter 1959).

*Quaternio terminorum* is indeed based on the intrinsic ambiguity of the middle term, which might have two different meanings. We will discuss four main cases of lexical ambiguity of a term: either the terms having two different literal meanings (the cases of *homonymy* and *polysemy*), or the terms having a literal meaning and a non-literal meaning, (the case of *lexicalized metaphor* and *live metaphor*). How might these cases of ambiguity influence the comprehension of a *quaternio terminorum*? Could they change its persuasive effect? In this paper, we aim at discussing in detail these four cases in order to understand whether lexical ambiguity actually plays a role in *quaternio terminorum* comprehension. In particular, we will try to figure out the ways in which the kind of lexical ambiguity of the middle term could influence the overall understanding of an argument having the structure of a *quaternio terminorum*. Indeed, we think that some disambiguation processes are required in identifying the meanings of the middle term in the two premises, and therefore their overall semantic value, i.e. their being true or false. Determining the truth or falsity of the premises represents an important step to the comprehension of arguments and we expect this might influence the overall understanding of *quaternio terminorum*.

## **2. Criteria for lexical ambiguity**

A term is lexically ambiguous if it has more than one meaning. The most common form of lexical ambiguity is polysemy, in which a term presents one (or more) literal meanings linked by a semantic relation. When the different literal meanings of a term have no semantic relation, we run into a rarer case of lexical ambiguity: homonymy (Frath 2001, Lyons 1977, Taylor 1989/2003). Let us propose two examples:

### **Homonymy**

The term *bank* has two completely different literal meanings (1) and (2):

- (1) financial institution;
- (2) riverside.

### **Polysemy**

The term *letter* has two different literal meanings (3) and (4), having a semantic relation:

- (3) symbol of the alphabet;
- (4) written communication.

Many criteria for homonymy/polysemy distinction have been proposed: the most important ones could be considered the *etymological*, the *psychological* and the *translation criterion*. Unfortunately, each of these criteria suffers from some criticism (Lyons 1977, Nerlich 2003).

According to the etymological criterion, ambiguity is a mere historical accident, randomly causing a superposition of terms. For instance, the origin of one meaning of the linguistic form *file* is from the French word *fil*, meaning folder or box for holding loose papers, whilst the other comes from the Old-English word *féol*, which refers to a tool with roughened surface. On the other hand, the meanings of the term *letter* (“symbol of the alphabet” and “written communication”) are polysemous because they share the same etymological root (Falkum 2011, Lyons 1977, Taylor 1989/2003). While in the case of homonymy the meanings of a term, in general, do not share any property, in the case of polysemy a semantic overlap between the two meanings can be observed.

The *etymological criterion* is a valuable tool in analysing those phenomena, however, it should be assumed with some provisos. In fact, assuming an etymological perspective *tout court* would mean assuming a degree of subjectivity of the relations among meanings, because it is relative to the knowledge of the speakers. For instance, the term *cardinal* has two meanings historically related:

- (5) leader of the Roman Catholic Church;
- (6) a songbird.

Nonetheless, it may well be the case that native speakers could ignore such a relation and the term *cardinal* could seem homonymous (Falkum 2011; Lyons 1977).

The *psychological criterion* precisely states that the polysemy/homonymy distinction is up to native speakers’ intuitions: if native speakers judge a linguistic form as having unrelated semantic representations, then such a form is homonymous, whilst if native speakers judge a linguistic form as having different but related semantic representations, then such a form is polysemous (Cruse 1995, Pinkal 1995). The difficulties with a

complete agreement of a psychological criterion relate to the fact that it is not easy to identify the role of speakers' intuitions. For instance: there are no clear intuitions on 1) the "causal ancestors" of a word and 2) the "new usage" of a word (Lepore and Hawthorne 2011). As an example, for a *dance*, a linguistic community could have 1) performance standards of the dance, but also 2) an evolution of that dance, performed in different times, and 3) no agreement on what to consider as a new dance. After all, as Wittgenstein stated, this is anyway compatible with having an image of that dance: "in order to *want* to say something one must also have mastered a language; and yet it is clear that one can want to speak without speaking. Just as one can want to dance without dancing. And when we think about this, we grasp at the *image* of dancing, speaking, etc." (Wittgenstein 1953: § 338).

Finally, the third criterion considers ambiguity as a matter of *translation*: if the translation of a term into a different language obliges one to choose among different translation equivalents, or if there is no one-to-one equivalence in translation (Ervás 2008), then that term is homonymous. Indeed, as Kripke noted, ambiguity is usually not preserved in translation: "We can ask empirically whether languages are in fact found that contain distinct words expressing the allegedly distinct senses [...]. There is no reason for the ambiguity to be preserved in languages unrelated to our own" (Kripke 1979: 19). For instance, the meanings of the English term *bark* – which denotes either the characteristic abrupt cry of a dog or the outer layer of a tree – could be disambiguated in the translation into Italian respectively with "latrato" and "corteccia". The term *bark* is indeed polysemous, as well as the Italian term *credenza* which can be translated into Spanish with "creencia" (when the meaning is "belief") and with "aparador" (when the meaning is "piece of furniture").

As with the other criteria, the translation criterion presents some drawbacks too (Zwicky and Sadock 1975). Against the claim that homonymy can be identified because it forces a choice among different equivalents in the translation process, there are also polysemous words which are translated into different terms in other languages. Consider, for example, the expression: "I like fish". This could be faithfully translated in Spanish in either "Me gusta el pez" ("pez" is a live fish) or "Me gusta el pescado" ("pescado" is an already caught fish): the English term *fish* is indeed polysemous and other languages, such as Spanish, can codify subtle nuances of meaning not codified in English. The same could be said for some Italian polysemous words, such as *nipote* in the Italian statement "Era la nipote di Angiolieri", which can be translated in French by either "C'était la nièce d'Angiolieri"

or “C’était la petite-fille d’Angiolieri”, according to the family relationship of the female subject with Angiolieri (Ervas 2012).

### **3. Pragmatic processes in lexical ambiguity**

It makes sense to wonder whether the difference between these two kinds of lexical ambiguity, homonymy and polysemy, is based on the fact that they involve different pragmatic processes which rely on the distinction between *narrow and broad contexts* (Bach 2012, Carston 2002, Perry 1997, 2001, Recanati 2004). As regards homonymy, the selection of the relevant meaning works by default on the basis of the pre-semantic context, the so-called *narrow context*. Conversely, for what concerns polysemy, the selection of the relevant meaning involves a process of pragmatic enrichment on the basis of the post-semantic context, or the *broad context*. In a narrow context using anaphora, both the meanings of a homonymous term, such as *bank*, would have the effect that “something does not work” as in the following sentence:

- a. He put some money in a bank and then he swam to it.

Sentence a. puts together unrelated semantic fields and at best it could be interpreted as a joke. The joke is created by the paradox of referring to completely different readings of the term, as in case of syntactic ambiguity: “One morning I shot an elephant in my pajamas. How he got into my pajamas I’ll never know” (Groucho Marx).

On the other hand, a polysemous term such as *window* can be used via anaphora and can be read in both its meaning (“window of a house” and “window on the computer screen”) preserving the impression that the overall sentence works in both cases, as in the following sentence:

- b. He opened the window and then went through it.

Indeed, in statement b., a definitely broader context is required to understand which meaning of *window* is relevant, otherwise both readings would be equally possible (Frazier and Rayner 1990, Garrod, Freudenthal and Boyle 1994). We could interpret this phenomenon as a different form of contextual dependence. While homonymy has a finite list of meanings and we do not need an extremely broad context to understand the relevant meaning used in the sentence, this is not really the case for polysemy. In



polysemy, indeed, the word contributes to an indefinite number of other meanings, which are the results of the modulation process of such a word (Recanati 2004, 2010). In homonymy, the use of context in the selection of the relevant meaning is pre-semantic: we need it to choose the relevant meaning among the others in the list. In polysemy, the use of context in the modulation process is post-semantic, because it involves finer knowledge of language and world, as well as subtle nuances of the communicative encounter (Simpson 1994).

The phenomenon of polysemy cannot indeed be solved simply through disambiguation. There is a clear gap between what is literally expressible and what speakers may need to express, between the encoded concepts and the intended ones (Hirst 1987). Modulation is a pragmatic process that fills this gap by pragmatically inferring the intended (“ad hoc”) concepts on the basis of the encoded concepts “in response to specific expectations of relevance raised in specific contexts” (Carston 2002: 322). The adjustment that produces the “ad hoc” concepts consists of narrowing or broadening the encoded concepts, namely in suppressing the information these concepts encode when they are not relevant in the context. In the case of narrowing, the semantic field of the encoded concept is reduced to a sub-set, as in the following sentence, where “drink” is narrowed down to “drink alcohol”:

c. I do not like to drink when I have to work.

The speaker clearly does not mean that she does not drink water or non-alcoholic drinks: this piece of information is then suppressed. In the case of broadening, the semantic field of the encoded concept is enlarged to a super-set, as in the following sentence, where “crazy” is loosened to “strange”:

d. This guy is crazy.

The speaker clearly does not mean that the guy has a psychiatric disease, but that he is a little bit bizarre. This explanation of the explicit meaning of sentences challenges the traditional distinction between literal and non-literal uses of language, as what is considered “literal” is the result of a pragmatic process of modulation (Carston 1997, 2002, 2010a).

#### **4. Pragmatic processes in metaphor interpretation**

Similar pragmatic processes have been hypothesized in case of non-literal language, such as metaphors, where – in a way similar to polysemy – some semantic properties of the source (literal) domain are shared with a target (non-literal) domain. It has been shown that suppression would be involved in both homonymy disambiguation and metaphor interpretation (Gernsbacher and Faust 1991). In both cases, a piece of information is suppressed, however, in the process of disambiguation the irrelevant meaning disappears significantly more quickly, when compared to the process of metaphor interpretation, which requires more demanding attentional resources to suppress the corresponding literal meaning (Gernsbacher, Keysar, Robertson and Werner 2001, Rubio Fernandez 2007). In homonymy disambiguation, the irrelevant literal meaning indeed has no semantic relation with contextually relevant meaning, while in metaphor interpretation the literal meaning of the source domain shares some semantic properties with the intended, non-literal meaning.

The case of metaphor interpretation is then similar to the polysemy case, where there is a semantic overlap between the semantic domains of the different literal meanings of a term. As in polysemy, metaphor interpretation is a context-sensitive pragmatic meaning-adjustment process whose result is an “ad hoc” concept (Carston 2002, 2010b, Vega Moreno 2004). To understand the sentence “Coffee is balm for the heart and the spirit” in the advertisement, we should modulate the term “balm” and the corresponding encoded concept:

- e. Coffee is balm for the heart and the spirit;
- f. Coffee is balm\* (“ad hoc” concept) for the heart and the spirit.

Apparently, coffee is not a topical medical preparation, nor a repairing pomade for hair, but it shares other properties with balm, as for instance the properties of being relieving and restoring, and so on, according to the contextual use of the term “balm”. When many properties are shared, there is a wider semantic overlap between the two readings of the term “balm” (the literal meaning in e. and the non-literal one in f.).

The pragmatic process involved is then similar to polysemy, especially in the case of *dead (lexicalized)* metaphors. Frequent use has brought them to a status similar to that of polysemous terms, i.e. literal terms. In dictionaries, these terms are classified as frequent uses of language, as modulations similar to the lexical entries of polysemous terms. This is the

reason dead metaphor comprehension requires linguistic knowledge of the ways the specific linguistic/cultural community uses the term. Consider the following example:

### **Dead metaphors**

The term *star* has two different meanings, the literal meaning (7) and the non-literal meaning (8):

- (7) celestial body;
- (8) famous actor.

Their semantic fields partially overlap for some properties: being bright, unachievable, etc. As in the case of polysemy, the two meanings have a semantic relation represented by the shared properties. The shared properties are so fixed in the cultural/linguistic knowledge of native speakers, and so well-established in their mental lexicon, that they are easily grasped even when just a sentential context is given. Moreover, dead metaphors often represent so widespread a schema of property associations that it is possible to find them in other languages and/or cultures, in exactly the same form (Bazzanella 2011, Handl 2011). For example, the English term “*star*” has a translation equivalent in Italian (as in “*stella del cinema*”) and in French (as in “*étoile du spectacle*”).

The case of *live metaphors* is somewhat different from the case of lexicalized ones. In fact, metaphors from this class involve a completely new and creative use of language, not referable to a frequent use of language (and already classified in dictionaries). Consider the following example:

### **Live metaphors**

The term *dinner* could have two different meanings, the literal meaning (9) and the non-literal meaning (10):

- (9) evening meal of the day;
- (10) old age.

Their semantic fields partially overlap for some properties, connected by the speaker in a new and creative way. This is the reason why live metaphor comprehension requires a more demanding effort to find out the shared properties intended by the speaker and a finer knowledge of the context and its features (Glucksberg and Estes 2000). Live metaphors usually appear in literary contexts and depend on a very deep understanding of the cultural-specific environment. This is the reason no well-established schema or pat-

terns of shared properties are found in other languages and/or cultures (Callies and Zimmermann 2002).

The continuity among literal/non-literal uses of language is also testified to by the existence of a third case of metaphors, i.e. the class of *mori-bund metaphors*. The distinction dead/live metaphors faces some difficulties, involving, in some sense, the “death” and the “resurrection” of a metaphor. Lexicalization is indeed a necessary but not a sufficient condition for the death of metaphors, because: i) different dictionaries do not recognize the use, or ii) they could “come alive again”. An etymological criterion opens a vivid perspective in those cases. Consider the case of terms such as *silly*, *pedigree*, or *daisy*, whose origins trace back to middle and old English. Those terms possess meanings classified as literal, have a metaphoric etymological root! *Literalization* could then be the “real death” of a metaphor (Alm-Arvius 2003, 2006, Goatley 1997). These cases show that the process of literalization can follow three main directions. In the first case the corresponding literal meaning is dead, as in the case of the term “silly”, in the sense of deserving pity or sympathy, is an alteration of the dialect *seely*, happy, and later *innocent*, *feeble*. In a second case there is a fusion of a metaphorical compound at both a phonological and a semantic level; this is what happens with the term “daisy”, whose old English origin is *dæges ēage*, *day’s eye*, because the flower opens in the morning and closes at night. Finally, in the latter case, literalization could be due to translation or linguistic loan from another language, as for the term “pedigree”, whose origins are from late Middle English, from Anglo-Norman French *pé de grue* ‘*crane’s foot*,’ a mark used to denote succession in pedigrees (Alm-Arvius 2006, Onions, Friedrichsen and Burchfield 1966/1994). Therefore, differences among cases are somehow blemished and seem a matter of degree. In some sense, against the classical view, we could speak of a literal/non-literal *continuum* instead of a literal/non-literal *divide*.

## **5. Quaternio terminorum understanding**

As noted above, the fallaciousness of *quaternio terminorum* stems from a semantic ambiguity of the middle term, which assumes distinct meanings in the two premises. Of course, such ambiguity may depend on different types of reasons. Namely, the middle term could be ambiguous because either it is a homonym, or polysemic, or else metaphoric. Moreover, our term could be metaphoric in two ways: either lexicalized, or living. So, the context of the *quaternio terminorum* is absolutely appropriate, from our point of view, for

investigating the degrees of the persuasiveness of an argument as the middle term varies through such a spectrum.

The nuances of literal meaning and the various cases of metaphor explored could influence the ways we understand an argument and, in particular, *quaternio terminorum*, which is exactly based on the intrinsic ambiguity of the middle term. To identify the fallacy of *quaternio terminorum*, we should disambiguate the middle term, which means something in the first premise and something else in the second one. Disambiguating a homonymous middle term would require suppressing one of its two literal meanings, the irrelevant one (Gernsbacher 1990). *Quaternio terminorum* comprehension requires then the suppression of one of the two meanings in the first premise and *vice versa* in the second premise. However, middle terms might be lexically ambiguous in many ways: for instance, middle terms used in a metaphorical sense have figurative meanings that depart from their literal ones. How might *quaternio terminorum* comprehension be when metaphors are involved?

In order to answer this question, we should understand how the different pragmatic processes discussed up to now influence the detection and the comprehension of the fallacy. We could hypothesize that *quaternio terminorum* comprehension should mainly depend on the nature of the middle term, and therefore on the corresponding cognitive-pragmatic process required to disambiguate the two meanings and to the degree of partial semantic overlap created by the different readings of a middle term (degree of shared semantic properties). Arguments, having the structure of *quaternio terminorum*, could contain either a lexically ambiguous or a metaphorical middle term. Moreover, some arguments could contain homonymous or polysemous middle terms (i.e. having two literal meanings) and other arguments could have middle terms corresponding to lexicalized or live metaphors (i.e. having a literal meaning and a non-literal meaning).

There could be then at least four groups of middle terms, classified as follows: homonymy (H), polysemy (P), dead (lexicalized) metaphor (DM), live metaphor (LM). From now on, with H, P, DM, and LM, we shall denote the classes of arguments containing homonymous terms, polysemous terms, dead (lexicalized) metaphors, and live metaphors, respectively. Examples of *quaternio terminorum* (true premises/false conclusion) with H, P, DM and LM are the following:

**H Example:**

[P1] Banco di Sardegna is a bank;

[P2] A bank is a financial institution;

[C] Banco di Sardegna is a financial institution.

**P Example:**

[P1] L is a letter;

[P2] A letter is written;

[C] L is written.

**DM Example:**

[P1] Clooney is a star;

[P2] A star is a celestial body;

[C] Clooney is a celestial body.

**LM Example:**

[P1] The old age is a dinner;

[P2] A dinner is quite long;

[C] The old age is quite long.

Disambiguating a homonymous word like “bank” would involve the selection of one of its two meanings, i.e. financial institution or riverside (Gernsbacher 1990, Gernsbacher and Faust 1991). Processing the lexical form “bank” requires the activation of two different and unrelated lexical entries, and the suppression of the irrelevant one. As recently shown (Rubio Fernandez 2007), there is indeed a mechanism of suppression, which seems to operate faster in the resolution of lexical ambiguity than in dead metaphor, for the suppression of metaphor-inconsistent information. Therefore we expect different processes of *quaternio terminorum* understanding: we do expect that arguments containing homonymous words (e.g. “bank”) as middle terms will be more readily recognized fallacious than arguments containing dead metaphor words (e.g. “star”) as middle terms.

We expect to find a difference in the processing of arguments containing polysemous words (e.g. “letter”) as the middle term too. Several recent psycholinguistic studies investigating the processing of polysemy and homonymy have indeed pointed out a differential representation of homonymy and polysemy (Frazier and Rayner 1990, Williams 1992, Pickering and Frisson 2001, Klepousniotou 2002, 2007, Beretta, Fiorentino, and Poeppel 2005, Klepousniotou, Titone, and Romero 2008, Brown 2008). In particular, Beretta, Fiorentino, and Poeppel (2005) empirically supported the single entry account of polysemy and the separate entries account for homonymy, and Klepousniotou, Titone and Romero (2008) suggested that the degree of sense relatedness of polysemous words influences their proc-

essing. We do expect that this difference in homonymy and polysemy processing influences the disambiguation of the middle terms and thus the comprehension of the overall *quaternio terminorum*.

Moreover, we suppose that the comprehension of arguments with live metaphors (e.g. “dinner”) as middle terms will be slightly different. This is because live metaphor comprehension involves elaborated pragmatic processes – as for instance iconic representations of concepts or imagery (Rubio Fernandez 2005, Carston 2010c, Indurkha 2007). Understanding a live metaphor is an extremely context-dependent action, involving a full perception of the intended meaning of the entire statement (Lai, Curran, Menn 2009). It has indeed been argued that additional semantic information coming from the context may produce more stable representations, i.e. an advantage called “context availability effect” (Schwanenflugel, Harnishfeger and Stowe 1988, Glucksberg and Estes 2000). Therefore, our hypothesis is that the disambiguation of an argument whose middle term is a live metaphor should be definitely dependent on the broadness of the context provided. In contrast, a narrower context would be sufficient for the case of dead metaphors, because of their high familiarity and frequency. As already experimentally proved, “the amount of attentional resources involved in interpreting a metaphorical expression would be determined by the combination of these two factors: the degree of familiarity of the metaphorical interpretation and the strength of the contextual bias” (Rubio Fernandez 2007: 366).

## **6. Literal and non-literal truths**

A preliminary study on the role of metaphors in *quaternio terminorum* comprehension (Ervás, Gola, Ledda and Sergioli 2012) shows that the majority of sentences with dead metaphors (83%) are perceived as *true*, even though they are literally false, whilst the majority of sentences with live metaphors (79%) are perceived as *false*, even though they are non-literally true. How could these preliminary data be interpreted?

According to the classical pragmatic view (Grice 1989, Camp 2004), sentence e. would be literally false, because of the literal, conventional meaning of “balm”. Metaphor is indeed an implicature generated by the flouting of the maxim of Quality: “Do not say what you believe to be false”. In Grice’s view, the fact that coffee is balm is “patently false”, so the interpreter should find another possible, implicit meaning that better fits the context. In a similar way, Searle summarized the interpretive procedure in

this way: “where an utterance is defective if taken literally, look for an utterance meaning that differs from sentence meaning” (Searle 1985: 105). However, this thesis seems to be “an old wives’ tale”: as Joseph Stern noted, “we now recognize the prevalence of twice-true (Cohen 1976) and twice-apt (Hills 1997) metaphors and, in general, the explanatory vacuity of what we might call the “literal deviance” thesis (Stern 1983; cf. also White 2001)” (Stern 2006: 249-250).

According to Contextualism and Relevance Theory (Recanati 2004, 2010, Sperber and Wilson 1986/1995, Wilson and Carston 2006, Carston 2002), there is instead no literal meaning in people’s head: when they read a sentence containing a metaphor, people usually assign intuitive truth conditions to the sentence, thus directly modulating the metaphorical term and considering the sentence containing it as true, or at least plausible. The “falsehood” of metaphor is then seen as a “myth” (Scheffler 1988) and as a tendency to judge metaphor with some kind of truth conditions, the literal ones, that cannot explain the very nature of metaphor itself (Clark 1994). According to the classical view, the principle of compositionality is applied to the conventional meaning of the constituents of a sentence, whilst according to the contextualistic view, the principle of compositionality is applied to the already modulated meaning of the constituents of a sentence (Recanati 2010). Therefore, the outcomes of compositionality are expected to be possibly different.

In particular, relevance scholars question the psychological plausibility of previous theoretical hypotheses, putting forth the “tribunal of experience” of Gricean philosophy of language (Noveck and Sperber 2004). They argued in favour of a difference between truth conditions of a sentence and the intuitive truth conditions assigned by a speaker in contextual uses of language. It is well known that Grice did not intend to explain these phenomena in terms of actual psychological processes. His theory is normative and has no psychological aims. His view of metaphor as an implicature directly came from his argumentative conception of rationality (concerning the whys of human linguistic behaviour), rather than the instrumental conception of rationality (concerning the hows of human linguistic behaviour) used by relevance scholars. Some scholars (Verbrugge and McCarrell 1977, Ortony, Schallert, Reynolds and Antos 1978, Janus and Bever 1985) have anyway used his theory to predict a two-stage process of metaphors: according to the account of meaning comprehension known as the “literal first hypothesis”, literal meanings are processed first, faster, and more easily than figurative meanings. The process of understanding figurative language is indirect because it is necessarily dependent on a previous literal interpre-



tation and would take longer than the understanding literal language exactly because of this previous mandatory step.

The “direct access view” argued instead that understanding figurative language, such as metaphor, does not necessarily imply the literal interpretation mandatory step supposed by the “literal-first hypothesis” (Gibbs 1994, 2001, Gibbs and Gerrig 1989, Glucksberg 2003). Experimental findings have shown that reaction times for the understanding of utterances containing metaphors are not always longer than reaction times for the understanding of literal utterances (Gildea and Glucksberg 1983, Glucksberg 2001). In fact, understanding depends on the salience and frequency of the metaphors used, or in other words, on their being dead or live (Giora 2003, Gibbs 1994). In this perspective, metaphors can no longer be explained in terms of an implicature arousing after the comprehension of literal meaning.

Appealing to a “unified approach” to literal and non-literal uses of language, the process of modulation has been proposed by Carston (2002) and Recanati (2004, 2010) among others to explain not only the cases of polysemy but also metaphors. On the literalist side, it has been claimed that the *ad hoc* concept mechanism produces a non-controlled proliferation of interpretations: “the pragmatic operation of loosening over-generates metaphorical interpretations, differences of interpretation that are not reflected in our intuitive judgments” (Stern 2006: 255; cf. Stern 2000; Stanley 2002). They also criticized the contextualistic side because the same solution, the *ad hoc* concept mechanism, seems to be adopted for all “loose uses” of language, all kinds of metaphors included, without paying attention to the specific differences of all those phenomena and thus losing explicative power.

Robyn Carston partially answered this kind of criticism by distinguishing different processing in the class of metaphors. Metaphors would still be explained as a local, on-line pragmatic adjustment of the encoded lexical meaning resulting in an *ad hoc* concept. However, in the case of live metaphors, an alternative, “imaginative” route is hypothesized (Carston 2010, Carston and Wearing 2011): the literal meaning would not be suppressed; it would be maintained in a more global pragmatic process resulting in a range of communicated affective and imagistic effects. This hypothesis has been confirmed by experimental studies, which showed that in the process of metaphor interpretation, the corresponding literal meaning is not suppressed straightforward (Glucksberg, Newsome and Goldvarg 2001, Gernsbacher, Keysar, Robertson and Werner 2001, Rubio Fernandez 2005, 2007) and remains to evoke further imagistic effects: “images are not communicated but are activated or evoked when certain lexical concepts are accessed and

may be further imaginatively developed (by, for instance, shifting mental focus or perspective, zooming in on detail, or forming a connected dynamic sequence) as the conceptual content of the utterance is recovered” (Carston 2010c: 319). This “second route” to understanding metaphors does not exclude the *ad hoc* concepts mechanisms, i.e. a more conceptual way to metaphor understanding. However, the literal meaning endures in evoking an image with more important effect with respect to the first route. In Carston’s view, literal meaning plays a fundamental role for metaphor understanding. In the same vein, but on the non-contextualist side, Stern noted: “No account of metaphor will be adequate without explaining the fact that something about the meaning of the literal vehicle remains active in metaphorical interpretation” (Stern 2006: 250).

However the main difference between the contextualist and the non-contextualist views is exactly on the nature of literal meaning and its contribution to the truth conditions of a sentence. According to the contextualists’ view, the pragmatic process involved in dead metaphor comprehension takes the encoded concept and generates an “ad hoc” concept in the proposition the speaker intends to communicate, i.e. a proposition corresponding to the intuitive truth-conditions assigned by speakers. They assign thus the intuitive truth-conditions to the explicit proposition, respecting speakers’ semantic intuitions: understanding a statement means knowing the concrete circumstances of its truth (Carston 2002). The contribution of a metaphor to the overall truth-condition of a sentence is then its intuitive truth-conditions, which is already done in the modulation process. This could be the reason why speakers judged most sentences containing a dead metaphor as true. Live metaphors instead would imply too complicated a process and contextual information given in a sentence would be too narrow to produce the desired imagistic effect. However, on the non-contextualist side, it could be claimed that dead metaphors are just perceived as true because they are lexicalised, similar to the case of literal meanings, such as in polysemy. Proper, live metaphors are still perceived as false, as the classical view stated (Grice 1989).

Live metaphors might also be perceived as true when a broader context is presented. Experimental literature has shown that the interpretation process of novel metaphors diverges from conventional metaphors (Blasko and Connine 1993, Thibodeau and Durgin 2008), and because of the unfamiliarity with live metaphors, more context is needed to understand them. A broader context is indeed useful to identify the relevant properties of the literal meaning used on a specific occasion. However, if aristotelic standards of syllogisms are respected, in *argumentative* contexts such as those repre-

sented by the concatenation of premises/conclusion in a *quaternio terminorum*, live metaphors have a very narrow context in which to be interpreted. This could be the reason why they are usually interpreted as literally false and thus they should not be problematic for the comprehension of the (in)correctness of the overall argument. In our view, there is indeed a link between the evaluation of the premises' truth conditions and the overall comprehension of the correctness of the whole argument. In a narrow context, dead metaphors are instead perceived as true even though they are literally false. The encyclopaedic knowledge linked to the everyday use of our mother language is sufficient to recognize the relevant properties carried by the conventional metaphor and a broader context is not necessarily required (Glucksberg and Estes 2000). The case of lexicalized metaphors is indeed very interesting because, as experimental literature testifies, they are processed as fast as literal meanings (Giora 2003), and people had difficulty in rejecting metaphors as literally false (Glucksberg 2003), even though they remain figurative meanings and literally false as such. This might be the reason why "common", dead metaphors make the arguments more persuasive than others. It is plausible that difficulties in attributing literal or non-literal truth conditions to premises containing metaphoric ambiguity influence the detection of the (in)correctness of the whole argument, as in case of *quaternio terminorum*.

## **7. Concluding remarks**

The core idea of the present article can be captured by two simple questions:

1. How much can metaphors influence the truth-condition perception of a statement?
2. How much can the type of ambiguity of a term influence the perception of the soundness of an argument?

In order to answer those questions, we discussed the main features of lexical ambiguity in both its literal forms (e.g. homonymy and polysemy) and non-literal forms (e.g. dead and live metaphors), arguing in favour of an "ambiguity spectrum" which could influence the perception of an argument, such as *quaternio terminorum*, when the middle term is ambiguous. We discussed the pragmatic processes involved in lexical ambiguity and metaphor comprehension, focusing our attention on the experimental literature show-

ing the ways disambiguation and metaphor interpretation work. We then proposed our hypotheses on the comprehension mechanism of sentences, such as premises of *quaternio terminorum*, containing such ambiguous terms. Also, we discussed some preliminary results of an empirical study (Ervas, Gola, Ledda and Sergioli 2012), designed to measure the influence of lexical ambiguity and metaphor on *quaternio terminorum* understanding. To answer the first question, we discussed the preliminary outcomes which reveal, up to now, that most sentences with dead metaphors are considered true; while a large proportion of the sentences containing live metaphors are perceived as false. To answer the second question, we hypothesized that these results should have an influence in the perception of the soundness and persuasiveness of the overall argument, making a difference for arguments containing dead *versus* live metaphors.

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# On a Few Convergences between Metaphor and Thought Experiments<sup>1</sup>

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## Introduction

In what follows, I intend to provide an indirect approach to a few epistemological issues raised by the wide use made in philosophy of figurative language in general, and of metaphors in particular. One of the many consequences of the progressive dismissal of the original logical-empiricist program, and of the corresponding disillusionment concerning the possibility of drawing a clear-cut distinction between *literal* and *figurative* language<sup>2</sup>, has certainly been the explicit acknowledgement of the fundamental cognitive role played by metaphors within our intellectual life as a whole. The view according to which metaphor, far from being a mere stylistic device used mainly for rhetorical purposes, should be thought of as deeply and essentially entrenched in human thought processes has indeed become increasingly popular during the second half of the last century. “Our ordinary conceptual system”, some have gone as far as claiming, “is fundamentally metaphorical in nature” (Lakoff and Johnson 1980: 3). The countless meta-

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<sup>2</sup> The separation between *figurative* and *literal* seems to be deeply rooted in western culture, and can be traced back as far as Aristotle. See Johnson (1981: 6). Amongst the contemporary approaches to metaphor which deny the existence of a clear-cut distinction between literal and figurative uses of language, it may be worth mentioning Lakoff and Johnson 1980, Hesse 1993, and Sperber and Wilson 2008.

phorical expressions we normally make use of in both everyday and technical discourse, according to this last view, can hardly be said to have an essentially *emotive* function, as a very influential logical-empiricist tradition had always maintained<sup>3</sup>, but play the epistemically much more fundamental role of shaping the very way in which we experience reality. This means that their reality as a linguistic phenomenon should be seen and treated as a consequence of more general principles which govern our cognitive life as a whole. Moreover, it suggests that locating metaphor, in its many forms, within its proper extralinguistic context would allow us to better appreciate the fact that most of the metaphors we live by, as George Lakoff and Mark Johnson (1980) would have it, end up placing significant constraints on our epistemic access to reality, thereby contributing to shape our own actions.

The present considerations originated from a personal interest in philosophical methodology in general, and in the nature and workings of a widely spread philosophical practice, namely thought-experimental reasoning, in particular. As it is well known, thought experiments (from now on, TEs) have undeniably become, over the last few decades, a fundamental item within the bag of tools of most analytic philosophers. Although thought-experiment based arguments, as we may call them, are certainly not new to modern philosophy<sup>4</sup>, many contemporary analytic philosophers seem to assign to the careful scrutiny of more or less far-fetched imaginary scenarios a decidedly unprecedented cognitive weight within their theoretical inquiries<sup>5</sup>, and this peculiar state of affairs has recently sparked off a lively methodological debate<sup>6</sup>. It now happens to be the case that the literature spawned by that debate and the one pertaining to the debate on metaphor display a number of connections which do not seem to be merely coincidental and which, while presumably able to contribute to a better understanding of the corresponding subject matters, have not been fully appreciated yet. This is the reason why I will try to single out, in the following sections, three different aspects of these two debates which I believe display illuminating similarities, and I will suggest, in the last paragraph, an additional, important function of metaphor which I believe has been lamentably disregarded by both research fields.

A first aspect I will draw attention to concerns the existence, in current debates on metaphor and TEs, of a strongly reductionist approach aimed at

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<sup>3</sup> See Ayer (1952) for a classical statement of this view.

<sup>4</sup> See, for instance, Descartes 1641/1986, Locke 1690/1978, and Leibniz 1714/1991.

<sup>5</sup> For a few standard examples, see Black 1952, Gettier 1963, Foot 1967, Putnam 1975, and Searle 1980.

<sup>6</sup> See, for instance, Horowitz and Massey 1991, and DePaul and Ramsey 1998.

showing that the respective objects of inquiry owe their purported epistemic virtues or shortcomings to a second object, on which they are thought of as being somehow parasitic. A second aspect concerns the cognitive underpinnings of both metaphor and TEs. Both debates have indeed appealed to a peculiar *tension* within the subject's conceptual system in order to characterise the peculiar kind of reasoning which underlies both intellectual phenomena. A third and last aspect concerns the fact that the kind of reasoning involved in both metaphor and TEs bears interesting resemblances to the one which characterizes the use of scientific *models*. Indeed, in both cases a first process of *idealization* of the relevant subject matter is usually followed by a process of *projection* of the features of a domain of discourse on a different domain, the validity of which projection can and should be subject to careful criticism.

In the concluding section I will focus on ideas due to the American philosopher of mind Daniel Dennett in order to put forward a proposal concerning metaphor's role in the creation of TEs. Dennett's works, I believe, represent a very interesting case of fruitful interaction between the kind of reasoning which takes place in metaphors and the one at work in TEs. I think it is fair to say that this author, more than anyone else in the analytic community, has raised metaphor to a sort of expository paradigm of his own philosophical views, thereby contributing to disclose the cognitive virtues and shortcomings of metaphorical thinking. What makes his thought relevant to the present considerations, I believe, is the fact that the creation of imaginary scenarios, in his case, seems to follow naturally from the previous acknowledgement of the explanatory power of a given metaphor. Now, if this way of proceeding turned out to be common to other authors as well, this could mean that the role played by metaphorical thinking in TEs is much less sporadic and idiosyncratic than it has been so far recognized.

## 1. Reductionism

It is often repeated that a good caricature, while not reproducing reality in a photographic manner, is nonetheless able of conveying the salient features of a face. In the same spirit, I would like to introduce a distinction which, although somewhat artificial, has perhaps the merit of capturing a common feature of our two debates. Indeed, both in the case of metaphor and in the case of TEs, the main theoretical accounts of the respective research object could be subsumed under two broad categories, according to stance they take towards their subject matters. To an initial, prevailing approach, which

we may loosely label *reductionist*, and which can be traced back to logical-empiricists' ideas, an alternative approach has subsequently been put forward, which seems appropriate to call *anti-reductionist* in that it was explicitly intended as a rejection of the former. Max Black's epoch-making article on metaphor (Black 1955) ends with the following words:

No doubt metaphors are dangerous – and perhaps especially so in philosophy. But a prohibition against their use would be a willful and harmful restriction upon our powers of inquiry (Black 1955: 294).

Many authors have felt that a similar kind of worry could apply to TEs as well. All the reductionist approaches in one field, for instance, agree in maintaining that we cannot credit metaphor with a proper cognitive function. Indeed, all such approaches, according to Johnson (1981), share the view according to which “insofar as metaphors may be used to communicate knowledge, that knowledge can be reduced to a set of cognitively equivalent literal utterances” (Johnson 1981: 35). The same cognitive work performed by a given metaphor, according to these views, could always be performed, at least in principle, by an equivalent formulation of that metaphor, which is ideally thought of as always available to the epistemic subject. Preferring a metaphor over its literal equivalent, in other words, would ultimately reduce to a sheer matter of taste<sup>7</sup>. Indeed, the general approach to figurative language that the logical-empiricist inherited from the tradition of modern empiricism can be summarized by the three following fundamental tenets, which together constitute what Johnson has appropriately dubbed the *literal-truth paradigm* (Johnson 1981: 12).

- The human conceptual system is essentially literal.
- Metaphor is a deviant use of words.
- The meaning and truth claims of a metaphor (if there are any) are just those of its literal paraphrase.

These three assumptions are obviously at work in what Black (1955) calls *substitution view* of metaphor, according to which, insofar as any metaphorical expression would be ultimately reducible to an elliptic simile, the metaphor ‘A is B’ (e.g. Claudio is a Martian) would just be a different way of presenting the same, easily recognizable, literal meaning of ‘A is C’ (Claudio is a human being whose actions are often difficult to predict) (see

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<sup>7</sup> Timothy Binkley spoke of “literal statements, dressed up for a special occasion”. See Binkley 1980 [1974]: 142.

Black 1955: 279). Interestingly, Black thinks of his own substitution view as a particular instance of a more general stance concerning the relation holding between literal and figurative language. This last stance, Black reminds us, looks at the creation of a metaphor as to a relatively mechanical procedure, namely the application of a “transforming function”  $f$  which takes the literal meanings of terms ( $l$ ) as input, and delivers their figurative meanings ( $f$ ) as output. This general framework will then make possible for the interpreter to go back from the figurative meaning of a term to its original literal meaning simply by applying the inverse function.

$$f(l) = f \qquad f^{-1}(f) = l$$

Different transforming functions, as Black explains, are associated to different tropes, and *analogy* or *similarity* would be the transforming function associated to metaphor (see Black 1955: 282).

What we have said so far is already sufficient to realize that Black’s polemical target, namely the *substitution view*, is more or less explicitly committed to what Timothy Binkley (1974) has fittingly referred to as a *parasitology doctrine* of metaphor, according to which, contrary to literal claims, metaphorical claims could only be said to be indirectly true, in that “they achieve the status of propositions only by virtue of their connections with literal language” (Binkley 1980 [1974]: 142). This means that, according to a similar reductionist stance, our sentence ‘Claudio is a Martian’ could be true only insofar as its literal counterpart, namely ‘Claudio is a human being whose actions are often difficult to predict’, is itself true.

It is now interesting to observe that, similarly to what happened in the case of metaphor, the logical-empiricist legacy contributed to shape an equally influential reductionist stance within the debate on TEs. Indeed, many of the accounts which have been recently put forward in this area concerning the nature and workings of these puzzling philosophical creatures have similarly originated from a sort of natural reaction to a rigidly reductionist stance. The *locus classicus* of such stance is to be found, in the case of TEs, in the epistemological considerations of the American philosopher John Norton (1991, 1996 and 2004a), to whom is normally associated a position which goes under the label of *elimination thesis*.

TEs, according to Norton, would be usually introduced in argumentation when the corresponding, straightforward argument would be difficult to develop (Norton 1991: 131). As a consequence, while certainly constituting a very useful and at times practically indispensable heuristic tool, there



would be nothing epistemically remarkable about them, in that they could be showed to rely on our standard epistemic resources, namely “ordinary experiences and the inferences we draw from them” (Norton 1996: 334). Their only cognitive function, according to Norton, would be that of facilitating the accomplishment of cognitive tasks which, in principle, could be completed even without their help. Indeed, since the conclusion of any TE could be reached by already well known inferential patterns, the fundamental epistemological point, according to Norton, is that “the degree of belief conferred by the thought experiment on its outcome *coincides* with the degree to which the reconstructed argument supports its conclusion” (Norton 1996: 340, my emphasis). Just as metaphor, from a reductionist point of view, is nothing but the elliptical expression of a literal truth, a TE, according to Norton, would be little more than “picturesque argumentation” (Norton 2004a: 1142). For this reason it seems fair to maintain that Norton’s eliminativist stance plays, within the debate on TEs, a role which can be thought of as functionally analogous to the one played by the substitution view of metaphor in the corresponding debate. Indeed, recalling Binkley’s reaction to this latter view, it seems appropriate to credit Norton with a sort of “parasitological” account of TEs, according to which a given TE could legitimately be credited with the capacity of justifying its conclusion only to the extent that its corresponding argument, deductive or inductive, can.

## **2. Essential tensions**

A second aspect which is common to both debates concerns the characterization of the cognitive mechanisms which underlie the epistemic role played both by metaphor and TEs. In each case, the relevant cognitive mechanisms have been accounted for, in the literature, by appealing to a peculiar *tension* within the subject’s conceptual system. In both cases, this tension has often been held responsible of triggering the mental activity required by both intellectual phenomena, and it has been thought of as a sort of precondition of the epistemic job carried out by metaphor and TEs respectively.

“Where there is metaphor”, wrote Goodman (1976), “there is conflict” (Goodman 1981 [1976]: 124). Monroe Beardsley (1962), before him, had already hinted toward the existence of a conceptual tension inherent to every metaphorical expression. The “metaphoricalness” of metaphor, according to Beardsley, has to be looked for “in some sort of conflict that is absent from literal expressions” (Beardsley 1981 [1962]: 111). The archetypical form of the kind of opposition at work in metaphor, he maintains, would be

*oxymoron* (see Beardsley 1981 [1962]: 110). He summarizes thus the process which takes place in the creation of a metaphor:

When a predicate is metaphorically adjoined to a subject, the predicate loses its ordinary extension, because it acquires a new intension [...] and this twist of meaning is forced by inherent *tensions*, or *oppositions*, within the metaphor itself (Beardsley 1981 [1962]: 106, my emphasis).

The *Verbal-opposition theory*, developed by Beardsley in order to account for the process just described, postulates the existence of two different levels of meaning enclosed in the same term, the *modifier*. Our ability to exploit metaphors, in particular, would draw upon a correspondent ability to distinguish between two different sets of properties within the same general term. The first set encompasses those properties which are said to belong to the *central* meaning of the term, in that their presence would constitute a necessary condition for the correct application of the term in a given context. The second set, on the other hand, would be the one formed by those properties which belong to what Beardsley calls the *marginal* meaning of the same term, in that they are held to be possessed only accidentally by the object to which they are attributed by the community of speakers. This last set constitutes what Beardsley calls the *potential range of connotation* of a given term, whose attribution to an object in a given context does not seem to be informed by any kind of pre-established rule. Now, when a term, i.e. the modifier, is combined with other terms in such a way as to create some incompatibility (not necessarily of a purely logical sort) between its central meaning and the central meaning of these other terms, there occurs a shift from its central to its marginal meaning which allows us to recognize its use as metaphorical (see Beardsley 1981 [1962]: 110-12). In Beardsley own words: “A metaphorical attribution, then, involves two ingredients: a semantical distinction between two levels of meaning, and a logical opposition at one level.”<sup>8</sup>

In order to illustrate this semantic phenomenon, the author draws our attention to the fact that when the predicate “spiteful” is metaphorically attributed to the sun in “the spiteful sun”, it loses its ordinary extension (to which people usually belong, not stars), thereby acquiring a new intension. This is due to the fact that when the modifier “spiteful” is combined with the term “sun”, an incompatibility arises between the central meanings of

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<sup>8</sup> In order to avoid contradiction with what previously stated in the text, I hasten to add that, according to Beardsley: “the term “logical opposition” here includes both direct incompatibility of designated properties and a more indirect incompatibility between the presuppositions of the term”. Beardsley (1981 [1962]: 112).

the two terms, in that, to quote Beardsley again, “our concept of the sun rules out the possibility of voluntary behaviour that is presupposed by the term ‘spiteful’” (Ibid.).

Now, it seems difficult to deny that some kind of tension or opposition is involved in TEs as well. In this case, as it is often claimed, the tension occurs between conflicting *intuitions* regarding the application criteria of concepts<sup>9</sup>. Indeed, to perform a TE roughly means to create an imaginary scenario aimed at rejecting a rival theory or hypothesis. This is achieved by appealing to the imaginary scenario and by showing that one of the consequences that the rival theory would be committed to if the state of affairs described in the scenario were to actually occur falls short of matching our current intuitions<sup>10</sup>. It is interesting to observe that one of the most influential accounts of TEs’ inner workings, due to Thomas Kuhn (1977 [1964]), takes the conceptual tension intentionally generated by its creator to be the fundamental ingredient of every TE. In this regard, Kuhn talks of an initial puzzling effect induced in the epistemic agent by the thought-experimental setting. Thought-experimental scenarios, according to his view, would indeed have the power to generate an experience of *paradox* by confronting us with a situation in which two previously well established criteria for applying a certain concept happen to clash.

This peculiar epistemic situation is undeniably ascertainable in the case of the famous TE<sup>11</sup> by means of which Galilei claimed to have rejected the

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<sup>9</sup> The exact nature and phenomenology of these elusive mental states, while being the subject matter of an autonomous debate, has become a highly controversial matter within the debate on TEs as well. For two opposite views on the subject, see Bealer 1998 and Cappelen 2012. Nothing of what I will say in what follows hinges on an assessment of this debate.

<sup>10</sup> It is only fair to add that not all authors would share my emphasis on the negative role played by TEs. According to Tamar Gendler, for instance, “To perform a thought experiment is to reason about an imaginary scenario with the aim of confirming or disconfirming some hypothesis or theory”. See Gendler (2006: 388). The TE due to Daniel Dennett, indeed, to which I will draw attention in the last section, seems to play a fundamentally positive role. Thanks to an anonymous referee for drawing my attention to this point.

<sup>11</sup> It is of course both possible and sensible to object that it would be improper to refer to Galilei’s considerations on falling bodies (or, for that matter, to Edmund Gettier’s epistemological considerations introduced in the next section) by the name of ‘thought experiment’, on the grounds that the procedure that Galilei appeals to *can*, as a matter of fact, be materially performed. Nonetheless, a well established use in the literature on the subject does refer to the case in question as an instance of a scientific TE. See, for instance, Brown 1991, Sorensen 1992, and Szabó Gendler 2000. This use finds its rationale in the fact that the possibility of being materially performed does not seem to be immediately relevant to the epistemological debate triggered by Galilei’s considerations, which concerns rather the

Aristotelian theory of motion, according to which the “natural speeds” of falling bodies would be a function of their weights. The concept involved in this case is therefore that of “speed”, and the two criteria which regulate its use would be the following:

1. Heavier bodies fall faster
2. The body AB is heavier than body A (if  $A > 0$ )

Galilei invites us to imagine that a heavier body be attached to a lighter one made of the same material, and then asks what would happen if the two bodies were to be released together and started falling through the same medium. The scenario is meant to show that if the two above criteria were simultaneously applied in answering the question, a contradiction would follow: We would be forced to maintain that the compound body must fall both faster and slower than the heavier of its components. Indeed, if (1) held, then the body AB, being heavier, should fall faster than A alone. On the other hand, (1) seems equally able to justify the opposite conclusion, in that the lighter body, “naturally” falling slower, should be expected to slow down the heavier one, and consequently the compound as a whole.

It is now important for our purposes to observe that a TE, according to Kuhn, leads us to focus our attention on the relation holding between the world and the conceptual apparatus by means of which we try to describe it. Insofar as it performs this function, a TE should be credited with the remarkable epistemic virtue of revealing us a tension between our conceptual system and a host of “unassimilated observations”, thereby drawing our attention to a situation in which nature fails to match our expectations (see Kuhn 1977 [1964]: 261). In a similar way, a metaphor, according to Mark Johnson, would force us to focus our attention on the relation holding between the event of its uttering and the context within which it is uttered or, to put the same thing in more general terms, between language and world (Johnson 1981: 24). “We apprehend an utterance as metaphorical”, writes Johnson, “not because of its literal falsity (though that may be a clue), but, more generally, because of a *tension* between the literal reading and its context” (Johnson 1981: 23, my emphasis). In both cases then, the concep-

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extent to which similar counterfactual speculations can be said to confer justification upon their conclusions. Moreover, as it has been pointed out in the literature, for instance by McAllister (2004), Galilei’s TE was not, in his time, quite as feasible as it may seem, in that it involves a high degree of idealization and abstraction. Thanks to an anonymous referee for this last sentence. I would like to thank my discussant, Marco Giunti, for giving me the opportunity to reflect on this matter.

tual tension generated either by metaphors or by TEs is made dependent on a sort of mismatch between reality and our own conceptual apparatus, which both phenomena have the merit to shed light on.

### **3. Scenarios and models**

A third and final aspect I would like to draw attention to concerns the epistemic role played both by metaphor and by TEs. The question I intend to consider is the following one: Why do we create and make use of metaphors and TEs? The answer I will propose is that this is due to the fact that in both cases, as I will try to show, we indirectly learn something about the world by learning something about our conceptual apparatus. It is indeed my impression that, as it seems to be the case of metaphors (see Hesse 1980 [1966]), the epistemic effectiveness of TEs as well rests on a similarity between their functioning and the functioning of scientific models, once these are construed in a sufficiently broad manner. As a consequence of this general view, I believe that both metaphors and TEs can be profitably thought of as sort of meeting point between mind and world.

According to Daniela Bailer-Jones:

A model is an interpretative description of a phenomenon that facilitates access to that phenomenon [...] Facilitating access usually involves focusing on specific aspects of a phenomenon, sometimes deliberately disregarding others. As a result models tend to be partial descriptions only (Bailer-Jones 2002: 108-109).

With the above characterization in mind, we could begin by observing that both in metaphors and in TEs we can be said to be focusing our attention on single aspects of a given object of inquiry, intentionally neglecting others, and thereby subjecting the information at our disposal to some sort of selection process. Moreover, just as the creation of a model presupposes the holding of some sort of similarity between the model itself and the portion of reality it is intended to be a model of, any appeal to metaphorical language or though-experimental considerations ultimately rests on the assumption that some of the relations holding within the so called *secondary system* (Hesse 1980 [1966]: 148) of a metaphor or within the *imaginary scenario* of a TE do hold in reality as well. Indeed, I believe that the analogy runs even deeper in that it can be showed that, just as it happens with models, both in the case of metaphor and in the case of TEs a first process of *idealization* of the corresponding object of inquiry is usually followed by a

process of *projection* of the features of one domain on a different target domain.

Since this last point has already been sufficiently argued for in the case of metaphor<sup>12</sup>, I would now like to clarify, by means of an example drawn from epistemology, the sense in which these two elements, namely idealization and projection, can be said to play a role in the case of TEs as well<sup>13</sup>.

In a now famous three pages article published in 1963 Edmund Gettier rejected, by means of a TE, a widely shared analysis of knowledge. According to the received view, which might be regarded as the standard analysis of knowledge up to his paper, being a *justified true belief* would be both a necessary and a sufficient condition for being *knowledge*. This widely shared tripartite analysis of knowledge holds that, in order for an epistemic agent *S* to *know* (i.e. to be in the relation of “knowing” to) a proposition *p*, it is both necessary and sufficient that the three following conditions be satisfied: (1) *p* is *true*, (2) *S* *believes* that *p*, and (3) *S* is *justified* in believing that *p*. The three conditions just stated are usually summarized by the writing: K = JTB. Now, despite the undeniable plausibility of the above claim, Edmund Gettier thought otherwise. Being a justified true belief, according to him, although necessary, would not be a sufficient condition for being knowledge. The way in which we normally understand the notion of justification, he maintained, seems to clearly allow cases in which an epistemic agent may be fully justified in believing a given proposition without thereby automatically being in the relation of “knowing” to that proposition. Accordingly, the scenario of his TE is aimed at capturing precisely this kind of epistemic situation<sup>14</sup>.

Gettier asks us to consider the following possible set of circumstances. Two men named Smith and Jones have applied for the same job, and Smith has evidence for the following proposition:

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<sup>12</sup> See, for instance, Hesse 1980 [1966], Bradie 1998 e Bailer-Jones 2002.

<sup>13</sup> By acknowledging the existence of an *analogy* between the kind of reasoning involved in a TE and the one at work in the creation a scientific model I do not mean to suggest that TEs simply *are* scientific models. Indeed, the exact nature of the relation holding between TEs and scientific models is certainly a question worth pursuing. An interesting proposal, in this regard, has been put forward by Humphreys (1993), according to which many TEs would be ways of exploring and refining theoretical models, and would be aimed at assessing the conditions under which a given model holds. Thanks to an anonymous referee for bringing my attention to this point.

<sup>14</sup> Gettier considered two different scenarios to the same effect. I will here present the first one of the two.

(a) Jones is the man who will get the job, and Jones has ten coins in his pocket.<sup>15</sup>

Smith is further aware of the fact that (a) entails the following proposition:

(b) The man who will get the job has ten coins in his pocket.

As a consequence, accepting (b) on the grounds of (a), Smith is justified in believing that (b) is true. Suppose now that, unknown to Smith, he (Smith) is the one who has been selected for the job, and who further *happens* to have ten coins in his pocket. If a similar situation were to actually occur, then the following three conditions recalled above would obviously be satisfied, in that (1) (b) is *true*, (2) Smith *believes* that (b), and (3) Smith is *justified* in believing that (b). Unfortunately for the standard analysis, Gettier points out, despite the fulfillment of the three conditions, it seems just obvious that Smith cannot be said to *know* that (b). Hence, concludes Gettier, there must be more to knowledge than our justifiedly believing true propositions:  $K \neq JTB$ .

Let us now introduce a new relation  $G$  and refer to it by the name of “Gettier relation”.  $G$  can be characterized as that very peculiar relation which holds between an epistemic agent and a given proposition in any Gettier-like scenario. Accordingly, we will read  $G(S, p)$  as: The epistemic agent  $S$  is Gettier-related to proposition  $p$ . Now, if we standardly take an *idealization* to be a “deliberate simplification of something complicated with the objective of making it more tractable” (Frigg and Hartmann 2006: section 1.1), it seems appropriate to think of the Gettier relation as of an idealization out of countless real world situations. According to Roman Frigg and Stephan Hartmann (2006), the current philosophical debate recognizes two different kinds of idealization, namely an *Aristotelian* and a *Galilean* one. While the former, according to the authors, would amount to a progressive stripping away from an object of inquiry of all those features that we deem not relevant to the problem at hand, the latter is said to involve deliberate distortions of the object under scrutiny (see Frigg and Hartmann 2006: section 1.1). Insofar as a Gettier-like scenario is an attempt at isolating those aspects that we deem more relevant to the kind of epistemic rela-

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<sup>15</sup> We are free to imagine, Gettier suggests, that Smith has come to know from a reliable source that Jones will be selected for the job, and that Smith has actually counted the coins in Jones’ pocket.

tion called ‘knowledge’, a process of Aristotelian idealization seems to me at work in Gettier's TE<sup>16</sup>.

The second element that TEs seem to share with scientific models, namely *projection* of the features of one domain on a different target domain, can perhaps be made more perspicuous by the following considerations. It seems plausible to conjecture that in his attempt at rejecting the standard analysis of knowledge recalled above, according to which  $K = JTB$ , Gettier began by formulating, in abstract terms, the relation  $G$  that we introduced above, and that we can now regiment as follows:

$$G(a,b) \leftrightarrow (T(b) \ \& \ B(a,b) \ \& \ J(a,b) \ \& \ \sim K(a,b))$$

Having thus worked out the general form of a counterexample to the standard analysis, Gettier may have started thinking of an epistemic situation which could count as a possible real world instance of  $G$ . It seems to me that, to the extent that the above conjecture captures the actual train of thought which led Gettier to formulate his TE, there is a sense in which his imaginary scenario could be said to resemble a model. Indeed, if we interpret the above schema as concerning a specific epistemic agent  $a$  and a given proposition  $b$ , then the situation we end up contemplating, being clearly possible in real life, could be thought of as a model of  $G$ . Gettier cases, that is, seem to succeed in rejecting as inadequate the standard analysis of knowledge in that they land a strong intuitive pull to the possibility of finding real world instances of the state of affairs described by  $G$ .

#### 4. A metaphorical path to thought experiments

I would like to conclude the present considerations by putting forward an hypothesis concerning the role that metaphor might turn out to play in the genesis of many TEs. The fundamental idea, as I will try to illustrate by means of an example, is that, at least in some cases, an acknowledgement of the explanatory power possessed by a single metaphor can motivate the elaboration of a whole imaginary scenario.

It seems fair to say that the American philosopher Daniel Dennett has raised metaphor to a sort of expository paradigm of his own philosophical views. It should be added that metaphor, in his case, seems to transcend a mere expository function, and to become a powerful tool of philosophical

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<sup>16</sup> Nonetheless, as one of the referees has sensibly pointed out, other TEs may involve instead a process of Galilean idealization, or even a combination of the two.



analysis. Philosophy, maintains Dennett, while only rarely producing results which can be likened in stability to the ones produced by science, can nonetheless be credited with the very remarkable power of bringing about “new ways of looking at things, ways of thinking about things, ways of framing the questions, ways of seeing what is important and why” (Dennett 1987: 2).

Over the last three decades, Dennett has defended a highly influential functionalist theory of mind. According to a standard construal of the term, *functionalism* in the philosophy of mind is the doctrine according to which “what makes something a mental state of a particular type does not depend on its internal constitution, but rather on the way it functions, or the role it plays, in the system of which it is part” (Levin 2010). It is not hard to see that the above characterization clearly allows for the attribution of mental states to entities whose material constitution might be very different from our own. This is what is meant by the functionalist slogan according to which mental states would be *multiply realizable*.

In his 1987 book *The Intentional Stance*, Dennett is after a plausible account of the widely acknowledged power and success of folk psychology (see Dennett 1987: 11). As human beings, we are perfectly able, in normal circumstances, to understand and predict the behaviour of other members of our species by attributing them mental states, and in particular *beliefs* and *desires*, of various kinds. This ability, according to Dennett, is due to the fact that each of us, in the course of personal development, has become an expert, as it were, in the application of an extraordinarily effective predictive strategy. He calls this strategy, upon which he believes that a correct theory of mind should be founded (see Dennett 1987: 2), the *intentional stance*, and describes it in the following terms:

The intentional strategy consists of treating the object whose behavior you want to predict as a rational agent with beliefs and desires and other mental states exhibiting what Brentano and others call *intentionality* (Dennett 1987: 15).

The enormous evolutionary success of this strategy, according to Dennett, comes from the fact that, by drastically restricting the number of our expectations concerning the possible future states of our environment, it lands us an extraordinary predictive power over that environment itself. This means, for instance, that even though it were in principle possible to deliver a complete microphysical description of all the events taking place in the brain of a given agent at a given time, and to formulate, on that basis, exact predictions concerning the future behavior of that agent, the adoption of the intentional stance would still allow us, most of the times, to reach conclu-

sions enjoying the same level of reliability in an enormously smaller amount of time.

Within the general framework just described, Dennett is particularly interested in shedding light on the logic which governs our attributions of mental states to other members of our species. It is indeed his firm conviction that any system, either natural or artificial, the behaviour of which could be effectively predicted by adopting the intentional stance must be thought of as a *true believer* under all respects, that is as an agent to which it would be fully legitimate to ascribe beliefs of various sorts. In Dennett's own words:

“*All there is* to being a true believer is being a system whose behaviour is reliably predictable via the intentional strategy, and hence *all there is* to really and truly believing that *p* (for any proposition *p*) is being an intentional system for which *p* occurs as a belief in the best (most predictive) interpretation” (Dennett 1987: 29).

In order to lend theoretical appeal to the perplexing amount of pragmatism which seems to underlie his thesis, Dennett appeals to an ingenious TE<sup>17</sup> by means of which he intends to show that the logic which governs our attribution of beliefs (as well as other mental states) to a thermostat is fundamentally the same logic which is at work in our attributing beliefs to a human being.

We are asked to imagine a *thermostat*, i.e. a simple device explicitly designed to turn a boiler on or off according to a variation in the ambient temperature. We are then requested to imagine applying to it the intentional strategy described above. This would lead us to attribute to the thermostat a very limited range of beliefs and desires. We could maintain, for instance, that it *believes* that the room is cold and the boiler off, that it *wants* the room to be warmer and *believes* that in order to bring about such change it is necessary to turn the boiler on. Indeed, the existence of an ascertainable causal link between the thermostat and its environment clearly seems to allow us to think of its internal states as *representing*, to a certain extent, the world in which the thermostat is embedded, as well as to ascribe *meanings* and *truth conditions* to those internal states. Now, adds Dennett, since the thermostat certainly does not possess the concepts featuring in the contents of the mental states we are attributing to it (i.e. ‘hot’, ‘cold’, ‘boiler’, etc.), we could, as it were, *de-interpret* its beliefs and desires and replace them by corresponding dummy predicates, substituting, say, ‘A’ for ‘hot’, ‘B’ for

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<sup>17</sup> In what follows, I will draw on Dennett (1987: 29-32).

‘cold’, ‘C’ for ‘boiler off’, and so on. It is now easy to see that, due to the simplicity of the thermostat’s internal constitution, the semantics of these predicates would be so impoverished as to allow that any formula in which they appeared be satisfied by a very high number of models. Another way to put this would be to say that the internal constitution of our device would make it suitable to perform different functions other than that of regulating the temperature in a room, such as, for instance, regulating the level of water in a tank or the speed of a train.

At this point the TE requires us to imagine progressively increasing the number of connections between the thermostat and its environment, thereby automatically enriching the semantics of its generic predicates. In order to do so, we could imagine endowing the thermostat with additional components performing the job of rudimental sensory systems. We could provide it, for instance, with a sort of primitive visual system which would allow it to detect the shivering of the people in the room, or with an auditory systems by means of which it could take note of their complaints. This would obviously enable the thermostat to deliver a more fine grained description of its environment. And yet an important consequence of this process would be that as the complexity of the device increases, that is as the number of its connections with the world grows larger, it becomes increasingly difficult to bring about changes in its environment, without thereby determining the need for an internal reorganization of the system as a whole. To any increase in complexity, in other words, there would correspond a decrease in the versatility of the device, that is in its ability to perform functions other than just regulating the temperature in a room. A similar scenario, concludes Dennett, lands a strong intuitive pull to the impression that if we carried on indefinitely the process of enrichment just described, we would end up contemplating a system which is, under all respects, disturbingly similar to our own fellow human beings (and to us, for that matter).

Now, as the above example shows, in the case of Dennett’s TE, the careful engineering of a highly articulated imaginary scenario seems to have been a natural consequence of a previous act of acknowledgement of the explanatory power possessed by a specific family of metaphors concerning the beliefs and desires of a simple thermostat. Indeed, with regard to the unavoidable process of anthropomorphisation to which the adoption of the intentional stance gives rise, Dennett explicitly talks of “pedagogically useful metaphors” (Dennett 1987: 22). As a matter of fact, the unsophisticated device featured by his TE can be regarded as a cognitively prolific metaphor in that the projection of some of its simple features on an extremely more complex biological system, such as a human being, proves capable of sig-

nificantly enhancing our understanding of the latter<sup>18</sup>. Should metaphor turn out to be involved to the genesis of TEs other than the one I have chosen in order to put my hypothesis to the test, this could lead to crediting metaphorical thinking with a further and not yet acknowledged cognitive function, namely that of effectively contributing to a philosophical analysis.

## Conclusion

The main points of the above discussion could be summarized as follows. The current debates on metaphor and TEs display a number of generally neglected connections, whose appreciation may shed new light on the respective subject matters. I singled out three different respects under which the two debates show striking similarities, namely (1) the presence of a reductionist approach to both metaphors and TEs aimed at explaining their epistemic achievements by tracing them back to other forms of reasoning, (2) the tendency to locate the cognitive underpinnings of both intellectual phenomena in a peculiar tension which arises within the subject's conceptual system and (3) the existence of a not yet fully investigated analogy between the kind of reasoning involved by metaphor and TEs, on the one hand, and the one triggered by scientific models, on the other. In the final section, I put forward an hypothesis concerning the role that metaphor might turn out to play in the genesis of many TEs, which draws on the explanatory power of metaphors, and which I believe deserves further exploration.

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<sup>18</sup> As one of the referees has correctly pointed out, “in the debate on TEs Dennett is typically considered as a skeptic”. In my opinion, this has indeed been a hasty judgment on the side of many interpreters of his thought. Commenting on the history of his famous expression “intuition pumps”, Dennett has recently observed: “Some thinkers concluded I meant the term to be disparaging or dismissive. On the contrary, I love intuition pumps!”. See Dennett (2013: 6). If we take a skeptic towards TEs to be someone who wishes to banish their use once and for all from philosophical inquiry, then Dennett seems definitely misplaced amongst the foes of TEs. While not thinking of their deliverances as conclusive, he nonetheless seems to think of TEs as of valuable cognitive tools. It may be worth quoting one last passage from his last book, *Intuition Pumps and other Tools for Thinking*: “These thinking tools seldom establish a *fixed* point – a solid “axiom” for all future inquiry – but rather introduce a worthy *candidate* for a fixed point, a likely constraint on future inquiry, by itself subject to revision or jettisoning altogether if somebody can figure out why” (Dennett 2013: 13).

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There has been considerable study of the persuasive effect that metaphors have in advertisements, political speeches, arguments in debates, educational material, and elsewhere. While an apt metaphor can strengthen an argument and make it more persuasive without doing violence to the truth, metaphor can also, by exacerbating problems of ambiguity, contribute to fallacies of argumentation. The present collection of papers combines logico-philosophical analysis and empirical research to study different aspects of metaphors in argumentation. The aim of this collection is to theoretically analyse the way metaphors are used in argumentation, and the linguistic and epistemological phenomena involved in metaphor comprehension in different research fields, such as science, literature and philosophy. All the collected papers were presented at the first Cagliari-Urbino Meeting on “Metaphor and Argumentation”, held in Cagliari in June 2012.





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