BOOK OF ABSTRACTS

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Keynote speakers

K1 | Naturalism in the age of real science

Daniel Andler (*Université de Paris-Sorbonne, Paris IV, France*)

A realistic assessment of the scientific process, conducted over the last several decades, challenges the notion that science is on its way to provide a faithful and complete representation of the world. On the other hand, over the same period, large swaths of the humanities and the social realms have been brought under the purview of natural science. Scientific naturalism appears weakened from the first vantage point, and strengthened from the second. An arbitration will be proposed: it is not pragmatically acceptable to remain agnostic.

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K2 | Does sciences seek the truth?

María José Frapolli (*Universidad de Granada, Spain*)

General contents are essentially linked to the kind of practices that make us rational beings. A background picture of the world, with the minimal stability required to permit some trading with our surroundings, needs entertaining general thoughts. Truth is a means of dealing with them. The title of this talk, "Does sciences seek the truth?", admits a short answer (Of course, they do! What else?) and a longer one. The longer answer will explain that truth ascriptions work as propositional variables, and that propositional variables are required to generalize over propositions. The sentence "sciences seek the truth" expresses a propositional generalization, which will be analyzed in the talk.

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K3 | Imagination and visualization of geometric and topological forms in space: about some formal, philosophical and aesthetic features of mathematics and physics

Luciano Boi (*École des Hautes Études en Science Sociales, Paris, France*)

Our talk is aimed at studying some aspects of the imagination and visualization of geometric and topological forms, like non-orientable surfaces, knots and links. The objective is to show that this study may represent a logic and philosophical

powerful method allowing for describing and explaining new mathematical, physical and perceptive properties of our surrounding space. We aim at showing that some "basic" operations like *cut* and *glue* can be composed in order to get more complex constructions or structures, such as *connected sum* and *boundary surface*, which show the existence of new mathematical properties. We will study some of these complex structures in relation with the processes of *embedding* and *immersion* of some families of surfaces and spaces. These properties may be elucidated thanks to the concepts of *homeomorphism* and *isotopy*. The most relevant point, from the topological and philosophical points of views, is that two objects may have the same "form" and therefore correspond to (at least) two different graphic images. This fact shows first of all that the *equivalence of forms* has a topological meaning much more important than the simple *equivalence of images*. Thus, we will clarify this formal and physical difference with respect to two families of objects or surfaces, the first being knotted and the other being unknotted. In fact, the knotted-like form is a property that essentially depends upon the kind of three-dimensional space in which these knotted or unknotted objects or surfaces are imbedded. Our hypothesis is that the study of objects and of the spatial environment in which they allow for different types of deformations is deeply correlated with the understanding of the dynamic transformations and the new emergent properties and behaviours of these objects and spaces. This is a point of paramount importance for our deep philosophical understanding of the different structures of space, which can be grasped only if we develop a dynamic and relational vision of space and its structures.

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K4| The Autonomy of the Special Sciences
Byron Kaldis (*Hellenic Open University, Greece*)

The recent debate in philosophy over the validity of the supervenience argument (SA) and, what is more, of the threatening possibility that it may be seen to generalize at all levels of reality (whereby higher order properties turned out to be epiphenomenal unless they are reduced) thus rendering the special sciences redundant, has been at the centre of the more general field of discussions regarding the autonomous or not status of the special sciences (and the causal role or independent causal efficacy of their principal items). The different viewpoint adopted in this talk puts to the forefront two things: first, it focuses on the higher special sciences, those squarely social, namely, those situated at levels above psychology, stressing the need for the discussion to move on to those levels where social action

takes place, while second, it introduces a crucial element in this analysis: the extended mind thesis and distributed cognition. The latter is shown to play a pivotal role in the analysis of the uniqueness of the protagonists of those higher levels of the (explicitly social) special sciences, i.e. joint actions (especially those carried out by organized groups, i.e. institutions and other structured social wholes). Joint or shared action, widely construed to stand for a certain, central, kind of social wholes and social events ('wholes' and 'events' here used purportedly in the strict ontological sense) instantiates one of the more promising cases of extended and distributed cognition. Supervenience is a relation that leads to causal inefficacy whereby the supervenient (non-physical) properties allow their subvenient (physical) base to carry all the causal weight itself; hence the former add nothing to the causal pool, i.e. nothing special of their own, since causation is taken care by the items at the base (e.g. group properties or mental ones vs. individual members' properties or brain ones, respectively). This places the special sciences (employing non-physical or superveneient properties as explanatory) in jeopardy. Their autonomy is compromised. In the standard discussion of the Supervenience relation reality is divided into, on the one hand, a hierarchy of levels of part/whole relations or mereological relations of macro-micro levels and, on the other, a hierarchy of orders couched in terms of second-order properties of some object and their realization by first-order properties of the same object (e.g. mental states vs. brain states).

(i) The first part of the talk deals with the discussion of the level-hierarchy and examines how particular criticisms voiced against the strategy of uncoupling supervenience from the macro-micro property relations, fare with respect to the case of joint action.

(ii) The second part of the talk challenges the dominant assumption that the second, the orders- hierarchy, is irrelevant in our domain.

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K5| La reconstitution, une pratique savante?
Philippe Artières (*LAHIC, IIAC, CNRS/EHESS, France*)

La communication s'attachera à montrer comment et pourquoi la pratique de la reconstitution, issue du monde judiciaire et largement présente dans l'art contemporain, peut constituer un nouveau moyen d'intelligibilité et de connaissance en sciences humaines. A partir de notre propre expérience, on interrogera cette pratique du «roleplay» et on se demandera dans quelle mesure cette expérimentation a du sens en recherche fondamentale.

K6 | Diagrams, Information and the Visual
Claude Imbert (*ENS, Paris, France*)

I first recall Frege's endeavour, including its graphic details and his daring use of new dimensions. It soon became a stumbling block, and a matter of discussion with psychologists, anthropologists, logicians and philosophers. The problem remained on the agenda during half a century, till a mathematical logic got its explicit transformation laws and (by the way) its options. In the same time, Frege's diagrammatic syntax suggested a rough draft for an electronic net.

So, Frege's case is now part of a visual challenge to which epistemology has been confronted along XXth century. The use of diagrams – in the context of visual art and visual anthropology – elicited a specific attention to the cognitive aspects of any visual syntax.

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K7 | Physicalism and Scientific Evidence
John Symons (*University of Kansas, USA*)

This talk will examine the role of scientific evidence in the development of the physicalist consensus in philosophy from the 1960s until relatively recently.

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K8 | The Science to Save us from Philosophy of Science
Ahti-Veikko Pietarinen (*University of Hensinki & Tallinn University of Technology, Finland*)

Although the exact rules of retroductive logic have proved elusive, recent discoveries in sciences dealing with under-structured problem spaces testify its prevalence. This puts paid to the need to find epistemic justification or confirmation to such methodologies and findings. A scientist, never frightened of not knowing something, strives to move at the forefront of ignorance, not that of belief or knowledge. Far from rendering science irrational, I argue that catering for the right conditions in which to cultivate ignorance is a key to the rationale to many of these findings.

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K9 | Reflexions on science and its role in the European civilization

Jan Sebestik (*Institut d'histoire et de philosophie des sciences de l'Université de Paris I et CNRS, France*)

All civilizations had some rudiments of scientific knowledge: elements of geometry and arithmetic, collections of astronomical observations, calendar, methods of treatment of illnesses, extensive knowledge of plants, animals and environment. Taking advantage of this accumulation of knowledge by their neighbors, the Greeks developed a completely different model of science unifying scattered pieces by logical methods and mathematics. While Greek science declined, the Islamic countries overtook the leading role for about four centuries, but again, science in these countries became practically extinct. The reasons of this double decline will be examined.

European science is a late product (why?): it awoke late and developed slowly since the XIIIth century, assimilating progressively Greek and Islamic heritage. After the renaissance of arts, an exceptional international scientific community came to life in the XVIIth century giving birth to science as we know it today. It was a collective work of men of genius and two of them should be mentioned because of their decisive and unpredictable innovations: Kepler and Einstein.

After two centuries that brought fundamental discoveries (unification of mathematics by set theory, mathematical logic, electricity and magnetism and unification of physics, theory of relativity, quantum theory, Darwin's evolutionary theory, Mendel's heredity theory, discovery of the genetic code, psychoanalysis etc, etc.), European science (and in a lesser degree also American) manifests first warning signals of recession: the interest of the general public as well as the number of students of science declines. Is democracy capable to promote the pursuit of scientific research? Science is not only our work and our heritage. it is also the only means to keep pace with the quickly developing outer world.

Sessions

The own goal of Philosophy of Science

Roi Bar (*University of Leipzig, Germany*)

Contemporary philosophy of science is dominated by epistemological naturalism. According to this view, knowledge, even human knowledge, is a purely natural kind. The knowing human subject is understood as a natural phenomenon explained sufficiently and exclusively by categories of empirical psychology (Quine, 1969) or neuroscience (Dennett, 1991). Science itself seems to be the crown of the world of nature. Consequently, epistemology, the science of knowledge, is considered as an empirical natural science, comparable with inductive gemology (Kornblith, 2002). In this manner, naturalistic philosophy of science scores an own goal. Denying the uniqueness of human knowledge as a self-knowing mind, a logical kind, and thereby leaving the philosophical question of science to the natural sciences, it loses the justification for its own existence. Genuine subject-categories for self-referential thought remain foreign words: רוּחַ, νοῦς, intellectus, Geist. This self-unaware zeitgeist is not without lethal consequences for philosophy in general. By referring only to natural science as proper science, philosophy is not conceived as a form of scientia, namely Geisteswissenschaft, the universal thought of the deductive world-spirit. Rather, it seems to become superfluous (Hawking, 2010). Thus, the naturalized philosophy of science asks for a grounding in itself. Without constituting the idea of science by itself, naked and poor philosophy would have to beg its method again and again from the natural sciences. The response to this problem could be inspired by the Hegelian spirits blowing through post-analytic philosophy today. The goal of reiterating the act of phenomenology of spirit is to show that science, as the highest form of self-conscious spirit, is "die Krone einer Welt des Geistes" (Hegel, 1807).

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The roles of cognitive and non-cognitive values in the assessment of scientific theories: a case study of Evolutionary Psychology
Silvia Ivani

This paper concerns the roles of cognitive and non-cognitive values in the assessment of scientific theories. Cognitive values are qualities that a good theory can embody, like coherence and simplicity. By non-cognitive values I am referring to political, aesthetic, religious, economic, and social values. Through theses notions I examine a specific theory, evolutionary psychology, and I suggest an analysis of a case study of this theory, concerning partner choice. The analysis shows that this theory has some explanatory and methodological gaps in terms of cognitive values. In my opinion, this case study also suggests that non-cognitive values may have a beneficial role in the assessment of theories. Philosophers traditionally deny a role for non-cognitive values in the assessment of theories in order to maintain the science as an independent research that can produce objective knowledge. Therefore, the genuine science is value-free. I move from this idea and, regarding the case study, I suggest a beneficial epistemic role for the non-cognitive values. In order to analyze this question I examine and confront the thoughts of Kristen Intemann and Heather Douglas. Kristen Intemann (2005) states that non-cognitive values can give good reasons to assess a theory if they are closely connected to the aims of a scientific research context. Douglas (2009) affirms that non-cognitive values can only have an indirect role in the assessment of scientific theories: they can't be used as reasons to accept or reject a theory, but they can have a role if scientists have to consider the ethical consequences of their assessments of theories. My aim is to show that some non-cognitive values can have a useful and beneficial role in the assessment of hypotheses and in the elaboration of a better evolutionary psychology. Non-cognitive values don't necessarily compromise the adequacy and the objectivity of a scientific theory.

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There is no such a thing as *a priori* knowledge that is certain knowledge of incompatibilities
Gaetano Albergo (*University of Catania, Italy*)

Dummett gave a great contribution for a logical foundation of metaphysics. We need, at this point, to put it the other way around. The most plausible account of what determine the meanings of our logical constants has it that our constants mean what they do by virtue

of their conceptual role, that is, participating in some inferences and not in others. Any such approach faces many difficulties. Quine urged that an implicit definition of logic leads to circularity. According to a currently popular idea, following rule **R** with respect to **e** may consist in our being disposed to conform to rule **R** in our employment of **e**, under certain circumstances. On this version, the notion of rule-following would have been reduced to a certain sort of dispositional fact. Alternatively, one might wish to appeal to the notion of following a given rule, while resisting the claim that it can be *reduced* to a set of naturalistically acceptable dispositional facts. I will work with the reductionist version of rule-following. Applied to the case we are considering, usually it issues in what is widely known in the literature as a "conceptual role semantics". But, there is an alternative, and that is what I define a "metaphysical foundation of logic". One needs a metaphysical basis for logic, insofar as we seek an origin for our grasp of the meaning of negation. In contrast to Neil Tennant and Francesco Berto, I believe this isn't to be found in our sense of contrariety, that is, in a semantical notion, but in our primitive grasp of incompatibility. Are incompatibility and contrariety coextensive notions? Or is incompatibility more primitive than the other one? I believe that every instance of contrariety is a case of incompatibility, but not the other way around.

Reductionism, nonreductionism and organism. Methodological quarrels and ontological perspectives
Duarte Gonçalves (*New University of Lisbon, Portugal*)

One of the fiercest methodological quarrels within social sciences regards the claim on the part of reductionists that not only there are only individuals, but that social phenomena, institutions, groups and the like are to be studied on an individualistic basis. Although there are considerable differences among reductionist theses, all consider that social properties are nothing but a combination of non-social individualistic ones or, to say the least, are lawfully entailed by these, that is, contemplating a reduction of the emergent social properties to the supervenient lower-level ones. As such, social laws should be reduced from higher-levels to the individual-level of analysis by means of bridge laws.

Against these perspectives, theorists are increasingly contesting for non-reducibility. Be it on interpretive grounds – namely positing a non-antecedent correlation between individual and social and defending a social emergence of individuality and self-consciousness – or relying on more formal arguments – such as those based on multiple realizability and wild disjunction –, nonreductionism presents a serious impasse to those exclusivist methodological stances.

In this presentation, we contrast both these perspectives to bring forward non-reducibility of emergent social properties and to further open way to the non-derivative hierarchical or downward causal capacity of the social level regarding the individual one, leading to multiple levels dialectical relations, with vocabulary incommensurability grounding the legitimacy of such multiple levels of analysis in social sciences. By legitimating the irreducibility of the social level of analysis and contemplating hierarchical causation, we consequently set a plea

for methodological tolerance and complementarity. Furthermore, we develop on ontological organicism as the escape-way out of the restrictive setting put forward by ontological individualism, offering a more realistic ontological understanding of reality.

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Can we represent types?

Alex Tillas (*Heinrich Heine University Düsseldorf, Germany*)

Perception allows us to get in contact with our environment and – most often – recognize a given perceived entity as falling under a given category. But given that we only have experi-

ences with particular instances (of kinds), how is it that we represent types? There are two dominant approaches about the nature and origins of general ideas or type representations (concepts): (a) Suggesting an abstraction process (e.g. Locke); (b) Stressing an idea's functional role (e.g. Berkeley, Hume, Prinz). In this paper, my main focus is on abstraction as a psychological process of similarities recognition across instances of a given kind and progressive exclusion of details between them. Though its origins are often traced in Locke (1690/1924), various senses of abstraction have been developed in fields as diverse as philosophy (e.g. Locke), psychology and cognitive science (e.g. Harnad, 1990; Hintzman 1986; Nelson, 1969), artificial intelligence (Smolensky 1988; Saund 1986), and computer science. Traditionally abstraction models have been deemed circular (e.g. Berkeley 1710/1957). In recent years abstraction models have also come under fire for being incoherent (e.g. Hendriks-Jansen 1996) as requiring large conceptual resources in order to operate etc. In the light of recent advances in cognitive science, I revisit the traditional debate about general ideas and flesh out the details of a process through which general ideas are formed out of representations of particulars. I argue that the suggested view avoids the challenges that both traditional and modern abstraction models faced. The main characteristic of the suggested view is that abstract representations are structured mental entities with general representational powers, while perceptual top-down effects play a crucial role in the abstraction process.

Keywords: Types; abstraction; concept individuation; top-down effects on perception; Hebbian learning; classical conditioning.

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Biological Function: the usefulness of teleological language in science

Margarida Dias (*University of Coimbra, Portugal*)

The aim of this work is to justify the crucial role of teleological language for the intelligibility of scientific discourse, showing the compatibility between teleological vocabulary and scientific objectivity, assuming from now an interdisciplinary approach between philosophy and science, with particular emphasis on discipline biology. For this purpose, Kantian reflection about natural phenomena is of utmost importance in describing the process of nature with reference to ends. The most interesting aspect in the Kantian reflection lies in the metaphorical [simplifying] value of the teleological vocabulary for human understanding about living organisms. In the context of contemporary biology, the question about the "function" that different organs and structures play in the vital process and their contribution to the adaptive process (survival) of individual organisms and species itself emerges as a guideline in this discussion. It will be in the context of an analysis of the concept of "biological function" that interpretations of R. Millikan - teleological interpretation and R. Cummins – non-teleological or systematic interpretation of function, will take particular relevance in this text. The first, focusing on a historical analysis of the function based on the principle of natural selection, and the second, offering a functional analysis in terms of the contribution of current parts (properties) to the survival of the current system (whole).The research undertaken here does not dispense a reading of the concept of "teleonomy" proposed by E. Mayr, which allows us to speak of "purpose" or "directionality" regarding living organisms without bring back science to the obscurantism of pre-Darwinian vocabulary.Based on the concept of "biological function", we are faced with a further issue - the problem of reducing the natural phenomenon to general statements of physics and chemistry, what here is a subject of discussion.

Keywords: Teleology, Science, Metaphor, Function, Organism, Nature, Natural Selection, Reductionism.

P2

Mechanisms meet structural explanation

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Causal/mechanical and mathematical explanations are hot topics in current philosophy of science, whose strict interrelation is getting more and more evident (e.g. Dorato and Felline

(2010) and Lange (2011) characterizing mathematical explanation as a non-causal explanation, but see also the recent "Mind and Life" (2013) conference in Belgrade). It is therefore somewhat surprising how little work has been done so far to understand the relationship between these two kinds of scientific explanation. This paper investigates such a relationship in the examples of Dorato and Felline's (2010) version of Structural Explanation (SE) and Glennan's (2002) Mechanistic Explanation (ME). 1. In the introduction, I illustrate how the quest for an explanation can originate from a tension between apparently contradictory elements of reality. To solve this tension, new information is required, which can be either about mechanical elements of reality or about features of our representation of reality that were previously considered universal or even a priori (e.g. a new spacetime geometry from Euclidean to Minkowskian). When explanatory information is of this second kind we often have a SE, leading to a reassessment of the conceptual framework within which we model the world. In such a way the tension originating the quest for an explanation is solved, without need to specify what kind of processes or entities underly the explanandum (e.g. the relativistic explanation of length contraction). 2. Building on the analysis above, I show how SE is particularly successful within fundamental physical phenomena, while Glennan's ME is only applicable to non-fundamental complex phenomena. 3. Against Glennan, I conclude that an explanandum being 'brute' is relative to a specific kind of explanation and that, although causally brute, fundamental phenomena can be structurally explainable.

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Pliability and resistance: Feyerabendian insights into sophisticated realism

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In his later writings, and most notably in Conquest of Abundance (1999), Feyerabend struggled to reach a comfortable middle ground between relativism and realism. Accordingly, while trying to distance himself from the relativism that he embraced, for instance, in Science in a Free Society (1978), he vociferously railed against realism. In this paper we focus on Feyerabend's critique of realism, and in particular on two claims concerning the

limited pliability of the world that constitute the core of his alternative view of science. The first—the pliability thesis—is the claim that the world can be described, in principle, by infinitely many conceptual systems, none of them enjoying a privileged status. The second—the resistance thesis—is the claim that the pliability of the world is limited: the world offers resistance to some attempts to describe it. We argue that, in spite of the later Feyerabend's notorious antirealist leanings, the pliability thesis is entirely compatible with a robustly realist view of science, and we suggest that, surprisingly, from a World-3 perspective Feyerabend's insights concerning the limited pliability of the world turn out to be those of a potential ally of realism. Indeed, as we show, (versions of) the pliability and the resistance thesis lie at the heart of Niiniluoto's (1987; 1999) critical scientific realism, according to which the main cognitive aim of science is truth approximation. Although mainly historical in character, our discussion illustrates the strength of the realist approach to science. Realism is the more defensible and attractive, the more nuanced and guarded—the more sophisticated—it gets: as Giere (2006, 85) vividly put it, a sophisticated realist is not committed to the view that science is "in the business of discovering the language God used when he named the beasts of the field in the Garden of Eden".

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The practical structure of scientific revolutions
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Thomas Kuhn was arguably one of the most influential figures in setting the agenda for the post-positivist philosophy of science in the twentieth century. In his prominent book The Structure of Scientific Revolutions, Kuhn argued for a historical or developmental view of science where standards, methods and concepts used in scientific practice change radically during periods which he called as "revolutionary". He is mostly famous for the phrase "paradigm shift" which mainly refers to change of scientific practice at those revolutionary periods in the history of science. According to Kuhn, revolutionary periods are marked by large disputes due to incommensurability between competing paradigms and these disputes cannot be resolved by the dictates of logic and experiment. Instead, Kuhn argues that some set of conviction methods are at work in paradigm choices. This argument faced many critiques from the philosophers of science who accused Kuhn of making science as an irrational, relativistic and subjective enterprise. According to our view, the basis for these critics mainly relies on Kuhn's incommensurability thesis which is misrepresented as in-

comparability of rival paradigms. In this study, we will first offer a new analysis that will disentangle incomparability from incommensurability. In other words, in Kuhn's account, incommensurability does not necessarily lead us to incomparability. As Kuhn's reply to his critics, paradigm comparisons can be realized through some set of "values" that depend on the relevant scientific community. Accordingly, Kuhn suggested that we need to adjust our notion of rationality in order to explain how such disputes are resolved. Richard J. Bernstein compares this type of rationality with Aristotle's concept of phronésis which relies on practical reason. In a similar way, we will argue that Kuhn's notion of rationality is a kind of practical rationality that is shaped by the social practices of the relevant scientific community.

Keywords: Thomas Kuhn, Incommensurability, Incomparability, Rationality, Richard J. Bernstein.

Viability criterion: criticisms and suggestions
Alexandre Coimbra (*Portuguese Catholic University, Portugal*)

The present work systematizes and comments a set of criticisms and suggestions made to the viability criterion. The viability criterion as a special case of verifiability and falsifiability was presented in the III Iberian American Congress of Philosophy of Science and Technology that took place in 2010 in Buenos Aires. Viability means the approval as viable by the peers of an accomplishment plan of something that has interest and doesn't exist yet. Examples of accomplishment plans are technical specifications of products, production processes definition or the social coordination mechanisms definition. The relevance of this special case is the exclusive focus in the analysis of things that begin to exist only in human imagination and that only can be accomplished by human action. The set of criticisms and suggestions was defined in interaction with members of European or American associations connected to the philosophy of science. As positive criticisms it was pointed that viability criterion is a proposal with interest, it includes creativity and is accepted as a special case of verifiability and falsifiability. As negative criticisms it was pointed that verifiability and falsifiability are obsolete concepts, the paper with the proposal is too concise and it is necessary more examples. As suggestions it was pointed to analyze parallel between the present time and the XVI and early XX century, analyze the role of viability in the unity of science, and analyze if imagination and interest can be justified empirically. We agree with the criticisms and suggestions. There is a discrepancy about the timeliness of philosophical concepts as verifiability and falsifiability between the area of philosophy and other areas such as engineering. It is a useful task and a challenge, the aid to the adoption of present-day philosophical concepts in areas distinct of philosophy such as engineering.

Tennant and the epistemic entrenchment contraction in the AGM model of belief revision

Diego Fernandes (*University of Salamanca, Spain*) & **Wagner Sanz** (*Federal University of Goiás, Brazil*)

Tennant in [2] and [3] criticizes the approach concerning the contraction operation adopted by the belief revision theory known as the "AGM model" [1]. This theory is based on the minimal change criterion, that is, when one intends to change a belief state, he must do so in a minimal way. In the AGM model, to block the derivation of a & b from the belief set K (that is, to contract a & b from K), at least one of the pair {a,b} must be removed and, when there is no reason to choose one instead of the other, both must be removed. Tennant named this approach "en bloc" and argued that it does not respect the minimal change criterion, since it removes from a belief set more than is necessary. He proposed another approach named "one-sentence-at-a-time" that is described as follows. To contract a & b from K, supposing that they are logically independent, one will not adopt the option of removing both a and b, even in the case in which there are no reasons to remove one instead of the other. Tennant still defends the one-sentence-at-a-time idea in his new book ([4], p. 152) about belief revision. In the presentation we will propose some counterexamples with the intention to show three things. First, it is relatively easy to find inadequate situations caused by the one-sentence-at-a-time approach. Second, there is no guarantee that the sentences "spared" from removal (for the sake of complying with one-sentence-at-a-time) will not afterwards allow intuitively invalid inferences, when new beliefs are added to the belief state; and the "culprits" of such invalid inferences might be very difficult to find in complex belief states. Third, the cost of the alleged information loss caused by the en bloc contraction will be compensated with an operation of contraction that is more even and sound.

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Kuhnian theory choice, witnesses, and base rates

Samuel Schindler (*University of Aarhus, Denmark*)

One of the most severe challenges in recent years to scientific realism, and in fact the entire realism debate, has been the charge of the so-called 'base rate' neglect (Howson 2000; Mag-

nus and Callender 2004; Howson 2013): realists (and antirealists) have neglected the base rate / prior probabilities of theories being true. However it is a trivial consequence of Bayes' theorem that prior probabilities are required to calculate the relevant posterior probabilities, i.e., a theory being true given that it is empirically successful. In this paper I seek to defend realism against the base rate neglect charge. I will argue that the Kuhnian picture of theory-choice provides the resources for strengthening the case for realism. Roughly, I will argue that, given Kuhn's claim that theories regularly do not possess all of the five standard virtues, it would be a miracle if a theory were to possess all of the five virtues and not be true. In order to argue this point in detail I will draw an analogy to converging witness reports and use the Bayesian resources that have been developed for it (Earman 2000).

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P3

To speak in the name of death. On colonial blind spots, ego- politics of knowledge, and "universal reason"

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In the beginning of the twenty-first century the Cameroonian philosopher and political scientist Achille Mbembe pronounced a historical 'no' to the Eurocentric philosophy of life. Few before him have dared venture into a major critique of sovereignty and what has been largely considered as 'universal reading' of biopower. What Mbembe performed was related to the normative understanding of Foucauldian concept of biopolitics and its linkage to the dominant model of epistemological power. Speaking in the name of death instead of life, Mbembe did not only oppose the hegemonic biopolitical reason: he also succeeded in executing a radical turn from it. Consequently, the seed of his efforts started to grow worldwide (most notably among the scholars outside of the so-called First World) and developed into a new global episteme centered on the work of death-politics. This paper focuses on Mbembe's groundbreaking work on the limits of Eurocentric biopolitical sovereignty under the guise of death-driven conflicts and necro-colonial matrix of power. Backed up by transnational theories of necropolitics developed since 2003, I have undertaken the task to analyze his methods in articulating novel cartographies of knowledge, theoretically

decentered from the travestied life-politics. This is all in order to question the hermeneutic inconsistency inherent to the First World 'universal rationality.' The paper serves as only one among innumerable related platforms across the universe of contemporary necro-colonial theory: it functions as yet another nodal point from which to launch a critical discourse on the work of death in the context of an ongoing neoliberal/ neocolonial/ necropolitical re-designing of the world. Its main aim, therefore, is to open up toward suppressed epistemological horizons while critically re-considering the foundations of knowledge production and destruction – a sort of epistemicide, according to Sousa Santos, characteristic of the erosion of global knowledge(s) through an imperial death-politics of 'abyssal thinking'.

Keywords: necro-coloniality of power, universal reason, death-politics, knowledge, South.

Ethics is a social science
Mark Fedyk (*Department of Philosophy, Mount Allison University, Canada*)

"Ethics is about those norms that should be fundamental relative to all other norms, be-cause any such norms, when realized in the form of social institutions, cause goods." Let us call this proposition institutional consequentialism. I contend that institutional conse-quentialism has a number of attractive implications, and therefore deserves to be central to our conception of ethical naturalism. First of all, the proposition defines ethics as a field of inquiry that is empirically successful, as data from different social, historical, and economic sciences demonstrates. It also provides guidance for how ethical inquiry can proceed: investigate the causal relations between social institutions and good outcomes. So, in other words, the proposition suggests an a posteriori methodology for ethical inquiry. Finally, considered from the standpoint of traditional philosophical ethics, institutional consequen-tialism is plausible as (at least the core of) a normative ethical theory. My proposed talk will largely focus on the first of these three implications. For, there is compelling evidence that institutional consequentialism has some of the hallmarks of a successful and progressive (but not mature) scientific discipline. I'll review the best pieces of this evidence and, in so doing, build a case for the conclusion that ethical inquiry, as per the lights of institutional consequentialism, is both an existing and an autonomous social science. To conclude, my talk will detail the most significant of the new questions and ideas that the conclusion that ethics is a social science forces philosophers of science to encounter – such as the idea that ethical knowledge is a type of causal knowledge, and that the natural kinds of ethics are both real and yet exhibit significant local and historical variability.

The Good and the Goods in Philosophical Tradition and Contemporary Ethics

Paulo Sousa Mendes (*Faculty of Law, University of Lisbon, Portugal*)

The philosophical tradition admits several kinds of goods (the goods of the soul, bodily goods and the external goods), but only one supreme good, the finis, summum bonum or ultimum bonorum (or, what is the same, the question regarding the foundations of morality). As Cicero said, the supreme good is a controversial issue, about which the philosophers were profoundly in disagreement (De finibus 1.4.11 and De legibus 1.20.52). Possibly, however, such discordance inter doctissimos was not really that profound, since the Epicurean, the Stoics and the Academic-Peripatetic doctrine grew from one minimally common basis: they were all ethical conceptions built upon the idea that there is a natural inclination in all living beings towards what is good for themselves. However, it was not before the arrival of the modern age that the ideas of a supreme good in human life were newly discussed, outside the context of religion and revelation, merely as an outcome of the exercise of the free and disciplined reason. In other words, it was not before the arrival of the modern age that nature was again taken as the ultimate base of morality (an issue that was dear to Epicureanism, Stoicism and Cicero's Peripateticism). But the modern age eventually narrowed the question of the good to the external goods. This presentation aims to reflect critically upon limiting the question of the good to external goods and also upon the erroneous, but widespread idea that the liberal and democratic society under no circumstances should do more than barely provide the protection of external goods.

Science and ethics: rethinking the relationship under the prism of stem cell research

Carlos Almeida Pereira (*Institute of Philosophy, Faculty of Letters, University of Oporto, Portugal*)

The relationship between Science and Ethics, historically tumultuous and social and philosophically disquieting, leads to the postulation that contemporary research finds itself constrained to operate, theoretically and in the laboratories, under the aegis of the abstraction of ethical presuppositions. In the complexity of the current biotechnological context, although (particularly in the ambit of the stem cell research), a redesigning of the relationship is required, once we seem to assist, in the investigational strategies, to the coadunation between the epistemically certified and the ethically adequate.We will attempt to sustain this position and, concurrently, seek to establish a whole set of subsidiary postulations, as:

– the conjugation of the positive education of the laboratorial researcher with the rules of the biocapitalist market, more than the shift of the ontological paradigm of the modern mechanism, is the cause of the referred turmoil in the relationship between Science and Ethics;

- the cultural and academic reaction to the turmoil in the relationship (from which results descriptive bioethical purposes) is evaluated, by the scientific community, as an exercise of external interference in areas of epistemic hyper-specialization;
- firstly, scientific community has structured vigorous opposition plans to this «external interference»; afterward, strategically, has adopted accommodation programmes of the ethical «constraint» in the research areas;
- though not completely detached from this logic, the current focus of the stem cell research in non-embryonic areas (despoiled of the major ethical dilemmas relating to the status of the human embryo) seems to show an approximation of the scientific agendas to the postulations of the gregariously desirable.

Technology in Fetal Medicine and Ethics empowering of Man

Marina do Vale (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

Technology in Fetal Medicine and Prenatal Diagnosis is usually discussed in terms of the enhancement of the human and ethical dilemmas associated. The author, from a hermeneutic phenomenology approach, defines another field of philosophical reflection about Technology in Prenatal Diagnosis and Fetal Medicine. The author discusses the possibility of technology as a vehicle for Ethic Man empowerment in Fetal Medicine. The embryo and fetus images recorded in the three-dimensional ultrasound, during surveillance of pregnancy, represent a possibility for enhancement of Human Ethics. The images unfold his human dimension, prior to delivery. The author concludes the need for a redefinition of the concept of "Human" in Ethics, inclusive of its alterity, clearly conveyed by the technologies of the XXI century.

P4

Scientific ideas successfully across borders - the big bang in the contemporary imagination

João Barbosa (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

An interesting challenge for the philosophy of science is the study of forms of ownership of a particular scientific idea in disciplines other than those in which originated, as well as in non-scientific fields such as art, religion, economics or policy. The big bang idea, which is paradigmatic in contemporary cosmology, is, this way, a very interesting example. In fact, the big bang idea is not only a dominant idea in cosmology but also became very present, although sometimes in just metaphorical sense, in other areas of knowledge. This idea was well received and appropriated by traditional religions, especially the Judeo-Christian tradition, and helped create new forms of religious spirituality as religious naturalism called epic of evolution. Furthermore, the big bang idea is very popular today, revealing and often with

very different purposes, including commercial purposes, in different contexts such as music, television sitcoms, literature, cinema or sport. Thematic analysis is a useful tool for studying such cases, as it identifies and describes elements that cross all areas of knowledge and culture in general (the themata), helping to understand the host, the ownership and use of certain ideas in different but contemporary disciplinary and cultural contexts, which appear to be involved in intellectual fashions and styles of thought of a time. The author will refer specifically to the current success of the big bang idea, especially outside of cosmology, examined under a thematic perspective.

Organicist cosmology in the 21st century
Andrea Mazzola (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

Whitehead proposes his organicistic cosmology (OC) to incorporate modern scientific knowledge in a general, logically coherent and empirically adequate concept scheme. Electromagnetism, quantum mechanics, relativity and evolutionism find a global unity in his 'philosophy of process'. The OC criticizes the materialistic atomism of mechanicistic ontology. It rejects the notion of independent substance (matter, space and time), replacing it with the notion of 'relational continuum network', 'vibrating complex organism' and 'prehension of potentialities'. Creativity is the most general character of the relational continuum. This creativity is the universal impulse that drives the coming into individual, actual being of a set of logical abstract relationship potentials. Nature is presented as a process of actualization of the potentialities in space-time reality. This means that space-time reality is only one aspect of natural becoming, an aspect that does not completely fill our category of existence. The pars destruens of his criticism of the 'simple location' led him to affirm, as pars construens, the extended and overlapping nature of all beings. He refuses the dualism between body and mind, considered by him as co-existing poles. In this way, the OC presents itself as the best philosophical frame in which we can understand the most recent developments of quantum mechanics, the eurhythmic physics, or physics of becoming, as elaborated by Prof. Croca. Moreover, thanks to his criticism of the conventional explanation of evolution as solely guided by competition and 'natural selection', and thanks to his idea of 'organism of organism', the OC appears to us as a metaphysical precursor of the most recent advances in biology, the theory of symbiogenesis demonstrated by Lynn Margulis. Furthermore, through his conception of the function of reason in nature, the OC appears to be the first attempt ever to bridge the dichotomy between 'natural science' and 'human science', a bridge that has by now become the methodological core of evolutionary epistemology.

The gap between epistemic and institutional practices in multidisciplinary research

Rebecca Kukla & **Bryce Huebner** (*Department of Philosophy, Georgetown University, USA*)

Epistemic labor is highly distributed in much contemporary research - especially in multidisciplinary, multi-site research in biomedicine, climate science, and the like. In such sciences, particular researchers don't typically have epistemic command over the entire project. They aren't in a position to offer a justification of the completed research, and they cannot know all of the interests and biases their collaborators may have had. Thus the products of such research aren't traditional epistemic contributions.

But institutional mechanisms are emerging that are supposed to secure knowledge claims in such contexts, using legal and procedural means to produce institutional correlates of familiar epistemic notions. For example:

- The epistemic notion of a distorting interest is replaced with undisclosed sources of funding.
- The epistemic notion of justification for a result is replaced with the transparency of the process leading up to the result.
- The epistemic notion of an author who produces a claim and is epistemically accountable for it is replaced with 'authors' who can document their role in the production of a publication.

None of these institutional notions are directly epistemic. Disclosing your funding sources, for example, is not the same as having no distorting interests. But the (typically implicit) assumption is that honest, epistemically skilled people who follow the proper procedures for satisfying these institutional correlates will produce secure contributions to knowledge. In practice, however, research is often designed, organized, and/or managed by private funders such as pharmaceutical companies or industrial lobbying associations. As a matter of institutional fact (regardless of researchers' intentions) such research is animated by goals other than securing knowledge, such as improving product marketability, increasing efficiency or productivity, protecting shareholder interests, protecting an industry's image, or securing a patent or FDA approval. Epistemic objectives like accuracy, replicability, reliability, and justifiability often contribute instrumentally to the fulfillment of these goals. But practices governed by these non-epistemic goals are not, properly speaking, epistemic practices. We argue that, when research is organized by non-epistemic goals, we cannot count upon the institutional correlates and the procedures we have for managing them to track epistemic notions, nor, likewise, to produce results that reliably model secure, justified knowledge claims.

Is Naturalism the Unsurpassable Philosophy of Interdisciplinary Science?

David Budtz Pedersen (*Humanomics Research Centre, Aarhus University, Denmark*)

In this paper, I review the literature on interdisciplinary science from the perspective of scientific naturalism. In numerous interdisciplinary collaborations, branches of the human sciences are expected to work together with the natural and social sciences and contribute to shared epistemic and strategic goals. Many of the most exciting and influential academic ventures in the human sciences today are seen as interdisciplinary, for instance, cognitive linguistics, evolutionary anthropology, social psychology etc. However, in most cases interdisciplinarity is conceptualised without considering which ontological and methodological commitments such inter-field collaborations imply. If, to any extent, interdisciplinary science imply naturalistic commitments (i.e. applying empirical methods and epistemic standards), we must ask which typology of naturalism interdisciplinary humanities are reconcilable to. Naturalism comes in many versions, ranging from minimal naturalism (Andler), pluralist naturalism (Putnam), normative naturalism (Laudan), subject naturalism (McDowell) through more militant versions such as eliminative naturalism (Damasio) and physicalism (Armstrong). For sure, not all of these doctrines are compatible with standard approaches in the humanities. In effect, this paper offers a contribution to the emerging discussion on the philosophy of interdisciplinarity by (1) exploring different doctrines of naturalism; and (2) by examining how standard ideals of unificationism and reductionism present serious challenges to the emerging interdisciplinary science system. Further, the paper presents a model-theoretical account of interdisciplinarity in which collaboration is the basis for organising different disciplinary perspectives around shared scientific objects. Accepting a model-based approach to science allows for a pluralist naturalism in which the objects of the human sciences (intentions, norms, cultures, values etc.) are perceived as non-reductive naturalistic categories. The paper closes with a list of challenges that an epistemology of interdisciplinarity needs to accommodate.

Towards a deeper understanding of the relation between scientific disciplines and transdisciplinarity: building on the case of Plant Physiology

Jorge Marques da Silva (*Department of Plant Biology and Center for Biodiversity, Functional and Integrative Genomics, University of Lisbon, Portugal*) & **Elena Casetta** (*Centre for Philosophy of Science of the University of Lisbon, Portugal and LabOnt, University of Turin, Italy*)

In recent years, the claim for transdisciplinarity as a tool to overcome knowledge fragmentation has been increasing (Zierhofer, W., Burger, P. 2007). However, the conceptual instruments needed to proceed towards transdisciplinary knowledge are largely still missing. Better definitions of transdiciplinarity, interdisciplinarity and pluridisciplinarity are re-

quired, as well as a clear account of the relation holding between such concepts. Nevertheless, looking at the history of science, a common aspect to all concepts of transdisciplinarity and associated terms can be traced: it is the rupture of disciplinary boundaries and the establishment of routes of connection, or even the merging of types of knowledge originally belonging to different disciplines. The main aim of this exploratory contribution is to put forward the requirements that transdisciplinary knowledge should meet, by means of a twofold strategy: enquiring the types of interacting knowledge, and discussing a concrete case. Transdisciplinarity that involves disciplines of the same epistemic nature (e.g., as when biology and chemistry interacted to give rise to biochemistry) doesn't seem to pose overriding problems. On the contrary, transdisciplinarity involving heterogeneous domains (e.g., as in bioethics, where scientific and philosophical knowledge interact) calls for caution. For instance, according to partisans of the most liberal approaches, there should be no constraints on the type of knowledge in play: even Shamanic practices can be involved with the aim of achieving a transdisciplinary holistic knowledge (Max-Neef, M. 2005). We argue that a cautionary approach to transdisciplinarity, which we call "sustainable transdisciplinarity" should be favoured and we outline its main features. Then, we discuss sustainable transdisciplinarity through a concrete case, analysing the history a specific discipline, namely Plant Physiology, focusing on the evolution of its disciplinary scope.

P5

Porque é que as ciências precisam de laboratório? (determinação e indeterminação no âmbito da Filosofia *com* Ciência)

Fernando Belo (*Centre for Philosophy of the University of Lisbon, Portugal*)

A definição e o laboratório são as duas invenções maiores da história gnosiológica do Ocidente, dos Gregos a primeira, dos Europeus a segunda. A definição é uma operação violenta de escrita operada sobre as narrativas e os discursos retóricos enquanto particulares que retirou o termo a definir dos seus contextos, ou seja que reduziu esses contextos e os seus caracteres particulares, incluindo os próprios verbos das narrativas com a sua ampla morfologia, e constituiu o texto filosófico enquanto tratando de generalidades (e não mais de particulares, acontecimentos ou opiniões), de essências intemporais, sem contextos pois e argumentando sobre elas, nomeadamente indagando de causas e efeitos como razão de ser das coisas. A especulação medieval mostrou os limites do alcance da definição. O laboratório de Física do século XVII acrescentou-lhe, à teoria científica de definições feita, a experimentação sobre movimentos detectados por instrumentos de medição (segundo dimensões que se foram multiplicando). O laboratório não deixou de ser filho da definição, já que, à semelhança desta, opera uma redução do contexto donde retira o fenómeno a analisar laboratorialmente, retira-o do alcance das narrativas e opiniões para o alçar ao saber gnosiológico intemporal, digamos 'universal', se entendermos como 'universo' os laboratórios que repitam as operações experimentais. O que o laboratório consegue e o torna condição

estrutural dessa verdade científica universal é a criação de condições experimentais de determinação que justamente não existem nos contextos habituais da chamada 'realidade', de que falam narrativas e opiniões. O que implica que, fora do laboratório não havendo determinação, essa dita 'realidade' é indeterminada, e é sobre isso que quero reflectir aqui.

Should discussions in philosophy of science ignore (advances in) history of science?
João Paulo Príncipe (*CEHFCi, University of Évora, Portugal*)

In the often ignored french tradition of epistemological reflection on scientific issues (from Cournot to Bachelard and Canguillem) some care is given to historical examples and some of the generalizations are supported by historical interpretation (ex.: Meyerson's identity 'principle'). In the traditon originated in logical empiricism and analitical philosophy that is not usually the case, rigour being associated with a clear separation between the context of discovery and the context of justification, metaphysical aspects being usually isolated from the internal coherence of theories and ignored or despised. These characteristics are present in recent literature concerning atomistics as exemplified in Alan Chalmers (2009) clear distinction between philosophers's and scientists' atoms, and in related contemporary discussions on realism. By comparing Chalmers' arguments, which are supported by historical references, with historical studies on the french XIXth century laplacian tradition in molecular physics (which is exemplified in works by Robert Fox, John Heilbron and Olivier Darrigol) I'll argue that Chalmers' clear distinction and conclusions are not compatible with the actual role of atomic or molecular assumptions which were pervasive in laplacian physics, a 'paradigm' which lasted longer, as a thematic source and as a cosmovision, than is usually thought, and that influenced Jean Perrin, which is supposed to have finally proved the existence of atoms with his experimental works in brownian motion. This critic, based in an uncontesteted important issue in historical and philosophical discussions, means that a empiricist biased view in philosophy of science is hardly compatible with recent advances in historical studies concerning the role of elements usually considered of metaphysical look. Also it supports the need and centrality of a new way of judging the (diachronically changing) epistemological status of theory components.

The idea of ecosystem services and its implications to biodiversity conservation and sustainability
Rodrigo Muniz da Silva (*Faculty of Sciences of the University of Lisbon, Portugal*)

The concept of ecosystem services, characterized by the benefits provided by ecological process to humans, has become one of the foremost trends in biodiversity conservation and sustainability. The notion of nature serving humans begins as a simple metaphor and spreads as a framework in environmental political agenda, turning ecological functions into

services, then into commodities. This idea brings not just technical, but also ethical implications, reducing ecological complexities and human relationship with nature. This study tries to demonstrate the implications of the concept of ecosystem services to biodiversity conservation and sustainability. First, it is argued that biodiversity conservation is dependent on how nature is valued. If nature provides services, then are the services that will be ultimately considered, not biodiversity itself, underlying the proposal that scientists can itemize and monetarily quantify services to recognize environmental depletion to protect nature. Second, the ecosystem services approach turns nature into commodities and synchronizes conservation with market-based logic. Whereas an ecological function can be itemized and monetarily valued, it can be monetarily and economically negotiable, shrinking the diversity of values around nature and human relations with nature. Finally, the idea of ecosystem service largely influences the already diffused notion of sustainability. By perceiving sustainability as a fundamental process to address humanity and the natural world, then it has to be carefully examined. In conclusion, biodiversity conservation and sustainability should not be reduced to the ecosystem services approach, considering the complexities of the current, and forthcoming, challenges and tasks.

Contributions for the history of the dialogue between art and science in contemporary Portuguese art

Cristina Azevedo Tavares (*Centre for Philosophy of Science of the University of Lisbon and Faculty of Fine Arts of the University of Lisbon, Portugal*)

Since the beginning of the 20th century the articulation between art and science has been present in Portuguese artistes' works. In this communication we propose to explore this topic. This subject is relevant for two reasons: first it addresses art history, and above all Portuguese contemporary art; second it is as hardly explored subject. Several critical essays and Art Story books mention art works which cross science and art. However this topic is never explored as an independent subject. For different reasons plastic artists, mostly painters, sculptors and engravers developed interfaces with art and science. Sometimes they would explore ideas, try new techniques, solve problems, or create their own instruments and machines. Particularly, we noticed that since the beginning of the 20th century, several, but not many, plastic artists were interested in these kind of liaisons, not only in what concerns technique issues, but also scientific matters. Here we will present several plastic artists and art works where this approach is to be found. In the 19th century some Portuguese painters, as their European colleagues did, started to use photography as way to explore art in different aspects. Later on, in the the 20th century, artists come to consider other subjects, such as: geometric problems, the conception of space, the use of light, the search for new materials and techniques.

Why should scientists bother about popularisation of science
Baudouin Jurdant (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

Scientists are quite ambiguous about the communication of scientific knowledge to the general public. Some of them are very keen to share their knowledge with as many people as possible. Some others are very suspicious about such attempts, claiming that the public cannot truly understand what science is about. What is really at stake with the public communication of science? Is it the integration of scientific knowledge within the culture of modern societies? Is it to provide some bits and pieces of scientific knowledge to some people? The paper will discuss various issues related to popularisation of science since its origin in the 17th century.

Can we play science? Heuristic strategies of science research
João André Duarte (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

Through citizen science, people can participate in science in a playful manner. Helena and Robert go camping often. I stay at home, caught at my computer. They are birdwatchers, taking their field guide everywhere, while I open my protein puzzles game for my leisure escapades. Still, we're all taking part on Science research. 'Others' like us were needed for the research of large-scale questions since the first-use of the term 'scientist' in the nineteenth century. As drafted by Jurgen Habermas, the 'public use of reason' in eighteenth century Europe has been fostered through spaces as the salons or the coffee houses. Nowadays, citizens can participate in science research projects thanks to Internet and web 2.0 cooperative possibilities. But what does this shift to participation means? My friends, the birdwatchers, are 'only' collecting data while I'm manipulating information during my puzzle, trying to solve a problem. Still, we're all involved in processes of discovery. To explore this process, the experience and the reasoning process, I use the philosophy and heuristic resources of John Dewey and Charles Sanders Peirce.

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Where do philosophy, depth psychology and quantum physics intersect?
Rui Freire Lucas (*University Hospital Center of Coimbra, Portugal*)

Over the last few decades many scientific advances from distinct disciplines have brought important contributions to the field of epistemology. Specifically, by reaching the limits of

the scientific method, sciences such as quantum physics and depth psychology have demonstrated the unreal and subjective natures of their object, leading to the recognition of the inevitability of an objective metaphysical reality underlying scientific phenomena. After attempting to expose the intersection point between the fundamental principles of quantum physics and depth psychology I will seek to demonstrate how Henri Bergson's time philosophy constitutes an answer to the epistemological dilemmas raised by these disciplines, when separately considered. Through the use of such an interdisciplinary metaphor, this paper ultimately aims to foster a reconsideration and validation of theories classically regarded as unscientific in the mould of a new science that acknowledges the subjective nature of its observations and the need for consideration of a primary metaphysical reality.

Reconciling ontic and epistemic constraints on mechanistic explanation, epistemically

Dingmar van Eck (*Centre for Logic and Philosophy of Science, Ghent University, Belgium*)

Recently, Illari (2013) reframed the current debate on ontic versus epistemic conceptualizations of mechanistic explanation as one that is moving away from analysis of the term 'explanation' per se, to elaborating ontic and epistemic constraints on mechanistic explanations. On her account, adequate mechanistic explanations ought to achieve both ontic and epistemic aims. They must describe the organized entities and activities by which phenomena are produced (ontic) and these descriptions must procure understanding (epistemic).

I argue that Illari's framework is a very welcome step forward in the ontic-epistemic debate in the mechanisms literature, yet incomplete. It does not recognize a third (epistemic) aim, achievement of which is requisite for meeting the aforementioned ones: '*identification of the causal roles of mechanisms' entities and activities*'. Experimental practices are key for describing mechanisms in the world (Craver 2012). Yet, these practices are *indirect* and hinge on epistemic considerations (cf. Silva and Bickle 2009): rather than directly monitoring changes in activities following (bottom-up and top-down) interventions, behaviors or behavioral effects are tracked, using experimental protocols, which are taken to be indicative of changes in activities. For instance, rather than monitoring changes in memory formation directly, following alteration of Hippocampal Long Term Potentiation in, say, rats, indirect effects like performance on a Morris water maze task are monitored. Based on such monitored behaviors, causal roles of activities of entities are inferred. Here, the causal role(s) of hippocampal LTP in the mechanism(s) for memory formation. Achieving the aforementioned epistemic and ontic aim, i.e., procuring *understandable* descriptions of *real world-mechanisms*, thus hinges on achieving a third (and second epistemic) aim of causal role identification. I present ramifications of this analysis for the (ontic) constraint of 'completeness' as a regulative ideal for explanation, and for the mutual manipulability account of constitutive relevance of mechanistic components (Craver 2007).

The paradox of perceiving time: A philosophical and psychological approach

Teresa Pedro (*Institute for Philosophy of Language, New University of Lisbon and Language, Interpretation and Philosophy, University of Coimbra, Portugal*)

The aim of this paper is to shed light on the phenomenological paradox of our experience of present nowness, a major issue for philosophical theories of time perception, drawing on theories from developmental psychology and developmental linguistics. I argue that philosophical theories of time perception and psychological accounts of children's cognitive development in grasping temporal meanings offer complementary insights on this problem. In the first part of my talk, I will address the problem of the perception of present nowness. Time perception is usually thought to involve an instant where successive events are perceived quasi-simultaneously. This leads to a paradox: on the one hand, we perceive several data together as present, and on the other, we perceive them as occurring in succession and consequently not as present together (simultaneous). I will analyse the different philosophical accounts of this paradox, especially the retentional and extensional models (Dainton 2010, 2012). In the second part, I will look at relevant empirical findings from developmental psychology and linguistics. Notably, I will analyse the "aspect first hypothesis," according to which children initially use verbal morphology to mark aspect and not tense (Wagner 2001). This means that they are able to use tense, but not able to locate particular events in a linear timeline, which is our "ordinary thinking about time." I argue that this distinction allows us to solve the paradox of the constitution of present nowness. In fact, the paradox arises from the fact that we think of the succession contained within the simultaneity of the "now" in terms of a temporal "before" and "after." Thus, I propose to draw the consequences for a philosophical account of time perception of these experiments in developmental psychology which show that our primitive grasping of a succession is aspectual, not temporal (Hoerl & McCormack 2011).

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The folk-epistemology competence and its principle

María G. Navarro (*Institute of Philosophy, Spanish National Research Council, Spain and Department of Philosophy, University of Birmingham, UK*)

Steve Fuller and Finn Spicer have recently defended that people do have and use in daily life a special folk-epistemology competence in order to ascribe and reason about knowledge. They also points out that some of the generally accepted principles in the development of the so-called folk psychology (specially, in the case of the Theory-theory that accepts the existence of a tacit theory of mind) can be used to describe folk epistemology principles. This presentation focuses on the principles Spicer decides to rescue from the folk psychology to build a definition of folk epistemology as a specific competence to reason about knowledge. Are these principles essential to maintain a definition of folk epistemology as a specific competence people possess to reason and to ascribe knowledge? I will compare several aspects of Spicer's folk epistemology definition with other models, such as the suggested by (1) Steve Fuller, and (2) Susan Carey and Elizabeth Spelke's work on domain-specific systems of knowledge as they are characterized by a set of core principles that define entities and support reasoning about those entities. Stakes-variability and salience-variability are two implicit patterns of variability in our dispositions to ascribe knowledge. They analyzed by Spicer in his reference to the DeRose bank case. Here it will be argued that this kind of context-sensitivity is incompatible with the assumed principles. Eric Schwitzgebel defended that there are cases in which it is intuitively plausible that a subject knows without determinate belief. Two final claims are maintained in the presentation. The first is that the existence of domain-specific systems and principles of knowledge would be required to improve a better research to distinguish which heuristics are deployed by people's ordinary reasoning in every occasion. The second is that the conception on vagueness in belief attribution is a necessary starting point to looking for cases in which explore people domain-specific folk-epistemology competence.

Empiricists and theorists. Limits in unification of scientific theories

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Unification of theories is common in Physics, but in other sciences as well such as in Biology (case of natural selection). Maxwell's unification of Electromagnetism and Optics, Boltzmann's unification of Thermostatics and Mechanics, and electroweak unification are a few examples ([7])

Unification is also a highest priority current research programme in Physics, having had keywords such as "supergravity", "theory of everything" and "grand unified theories".

We have applied learning theory in the sense of [1, 3, 4] to the concepts of theory of science, unification of scientific theories and unit of science (see [2, 5]). Basic concepts are mathematical models of empiricist as scientist that after collecting finitely many experimental

observations comes about with a law and theorist as scientist that after collecting finitely many scientific laws comes about with a theory. Unification of two theories is (in this abstract informally) considered as a third theory that implies both theories.

Is unification of scientific theories always possible? We provide a negative answer based upon recursive function theory (see [4, 6]). We argue that, in a logical framework, within the paradigm of simulable Physics ([8, 9]), unification has limitations. We state such limitations through a few mathematical statements.

At the end of the day, we wonder if unification produces explanation.

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Computational approaches to language learning
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Traditionally, computational psychology is committed to a tripartite picture of explanation, according to which interdependent but nevertheless separable hypotheses are put forward at the computational, algorithmic, and implementational levels (cf. Marr 1982, Newell 1980, Pylyshyn 1984). More recently this picture has been challenged on a number of grounds by proponents of mechanism (Piccinini 2007, Craver 2007, Bechtel 2008), connectionism (Elman et al. 1996), and dynamic systems approaches (van Gelder 1998) to cognition. One common challenge raised by these distinct accounts against the classical picture of computational explanation is that it does not provide a robust enough picture of learning and developmental phenomena. This paper argues that computational theories use mixed-level explanatory strategies in order to account for a host of complex cognitive phenomena and that it is only in the context of such strategies that one can elucidate the more specific epistemic and theoretical contributions that the different computational notions and techniques make to the study of cognition. In particular, I propose to analyse a case of computational modelling from the domain of language acquisition which illustrates precisely this mixed-level strategy. The variational model of language acquisition (Yang 2002, 2004) combines both classical (generative linguistic) principles and statistical modelling tools within a framework which borrows a mode of explanation specific to evolutionary biology (i.e., variational thinking), in order to account both for a host of systematic patterns of language learning as well as for the gradualness of language developmental processes. I conclude by showing the advantages of adopting such a practice-based perspective in the philosophical investigation of the scope and structure of computational theories of cognition.

Contextual values as necessity in bioinformatics systems
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The material constraints that influence the context of discovery in bioinformatics systems necessarily entail that representation in those systems is using some contextual empirical base. The material constraints that are present and give form to bioinformatics systems include the lack of relevant material that necessitates a bioinformatics system to be an epistemic object. I will defend how Helen Longino's account of contextual values provides a way to understand the justification of bioinformatics objects and their systems. Further, I will discuss how certain systems may express hard limits of the system in the information it produces. Understanding what contextual values as a necessity means for bioinformatics systems both in the terms of knowledge production and production of these systems is important because an failure to develop relevant epistemic criterion and epistemic safety

that is observable in metadata in these systems could lead to epistemic failures as well as undoing many of the advantages of representation offered by bioinformatics systems.

The ways of probable truth

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The famous aphorism of Lord Rutherford, "if your experiment needs statistics, make a better experiment", is undoubtly outdated, and nowadays anyone of his status would perhaps say something like "your research needs statistics, to start with planning an adequate experiment, choosing appropriate data gathering discipline and data analysis tools" — followed by a caveat: Use statistics quantum satis, no more no less." Good statistics is a scientific crystal ball to peer into the future, but the eternal agon opposing accuracy and probability results in some kind of equilibrium, a probable truth, but neither the all truth nor certainty, something more fuzzy that we can conceptualize as probable truth. But the ways of establishing probable truth are frequently abused, and the statistics crystal ball is substituted by a void soap bubble of bad science. We present some examples of good science and of bad science achieved using statistics, and stress once again that the power of statistics stems out from its usefulness in rejecting false conjectures, with a caveat: there is no good statistics with insufficient data, but with too many data anything can be rejected, even truth.

On the structure of ill-structured problems: An empirical study on the development of an HIV vaccine

Muriel Pádua (*IN+, Instituto Superior Técnico, University of Lisbon, Portugal*) & **Luis Custódio** (*Institute of Systems and Robotics, Instituto Superior Técnico, University of Lisbon, Portugal*)

This paper aims to examine how science based invention comes into being. While science based invention has been a traditional focus of philosophy and, more recently, it is becoming a new topic of interest in fields like innovation studies, the fact is that despite a number of key contributions on patterns of discovery, we still know little about how processes of scientific discovery and invention take place and thus whether a strong or weak form of inquiry is possible (e.g,, to relate outcomes with processes through the use of heuristics, namely by using probabilistic methods), a critical issue if we want to gain an understanding about how to coordinate efforts of knowledge production to accelerate radical science based inventions. The rationale of this paper is that by putting together perspectives from philosophy and innovation studies we can learn from each other field, on one hand on processes

of scientific discovery and invention (from the philosophy side) and on how to organize search processes (from innovation studies side). This study departs from H. Simon ground breaking paper of 1973 "The structure of ISP" where he argues that ISP form a residual class of problems and can be solved through linear method/decomposition thus arguing that there is a strong form of inquiry in discovery even for ISP, (relate outcomes with processes through the use of heuristics). More recently, new reductionist perspectives agree with H Simon that some problems are solved through decomposition strategies while others require an understanding of the interdependences that compose a problem. Taking into account this last type of problems, the new reductionist perspectives have dismissed H Simon's assumption regarding the idea that interdependences are negligible (at least for certain problems), and instead argue that the later are a key factor to account for the emergence of new global peaks (e.g., new interfield theory as in Darden's work). Taking into account that a new global peak is associated with a new perspective of a problem at hand, these new reductionist perspectives have criticized the principle of the invariance of scale, e,g., the existence of a single or global method valid for all problems. From this perspective a critical issue is how one goes from a local search to a new global peak. However, although philosophers have contested the assumption of invariance of scale, we still have a poor understanding about how one goes from local search to the emergence of a new solution (that corresponds to a change of scale). Firstly, studies in philosophy of sciences argue that there are two types of reductionism, one associated with local search and another one with emergence and of new scales but there is a poor account of the interplay between local search and how the later creates the conditions for the emergence of a new scale. Secondly, even though more recently scholars focus on modes of constructions of interdependences and different modes of local search, these studies lack empirical support. Thirdly, certain reductionist approaches use NK models (strategies that have been called by Bechtel as emergent mechanism) to argue that it is possible to have a statistical representation of methods of search but these studies assume invariance of scales (they don't say how the emergence of a new scale changes the structure of a given search landscape). Summing up, although new reductionist strategies have been put forward they lack empirical foundation either the strong or weak form inquiry. This is the first study that proposes to combine both approaches (historical and statistical one) with an empirical methodology to examine how the search space in both scientific discovery and invention is structured and evolves over time. Secondly, we put forward a new heuristic to account for the processes whereby one goes from local search. We argue that scientists decompose the problem into different problem complexity that correspond to different scales. We argue that there are two types of problem complexity. A former one where interdependences do not lead to the emergence of a new scale and a second one that leads to emergence. Then we argue that the methods of interdependences construction are specific to these different scales. Thirdly, we argue that when testing a knowledge representation at certain scale we can use statistical method to test it at a given scale. A third original element of the methodology lies in the way we handle the information. This paper proposes a case study methodology to map dynamics of knowledge production for the case study of the discovery of an HIV vaccine. It uses co-word analysis to account for the dynamics of knowledge production. Moreover, it incorporates a template or a proxy for a knowledge representation against which it is possi-

ble to map these key words and their changes over time. Findings suggest that, there are different types of problems that correspond to different types of problem complexity. Moreover, alongside Simon, it is shown that ISP have a structure. There is a hierarchy thereby supporting Simon's insights on properties of ISP problems. Moreover, alongside Kaufman or NK models, order and instability co-exist. In other words, "rugged landscapes" that combine local search and instability (search landscapes that are near the edge of chaos) are more adequate for emergence of a new scale. Finally, suggestions about ways to organize the HIV vaccine search are proposed. Suggestions go well beyond the so called parallel economics of search (so far one of our bests bets to organize search in conditions of uncertainty) and propose a layered systems view to innovation where we consider different scales of problems solving (from micro to macro level).

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Scientific representation from an analytic perspective
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One of the oldest problems in the philosophy of science is to understand how abstract theoretical structures manage to represent the concrete world of experience. Reichenbach characterized this problem as one of "coordination," and Van Fraassen has recently posed this problem in a particularly stark form, as one that can be solved only with the help of an implicit indexical element, a link between the theoretical structure and the phenomena as represented by a particular subject in particular circumstances. I argue that such approaches start from an improper formulation of the problem, based on a misunderstanding of the problems in the foundations of science, in the 19th century, by which they were first suggested. Work in the foundations of geometry led to philosophical investigations of the links between geometry and experience, investigations whose insights were not adequately realized in the development of 20th- century philosophy of science. I suggest that by revisiting the analytic context in which this problem first arose, and by emphasizing the role of conceptual analysis in connecting formal structures with experience, we may arrive a more promising approach to scientific representation.

Metaphysics and Science: with or without? - Clearing up for an inclusive disjunction
Nuno Fonseca (*Institute of Philosophy of Language, Faculty of Human and Social Sciences, New University of Lisbon, Portugal*)

This presentation will focus on the recent debate over the possibility of a "scientific metaphysics" and the need for a "metaphysics of science", keeping in mind the metaphysical tinge of certain contemporary trends of theoretical science (e.g. string theory, the holo-

graphic principle, the anthropic landscape or the multiverse). Both manifestations scramble the traditional demarcation criteria between science and metaphysics, such as the a posteriori nature of scientific inquiry versus the a priori speculative study of metaphysics. Despite the excommunication of metaphysics from philosophy of science and the scientific world conception of the Vienna Circle, subsequently confirmed by logical empiricism, the later decades of the 20th century and the beginning of the new millennium have seen a growing resurgence of metaphysics. The latter pertain mostly to criticism over the analytic/synthetic distinction, the development of semantic interpretations of modality, a realist and revisionary metaphysical attitude and the outbreak of dispositionalist views concerning the laws of nature, thus overthrowing the post-kantian prejudices against metaphysical ambitions towards the knowledge of nature. This repulsion-attraction dynamic between the two domains reveals they overlap on several subject matters (space, time, the fundamental nature of reality and the laws that govern it), but they also distinguish themselves in the nature and practice of their inquiry. Nevertheless, in place of being (asymmetric) rivals, both have much to gain from a balanced - and occasionally therapeutic - complementarity. The purpose of this presentation is, then, both to clarify the terms of this complementarity and to evaluate the dangers of defective or excessive mutual acquaintance, be it the disdain of science by arrogant philosophers, the philistinism of overconfident and oblivious scientific practices, the scientism of "naturalized metaphysics" or the undeterred speculative impulse of some theoretical scientists.

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Measurement and the problem of coordination: a defense of Van Fraasen's solution

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In Scientific Representation (2008), Van Fraassen proposes a solution to the problem of coordination which consists in conceding that one cannot answer independently the questions 'What constitutes a measurement of (physical quantity) X?' and 'What is (physical quantity) X?', but that instead one must accept that measurement practice and scientific theory evolve conjointly throughout history. Though the solution presented by Van Fraassen to the problem of coordination is prima facie very appealing, it faces some difficulties. In particular, Gordon Belot (forthcoming) maintains that there seems to be a tension in Van Fraassen's view because on the one side, he appears to be committed to the thesis that our cognitive situation plays a role in determining the geometric structure of the world, but this neo-Kantian thesis leads him to adopt a metaphysical view about the nature of the world akin on some levels to the views of certain speculative metaphysicians. In this paper, my purpose is to provide a response to Belot's challenge. In particular, I will argue that Van Fraassen's view in Scientific Representation is indeed committed to certain metaphysical theses, but that these metaphysical theses are part of a project in what Peter Strawson calls 'descriptive metaphysics'. In virtue of this, since Van Fraassen's is very careful in steering away his proposal from views according to which there is a well-organized world beyond experience that a certain scientific theory can in principle capture, his account of measurement as assigning to an item a location in physical space involves certain metaphysical theses, although these are framed in way that allows them to be shaped by empirical content.

About scientific and metascientific models as abstract objects and their semiotic elucidation

José L. Falguera (*Department of Logic and Moral Philosophy, University of Santiago de Compostela, Spain*)

P. Suppes (1960) defended that there is something in common underlying the different types of models used in science (Hutten, 1954; Black, 1962; Hesse, 1963; MacMullin, 1968; Harré, 1970; Wartofsky, 1979) and that the notion of 'model' of formal semantics –that

corresponding to a set-theoretic structure– is appropriate to capture what these different types have in common. This thought is behind the metascientific use that several philosophical approaches have made of set-theoretic structures (Suppes, 1967; Suppe, 1967, 1974, 1989; van Fraassen, 1980; Cartwright, 1983; Giere, 1984, 1988, 1999), highlighting the use of structuralist metatheory (Balzer, Moulines and Sneed, 1987). In this paper: (i) I will argue that what is common between different types of scientific models depends mainly on the representational character of these models (Falguera, 1994); (ii) I will consider the problem of how to conceive of set-theoretic structures to capture this representational character and thus to better understand the metascientific use of such structures; (iii) I will provide a semiotic elucidation of (scientific and meta-scientific) models (Falguera, 1994); (iv) I will make some considerations concerning the abstract and fictional/idealized (Frigg, 2010) nature of the theoretical models in the light of such semiotic elucidation; and (v) I will propose, that given this fictional/idealized character, theoretical models should be considered as abstract objects (in the sense of Zalta's Abstract Objects Theory; Zalta, 1983, 1988, 2001).

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The role of information loss in scientific explanation

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One of the problems with traditional models of scientific explanation is that they require a universal account that can be applicable to all the sciences. We will argue that this requirement is unrealistic. For example, a suitable model of scientific explanation that will account for QM phenomena may not be a suitable one for evolutionary biological phenomena. Scientific explanations need to accommodate to the nature of the subject of investigation. The information that scientist can receive from scientific data will constrain the type of model of explanation that will be suitable to explain the phenomena in question. In particular, we will focus on how information loss can be problematic for scientific explanations. We will aim to show how information loss in the quantum eraser effect will constrain scientific explanation in a different way than information loss will do so in explanations of evolutionary traits using Markov models. These examples will demonstrate how the effects of information loss on scientific explanations need to be re-examined.

Are scientific thought experiments objects of fiction?

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The philosophical debate about thought experiments in the last twenty years has been polarized by two different and opposite explanations, James R. Brown's and John Norton's

views. Dozens of papers have been published trying to establish a good ground to their solutions, either a Platonist or an empiricist view. Meanwhile, behind those received views, a more open-minded interpretation has been developed about the nature of scientific objects and the work of fiction and imagination in science. The purpose of this paper is to analyze a possible way out of this apparent impasse between Brown's and Norton's explanations. In recent papers Davies (2007) and Frig (2010) tried to consider thought experiments as fictional narratives, and special models lacking of a formal apparatus. It is important to analyze those hypotheses, especially regarding some classical examples, like Galileo's thought experiment of free fall, or other contemporary thought experiments. But, the debate about thought experimentation should be conducted a bit far from the classical locus of argumentation, or the imagery debate. There are, may be, some grounded reasons to think about thought experiments as a way the world could be, what would drive us to fundamental and ontological commitments about the description of reality. According to this, I'd like to explore the possibility of explaining thought experiments as hypotheses of nonexistent objects, in Meinong's style. In a way, explanatory thought experiments, before being arguments, theories like or models, they belong to a world where reference to accepted scientific laws and theories could not match. In conclusion, we try to evaluate if there is a gap between those, like Mach says (1976), who build imaginary representations that do not belong to reality, and the "good thinker", the scientist in opposition to the utopian, who builds images always as a similae of the reality.

Are there *a priori* causal models in evolutionary theory?
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Popper famously supported the (later recanted) idea that the principle of natural selection is analytical, which therefore cannot be regarded as a scientific theory since analytical claims are unfalsifiable. Sober (2010) makes a similar point, considering examples of population models involving a fitness variable. Arguing for the analyticity of these models, he reaches the conclusion that there exist causal claims that are known a priori, which refutes an assumption that goes back to Hume's discussion of causality. Sober's paper addresses an interesting problem pertaining to the interpretation of the concept of fitness and resulting in broader considerations about the interpretation of a priori causal claims postulated in scientific models. This issue represents a challenge for contemporary theories of causation, in particular for the manipulationist account put forward by Woodward and Hitchcock (2003), who apparently fails in rejecting those a priori causal claims. It also provides an interesting starting point for assessing the type of knowledge gained from models, in particular the epistemic value of a priori assumptions and the role they play in the establishment of causal knowledge. The aim of my presentation is to refute the conclusions that Sober draws on the basis of these population models. I argue that the fact that some fitness causal assertions can be interpreted as analytical is due to the peculiar dispositional nature of fitness, which leads to an ambiguous use of the term by conflating the causes of fitness with its consequences. In fact, although it may seem that some particular models do provide a priori causal knowledge, determining the conditions of their successful applicability indeed

always require empirical verification. The apparent aprioricity of those models rely actually on implicit analogies with already established knowledge, whose validity cannot be granted per se.

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Properties as world-lines: How fictional models are related to target systems

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The understanding of scientific models as fictions allows to explain the idealizations or abstractions of some models, like those produced, for example, by the analogy between gas molecules and billiard balls in the dynamical theory of gases, highlighted by Marie Hesse. However, this interpretation struggles to explain the predictive success of scientific models, and more generally, the relation between a model as fiction and its real target system. Indeed, the realist correspondence theory of truth cannot hold, notably when a theoretical object is described with idealized properties according to a scientific model. Roman Frigg proposed a fictionalist approach to scientific models based on the notion of make-believe developed by Kendall Walton. Its principle is to compare properties rather than objects themselves; an idealized object of a model does not belong to the same ontological category as a real object of a target system. We agree with that idea because, as Fred Dretske showed, scientific laws describe relations between properties expressed by predicates, and not between extensions of those predicates. But according to Frigg's approach, the comparison between models and reality is possible because the properties of abstract entities and of real objects are the same. In this paper, we will argue that this idea is a kind of correspondence-truth and we will propose to understand properties as world-lines: the real and the fictional properties are not the same, but they are linked by the same world-line. Originally, in this sense a world-line is a concept developed by Jaakko Hintikka to solve the issue concerning the identity of individuals in modal contexts. Here, we will generalize that idea to understand the relation between a fictional property of a model entity and a real property of an actual object. Hence, we persist in understanding models as fictions, but propose to explain their success in a new way.

Image: the desire of seeing

Isabel Nogueira (*CEIS/20 – University of Coimbra; ISEC University, Lisbon*)

Images are framed objects, and it appears detached from everything that surrounds them. And it is always representation, construction. The frame, or framework, whose main function is to delimit the two-dimensional surface, illusory dimensional, in perspective image, which has a plastic and emotional component, gives the presence and becomes the visual body. Through a physical delimitation, material and deliberate, it establishing a space for legibility based on the power of see: who builds and who sees, what Roland Barthes defined as operator and spectator, having as the link spectrum, i.e. the object itself and what it represents at the same time, "no matter what" (La chambre Claire, 1980). The picture is primarily fixed. An image has never history, because it has no time, contrary to filmic device. In this complex process, mainly interest to us the question which relates to the desire to see an image, decisive for image condition itself.

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Microscopy, micrographs and texts – of images as decisive evidence

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This paper addresses the role of images and imaging practices in the dynamics of science. It explores the presence of micrographs in scientific articles in the field of life sciences and biomedicine, paying particular attention to the interconnection between these visual displays and the text they accompany. Looking specifically at examples from research conducted in the 1960s and 1970s around the problem of erythrocyte aging, the analysis ends up going beyond the published materials back to the laboratory and the underlying experimental work. The subject of visual representations in scientific practice has been studied by several scholars in the history, philosophy and social studies of science. Here, I follow the approach by Alberto Cambrosio and collaborators, in which the authors resorted to examples from the field of immunology, to explore some cases concerning erythrocyte aging. These studies provide other interesting examples to further understand the ways scientific imagery play a role in the dynamics of knowledge production and dissemination. My paper examines the combination of various microscopy techniques and its interplay with the written narrative to reinforce the evidential role of the micrographs in the illustrated article.

Nineteenth century medical photography: a collaboration between physicians and photographers

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Since its invention in the nineteenth century, the photographic technique was understood as the French astronomer Jules Janssen (1824-1907) called it, "the true retina of the scientist". One of the first scientific applications of photography was in the field of medical sciences: associating a photographic camera to a microscope, the physician Alfred Donné (1801-1878) obtained, in 1839, photomicrographs of human blood and mucus which were published in a medical Atlas in 1845. Throughout the nineteenth century, medical photographs will be often obtained with the collaboration of renowned photographers, leading to a high value corpus of photographic iconography related to the practice and communication in medicine. The making of these medical images did benefit from the work of these artists who also invested on the research of photographic emulsions, photomechanical techniques and photographic instrumentation. Some of these photographers are now an intrinsic part of the history of photography and medicine, among many others: the brothers Felix Nadar (1820-1910) and Adrien Tournachon (1825-1903) who collaborated with the neurologist Duchenne de Boulogne (1806-1875); Fernand Monpillard (1865-1937) who worked with several medical institutions and did research on colour photography; Georges Demeny (1850-1917), assistant to the physiologist Étienne-Jules Marey (1830-1904), conducting with this physician, research on how to capture and display moving images of the

human body which in turn had an influence as visual models for modern artists like Marcel Duchamp (1867-1968) and Giacomo Balla (1871-1958). In Portugal, two of the most successful professional photographers, Augusto Bobone (1852-1910) and Emilio Biel (1838-1915) obtained radiographs at the initial period of the medical application of X-rays. Bobone who worked closely with the physician Virgílio Machado (1859-1927), published, in 1897, a monograph on the research and practice of radiography. In this paper I will examine the historical role that nineteenth century photographers played in generating through medical photographic representations, perceived as "truthful", new conceptions of visual communication in medicine.

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The Beauty of Physics in Berenice Abbott's Photographs

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In 1987, an exhibition entitled "Berenice Abbott: The Beauty of Physics" opened at the Academy of Sciences in New York. This exhibition brought together a large portion of the photographs Abbott (1898 -1991) made as part of a project developed, at the MIT (Massachusetts Institute of Technology), between 1958 and 1960. According to Garfield (1989), in the exhibition catalogue, one could read a sentence by Abbott (1939) on the necessity of the existence of a "friendly interpreter between science and the layman... I believe that photography can be the spokesman as no other form of expression can be. There is an essential unity between photography, science's child, and science, the parent". This text challenges us in many ways. We learn that, as a photographer, as early as 1939, Abbott was interested in science, and we are left with the desire to know how this interest appears in the life of this photographer, and why she dedicated 22 years of her career to photographing the laws of nature through the "eyes" of science. Citing Bos (1985), we can characterize Abbott's professional life, saying that, "poets and skyscrapers cede the stage to mirrors and magnets, gravity and Van de Graaff." In Art, Abbott's photographs get the attention they deserve; they were shown in an art exhibition in Paris, in 2012. In science and in science education,

however, Abbott is almost forgotten in Europe, even if some of her photographs are very familiar to us. In fact, Abbott produced very difficult photographs in the laboratory. Other photographers reproduce them till today and some of them are commonly used in scholarly texts. Why then bring them here today? In this presentation we will show that Abbott's photographs can be appreciated from multiple points of view. Martin Kemp (2000) states, that Abbott's interest in science arose from her contact with Whitehead's thinking.. Presenting the singular path of this American photographer, we will discuss the contemporary educational interest of these images, linking them to Whitehead's thinking on education; we will also show how they can enrich our relation with the physical world, "seeing", through them, the beauty of nature.

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Reductionism, agency and free will

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According to compatibilism, free will is the agent's ability to decide to act according to her reasons (beliefs and desires). This is considered to be possible in a deterministic world in which, under the exact same circumstances, given the past and laws of nature, the agent could not have chosen differently. She can nonetheless consider herself free because the mental states and events which gave rise to her decision, and thus to her action, are *hers*, and she is identified with them. Such a view is sustained by the Causal Theory of Action, according to which there is a direct causal relation between the agent's mental states and events and her decision. Such a theory is also assumed by event-causal libertarianism, with the only incompatibilist addition that the agent's decision be undetermined. A usual objection to this sort of libertarianism is the "luck problem", a famous recent version of which is called the "disappearing agent" argument: if the agent's decision remains undetermined up to the moment when it is made, and if the agent can be reduced to her psychophysical states and events, then we're force to conclude that the agent does not control the final decision, which is just a matter of luck. The agent "disappears" from the causal etiology of action.

However, according to another sort of libertarianism called "agent-causalism", this sort of problem can be avoided, since it arises only if the agent's decision is brought about by her inner states and there is nothing, besides them, which can influence the outcome. Thus, a libertarian theory who wishes to enhance the agent's control over her action must abandon the usual event-causalist forms of reductionism, for an alternative view that recognizes that causes of actions are substances, i.e., that the agent herself, as an irreducible substance, is the ultimate cause and originator of her actions. In fact, free action entails responsibility insofar as it involves authorship, in order for the action to be something that the agent *does*, as opposed to something that merely *happens* to her. Thus, the libertarian free agent must be someone whose *will* can supersede the blindness of event causality which would otherwise make her an automaton.

Many event-causalists have counter-argued that if the agent *identifies* with some of her states and these states play the self-determining causal role in bringing about the action, then it is *as though* the action was directly caused by the agent as such. I'll object that this is not a distinctive aspect of free agency, since that identification could have happened merely by chance. I defend instead that *self-determination* is what makes an agent free, and that for it to be possible, actual free agents must have an irreducible identity, a *self* that is much more that their psychophysical states and who makes the final call from amongst the open alternative courses of action that are available to them.

Agent-causalism hasn't had an easy life in the context of analytical philosophy. It has been criticized from most naturalistically inclined fronts, and it must address several risks of implausibility, contradiction and unintelligibility. Even though I'll recognize these challenges and state them openly, I'll still argue that a libertarian free will cannot be defended by any reductionist alternative.

Instrumental rationality and the free will debate

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According to our traditional view of ourselves, Man is supposed to be both free and rational. But how do ascriptions of free will and rationality relate to each other? Is the truthful ascription of any of these qualities a precondition for the truthful ascription of the other? In particular, is free will a necessary condition for rationality?

Cognitive science and its implications for our self-understanding

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René Descartes placed the mind (*res cogitans*) outside of the mechanical material world and adopted an interactionist dualist position concerning the mind-body relation. He thought that non-human animals are machines that could be explained from purely mechanical perspective and operate according to natural laws, but stressed that when mental attention is involved a separate 'rational soul' must be posited. When scientists started to turn their attention to the human mind they were approaching what has for many centuries been a domain of philosophy and religion. The emergence of cognitive science has opened new challenges to our place in the world and to our self-understanding. Many scientists and philosophers tried to find a place for the mind in nature by giving it a physical explanation and recent developments in neuroscience raise the worry that understanding how brains cause behavior will radically change our understanding of the mind and undermine our views about free will and, consequently, about moral responsibility (e.g. Wegner, 2002; Churchland, 2011). Owen Flanagan (2002) believes that in the Western tradition we have two grand images of who we are: the humanistic and the scientific. The first has its roots in religion and in perennial philosophy and is seen a set of beliefs about ourselves based on the assumption that we are beings with free will and consequently able to lead a moral and meaningful life. In contrast, the scientific image suggests that we have evolved according to the principles of natural selection and cannot circumvent the laws of nature. Can these two images be compatible?

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Meta-emotions and argumentation: some effects for decision and actions

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Emotions are commonly present in Argumentation (Walton 2002). Research on emotion has revealed that the presence of emotion is not always as straightforward as the clear and compact names we have for them and that emotions may sometimes mask other emotional realities (Pugmire 1994) making it harder to address and regulate the emotional aspect of argumentation for decision and action. In addition, differences in meta-emotion may also be at the base of misunderstandings and disputes (Jones & Botker, 2001, p. 240) and complicate matters even further. This article discusses the way in which unconscious emotions (Winkielman & Berridge 2004) and meta-emotions (Mendonça 2013) appear in argumentation. The first part describes the nature and scope of both meta-emotions and unconscious emotions showing how both are deeply connected to or values and show how they turn argumentation and communication more opaque. Arguing that the fact that both meta-emotions and unconscious emotions can be seen as the result of education and emotion regulation. Consequently, both unconscious emotions and meta-emotions render decision and action harder because people are less aware of them, and they also assume that others have similar emotional processes for these are culturally determined, and mirror our values and beliefs about emotions. Finally, the first part indicates how conflict is a tool for bringing to the surface our deepest emotions and important to better understand them. The second part looks at how the emotions of surprise, shock, and awe may provide ways to both help and aggravate argumentation by looking to how it can interfere with other emotional experiences. Finally, the article offers a practical analysis of the arguments around the law forbidding students to wear visible religious signs in public schools (Jones 2012) to show how theoretical exploration done can be useful for understanding and analyzing argumentation in general.

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Philosophy of the Internet and of the Technique
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The Internet is primarily a manifestation of contemporary writing: electronic, networked. This kind of writing expresses perhaps more precisely than former kinds of writing the link between technology and thought. It helps us to understand how much our intellectual practices are technical: from repetition of gestures, application of recipes (algorithms), textual gymnastics (combinatorial applied to various graphic shapes) operations of distanciation (produced by the construction of lists), need to invent new classifications (in front of the heap of these lists which show the limits of the old conceptual categories) till the need to take the objects and methods established by these operations as objects of reflection.

In other words, the Internet is more of a revealer than a revolution: by focussing attention on this technique, we rediscover the reflective dimension of the technology of the intellect that we know well for a few thousand years: writing (Goody). We also understand that the Internet is a sophisticated product, because it is directly related to the scientific process: we know, since Descartes invented modern algebra (La Géométrie, 1637), that is the technique (methods, know-how, writing) which provides the link between experience and theory, between field and conceptualization.

Hence the Internet invites us to rethink the historical relations between science and technology. The latter is not an application of science, possibly misguided and threatening (Heidegger). It also has a reflexive dimension: it is not objectivable as one might hope. More precisely, it indicates our conceptual difficulties, the ambiguity of our inheritance, when we think of the relationship between subject and object, or between writing and materiality of the world. Gilles Gaston Granger also points out that we tend to underestimate the virtual part of the object.

The Internet also presents us with another question, more difficult because more sociological: it is the first time in history that the industry invests so explicitly the field of intellectual instrumentation. Perhaps this assertion stems from an excessive focusing on present (as the forgetting of history facilitates the multiplication of "revolutionary" discourses : about the internet, web 2.0, the digital, etc.). That said, the researches of historians (on writing, on scientists and scholars, on technical worlds) allows such a statement. Then, a question comes: which are the effects (actual or potential) of this industrialization on our discursive formations, on the autonomy of our reasoning and on the organization of intellectual professions?

Rhetoric, materiality and technological artefacts
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Considering a navigation device (GPS), this work intends to articulate both the semiotics of consumption developed by Baudrillard (1969), and the material semiotics of actor-network theory, particularly the one introduced by Latour (1992). Besides the symbolic differentiation acting upon technological artefacts through advertising, branding, and aesthetical design, there is on it an increase of possibilities of action as an output of the multiplication of functionalities, like navigation systems in mobile phones, that calls for a material semiotics analysis. With this approach becomes available the consideration of a material dimension that Baudrillard forgets. But, by articulating the latter more traditional semiotics with the material one, it is possible to introduce a critique tone too often not present in Latour's work.   Rhetoric as a concept and practice is highly heuristic in order to understand a process that is made of persuasion (of the consumer), argumentation (to consume), and problematization (of everyday ways of living). This approach is fruitful to articulate a «one way» perspective of domination - like the one represented by Baudrillard's - and Latour's vision, that tends to be more attentive to the density and complexity of the micro relations of the real. Rhetoric as a concept and practice is made, at the same time, of a mono movement of relations of persuasion and of a dialogical movement of relations, as argumentation, that

shows in its emergence a net of material and non-material connections. In fact, rhetoric as a concept and practice permits a combination not just of these two theoretical perspectives, but also of both traditional and material semiotics. It is on the layers of rhetorical associations that speech, image and material dispositions intersect each other. In this approach it is possible to find micro dispositions of domination that are not confined to macro-structured views.

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Technology, knowledge and externalization in the virtual world age
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The present study intend to discuss the contemporary relation between knowledge and technology starting from the considerations presented by Ernst Cassirer in his Form und Technik and in his general philosophical outlook. Accordingly, it is especially concerned with the relation between knowledge and the created and developed tools to store and communicate it, as well as the consequences that can overcome from this particular bond for culture. Here is proposed a study of the cultural changes that may arise from this new relation with knowledge – and it exists since the appearing and huge expansion of the global computer network and it's search mechanisms and other related services such as data storage "on the cloud" (cloud computing). Thus, the investigation of this new relationship can help the systematic understanding of the factors surrounding the current development of culture and also can provide the basis for philosophy's role as the mediating authority in such case. The present study proposes: 1 To present a brief introduction to Cassirer's philosophy of technology with special emphasis on the issues of the relationship between the ego with itself and with the nature, fate and alienation. 2 To correlate these subjects remarked on philosophy of technology with the present situation of knowledge, meaning, the state of externalization of knowledge by the increasing dependence of humanity upon outer tools. 3 To bring forward the main consequences that can overcome from this new relation, and to discuss the task of philosophy in coping with this cultural situation.

Keywords: Technology, Externalization, Virtual World, Ernst Cassirer.

Artificial societies and the interpretation of formal systems
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Autonomous mobile robots embedded in human environments are interpreted automatic formal systems. Possibilities opened up by recent trends of New Robotics (e.g., Humanoid

Robots) make it important to fully understand this assertion. With an increasing number of machines interspersed in our social interactions, making it increasingly possible that some of them regularly pass the test of the intentional stance (some machines and some humans tending to be treated as equivalent agent), it is important to understand the meaning of this question: What is the origin of the interpretation of these interpreted automatic formal systems? To answer this question it is necessary to overcome the constitutive illusion of the Sciences of the Artificial: the illusion of certain machines having genuinely intrinsic significant connections with the world where these connections are strictly dependent on human interpreters. We clarify this constitutive illusion explaining the underlying mechanism: the invisibility of interpretation. How the invisibility of interpretation works will be explained with the help of a parallel with Tarsky's theory of truth. Overcoming the constitutive illusion of the Sciences of the Artificial and recognizing the underlying mechanism (the invisibility of interpretation) is important in order to understand how intelligent machines can enter the social life of humans. Perhaps it may be seen as somewhat unproblematic to say that "computers play chess" or "robots play soccer". Other situations may be more sensitive. For example, saying that robots take care of the elderly raises the question: are robots really taking care of someone or are we just trying to avoid some ethical issues in specific circumstances by providing such an interpretation? Exploring concrete examples of recent robotic experiments, we show how important the interpretation of formal systems is to understand what is at stake given the prospect of human societies converging to artificial societies.

P13

Objective probability and scientific realism in the context of contemporary science

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In contemporary science probabilistic explanation has very crucial role. The force of this impact can be observed both in the context of some scientific theory as well as in the overall picture of the world created by modern science. For instance, this kind of explanation has a central role in quantum physics, genetics, or in the social sciences. Their specificity lies in the fact that, unlike the two-valued inferences, it uses probability tools. Therefore, there is a general question – should these probabilistic descriptions be interpreted as objective representation of reality? In this paper I will focus on a problem that concerns relations between objective probability and realistic understanding of science. Objective probability is an interpretation, which assumes that probabilistic statements relate to the real, physical world characteristics. In regard to this - we get series of specific problems, such as conflict with deterministic nature of certain theories. In the other side - If we accept the subjective interpretation of probability, the probability becomes the measure of person's degree of belief, which is based on some available information. That way we can avoid previous troubles, but we face of another serious question - how is it possible (basis of subjective observation) that

we have such successful, well-functioning science? If we apply these problems on the ground of scientific realism, we get another interesting issue. In this position, we can say - our scientific theories give true descriptions of mind-independent world. But, if our judgments will be based on probabilistic inference - resulting values will oscillate in range between truth and falsehood. How we can interpret these values? In response to this question I will try to show different interpretations of 'objectivity' (in probability context) and their relationship to scientific realism. I will show how different meanings of this term (logical, semantic, epistemic) present different issues, which are causes of many, unnecessary philosophical confusion.

A 'faithful' interpretation of Everett: empirical faithfulness
Susanna Cocco (*Università degli Studi di Cagliari, Italy*)

Everett's Relative State Formulation is one of the most famous and debated interpretations of Quantum Theory. Further deepening of the debates has been made possible by the discovery of his unpublished notes and manuscripts. For Everett, Pure Wave Mechanics gives a complete description of physical reality, while collapse is confined to a subjective level, in a relational context. Everett's explanation of the determinate-record and the probability problem is nevertheless vague, and hence his readers found room for developing diverse ontologies, some of them adding a lot of metaphysical structure. However, Everett himself was 'agnostic' with respect to metaphysical assumptions because he was committed to a strong empiricism. According to Everett's approach to physical theories in general, the only requirement for a scientific theory to be good is empirical faithfulness, which implies that there must be a sort of 'isomorphism' between a mathematical model and the perceived reality. I think that a 'faithful' interpretation of Everett, which starts from his concept of empirical faithfulness, can offer new elements of great interest for understanding Pure Wave Mechanics in a new way: even if it could be considered a relatively weak concept, looking at the theory from this perspective standard interpretational problems disappear, and the theory becomes self-contained. My purpose here is to show that Everett's understanding of actual experience can be put into correspondence with the latest forms of constructive empiricism, and could be considered a variety of van Fraassen's empirical adequacy: the problem in figuring out 'extra structures' coming from the model, which is the reason for metaphysical interpretations, can be solved by using pragmatic criteria to choose in which way the theory should correspond to empirical evidence.

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Empirical and experimental philosophy as a new frontier for the philosophy of science in the 21th century: The case of folkbiological classifications of living and animate beings

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Empirical and experimental philosophy are new interdisciplinary fields in the philosophy of science (Prinz 2008). They constitute both a danger and a frontier for philosophical research in the 21th century. On the one hand, they could endanger the specificity of philosophy and of the philosophical method with respect to science. On the other hand, they could promote a revival of the original spirit of philosophy that up until the XVIII-XIX century had been inseparable from science (Knobe, Nichols 2008). This paper will discuss the main issues related to these new fields with reference to an empirical and experimental study we carried out on the classical Aristotelian question of categories and specifically on the folkbiological taxonomy of living things (plants and animals) (Aristoteles, Categories; on folkbiological classification see e.g. Medin, Atran 1999). The research we are proposing here starts from an hypothesis about the possible origin and internal organization of the category "living" (Dellantonio, Pastore, Innamorati 2012). This hypothesis suggests that the differentiation between living and non-living things is related to cultural factors based on a more fundamental opposition – i.e. the opposition between animate and inanimate entities (i.e. humans-animals vs. plants-material objects) – that humans develop on the basis of the specific movement characteristics of animate instances. After sketching out this hypothesis we will present and discuss the data and the design of an experiment we carried out on Italian adult native speakers to begin testing this hypothesis. As regards the issue of whether experimental research represents a danger or an opportunity for philosophy, the discussion of this study will point out that – even though empirical data are essential to disentangle specific issues – philosophy with its peculiar method continues to play an essential role both in the development of new solutions and in the evaluation of their plausibility.

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Laws of nature: what else if not governing?

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According to a common intuition, the very idea of natural law entails that the law governs the phenomena falling under its domain of application. Bas van Fraassen, just to mention one out of many possible examples, echoes such a widely felt intuition when in his Laws and Symmetry he recalls that one of the main tasks traditionally attributed to natural science is exactly "to state the laws which the things in the universe obey" (van Fraassen 1989, p. 18, emphasis added), and – in the case of natural phenomena – for them to obey means that they are constrained by some form of necessity or 'nomicity'. It is highly controversial, however, whether we can legitimately project such necessity or nomicity onto the world or we should limit ourselves to locate them within the knowing subject. According to the Ramsey-Lewis 'best-system' approach, for instance, we should resist the governing view of laws: in such a regularist framework, it is not a conceptual truth that laws govern, namely it is possible to entertain a non-governing view of laws without being plainly inconsistent. In the present paper, I will try to defend the governing view of laws with a two-fold strategy. First, I will investigate whether the claim that the governing character is not intrinsic to the notion of law is justifiable (Beebee 2000, 2006): this move will lead to the claim that the non-governing view of laws fails to countenance essential properties that an intuitive notion of law cannot, after all, afford to miss. Second, on the basis of the idea that laws cannot but ground natural processes in a somewhat governing fashion, we will elaborate on the so-called primitivist approach to laws. In particular, I will try to substantiate it against the criticisms according to which it is a 'cheap' solution.

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Quantum computer: quantum model and reality

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There are a few most essential questions about the philosophical interpretation of quantum computer: 1. Can a quantum model unlike a classical model coincide with reality. 2. Is reality interpretable as a quantum computer? 3. Can physical processes be understood better and more generally as computations of quantum computer? 4. Is quantum information the real fundament of the world? 5. Does the conception of quantum computer unify physics and mathematics and thus the material and the ideal world? 6. Is quantum computer a non-Turing machine in principle? 7. Can a quantum computation be interpreted as an infinite classical computational process of a Turing machine? 8. Does quantum computer introduce the notion of "actually infinite computational process"? Any computer can create a model of reality. The hypothesis that quantum computer can generate such a model designated as quantum, which coincides with the modeled reality, is discussed. Its reasons are the theorems about the absence of "hidden variables" in quantum mechanics [1-2]. The quantum modeling requires the axiom of choice. The following conclusions are deduced from the hypothesis: A quantum model unlike a classical model can coincide with reality. Reality can be interpreted as a quantum computer. The physical processes represent computations of the quantum computer. Quantum information is the real fundament of the world. The conception of quantum computer unifies physics and mathematics and thus the material and the ideal world. Quantum computer is a non-Turing machine in principle. Any quantum computing can be interpreted as an infinite classical computational process of a Turing machine. Quantum computer introduces the notion of "actually infinite computational process". The discussed hypothesis is consistent with all quantum mechanics. The conclusions address a form of neo-Pythagoreanism: Unifying the mathematical and physical, quantum computer is situated in an intermediate domain of their mutual transformations.

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What entities exist? A lesson from "genes"

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Many scientific realists believe in the existence of some entities (e.g. electrons). There are three famous criteria to evaluate whether certain entities exist: 1) If some entities are postulated by the successful scientific theories, then those entities exist (Putnam 1975); 2) If some entities are experimentally manipulated, then those entities exist (Hacking 1983); 3) If some entities are supposed to play a given causal role in respect of a certain set of phenomena, then those entities exist (Psillos 1999). "Electron" is a favourite example by realists. Surprisingly "gene", as a widely employed biological concept, was not widely discussed in this context. So, a natural question occurs: Do genes exist? In this paper, I argue that it is controversial whether genes exist. On the one hand, for many philosophers, genes "obviously" exist since "gene" fulfills all three criteria. On the other hand, for many scientists, what is gene is still under discussion. If the concept "gene" is not explicitly defined, how can one contend the existence of the entity that the term "gene" refers to? This paper argues that there is a dilemma for the realists who contend the existence of some entities. If genes do exist, it seems that all three criteria are not sufficient conditions. If genes do not exist, then the realists have to make a further distinction between the entities like electrons and those like genes, both of which fulfill three realist criteria. Therefore, I argue that this is a serious question that the realist must address.

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Ontic structural realism and thermodynamics

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In recent years, structural realism (SR) has been taken as a promising account within the debate on scientific realism. This abstract focuses on moderate ontic structural realism (mOSR) that understands structures as a net of concrete, particular, and physical relations. mOSR is supported, if the properties of fundamental objects consist in relations instead of being intrinsic properties. Looking upon the debate and the literature, one may well say that it is quantum physics and its ontology on the one hand, and general theory of relativity (GTR) on the other hand that set the frame for most of the structuralist's discussions. Much less focus has been put on another fundamental theory in physics: the theory of (statistical) thermodynamics. I argue that the conception of statistical thermodynamics very well fits central ideas of mOSR. Thermodynamic properties indeed can be understood

within a relational net, and they should be described as non-intrinsic properties. However, the characteristic relations within the theory do represent a separate group of relations compared to quantum physics. Thermodynamics is based on two statistics of rather different kind. The second statistic is superimposed on the first, but only the first one is concerned with the basic theory of quantum mechanics. The consequences of such a two-step creation of statistics together with a statistical justification of the basic equations in thermodynamics force mOSR to accept a delicate concession. The relational net of statistical thermodynamics consists of non-concrete and non-particular relations. The result is that mOSR is forced to untangle a fact that it once tried to object against: the problem of an occult linkage between abstract relations and concrete particular physical occurrences and events. The analysis additionally provides us with an argument for why thermodynamics should not be taken to be completely reducible to the underlying theory of micro-states.

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P15

The role of Ibn Sina's intentionality and the generation of numbers: constructivist features in Ibn Sina's approach to the nature of number

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One of the main claims of this talk is that Ibn Sīnā (980-1037) has introduced a major shift in the philosophy of mathematics that is neither Platonist nor Aristotelian and that is structured into 5 main conceptual developments: 1. the recognition of mathematical objects as intentional entities and the acknowledgment that this amounts to provide an intentional notion of existence; 2. the link between the intentional act of apprehending unity and the generation of numbers by means of a specific act of repetition made possible by memory; 3. the identification of a specific intentional act that explains how the repetition operator can be performed by an epistemic agent; 4. the development of a notion of aggregate (or constructive set) that assumes an inductive operation for the generation of its elements and an underlying notion of equivalence; 5. the claim that plurality and unity should be understood interdependently (we grasp plurality by grasping it as instantiating an invariant).

The Kepler's vision in the Copernican revolution

Pedro Henrique C. da Silva (*Faculty S. Bento, S.Paulo, Brazil*)

This paper discusses how Kepler uses the Copernican Revolution to show its legitimacy ahead of the geocentric theory. The Summary (Epitome) of Copernican Astronomy is one of the most mature works of Kepler, brings a thorough investigation not only the defense of Copernicanism, but denying that Kepler is infinity. Kepler was the one who brought in a genuine way the Copernican Revolution to discuss the so-called "Scientific Revolution." Until then, the work of Copernicus, Revolution of Celestial Orbs, had expected a dynamic, incidentally has been set-aside for a few years, this work only with Kepler began an investigation had expected. The astronomer looks such a revolution and advances in research on heliocentrism. The Copernican Revolution was not accepted at the beginning of its publication, there have been several attempts to erase it, but it was with great effort that such a course proposal gained perspective. Kepler in his book Epitome (Abstract) shows his acceptance of the Copernican Revolution in the Book IV shows how the geometric models have as their development heliocentric calculations, in other words, starting from the more

complex model, the dodecahedron, to model the most simple circle, but does not leave theology to explain how the composition astronomical. Two questions arise when we enter into the interpretation of the Kepler Copernican Revolution: what exactly attracted Kepler with such force the Copernican universe? What exactly Kepler uses the Copernican theory, since the model was not a Copernican heliocentric scheme truly, but a system, so to speak, vacuocentric?

The metaphysics of space: Mach, Poincaré and the non-Euclidean geometry

Isabel Serra, **Elisa Maia** & **Alexandra Van-Quynh** (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

The current epistemological debate about space can only be understood in the light of the history of science. Space has been a privileged theme for philosophers since the ancient Greeks developed a key tool for dealing with the issue - geometry. Greek geometry constituted the basis of physics until the 19th century. Newton used a very simple model of space and time described by Euclidean geometry which was consistent with the majority of the scientific experiments as well as with ordinary experience. Alongside the use of mathematical models based on Euclidean geometry, the metaphysics of space was, for science, part of the accepted view of nature from the 17th to the 19th century. The nature of space was a question that concerned scientists and philosophers. To Kepler, geometry furnished the model of God's creation. According to Newton, space was continuous, infinite, tridimensional and homogeneous, and all the points in it satisfy the theorems of Euclidean geometry. Rather, Leibniz has argued that space (and time) does not exist in an absolute form. The discovery of non-Euclidean geometries in nineteenth century, as well as their development and applications, completely changed the scientific and philosophical thinking about space. Then, new scientific and philosophical positions such as Riemann's generalized conception of space or Poincaré's conventionalism emerged. Mach developed the point of view that space and time do not exist in absence of matter but they should be seen as formed from the relationships between objects. Einstein, who was greatly influenced by Mach's philosophy, discovered relativity, introduced a new framework for all of physics and proposed new concepts of space and time. Space continues to raise numerous questions for modern philosophy of science. In particular the current models of space and time may be very unrealistic descriptions of what they really are, even though they give accurate predictions in experiments. In this talk we will try to approach pertinent questions and problems about the nature of space raised throughout history and that somehow contributed to the existing conceptions. We will focus in particular on the thought of the philosopher-scientists of the 19th century who discussed the problem of the notion of space in physics. We will also explore the role of the emergence of non-Euclidean geometries in changing this notion.

Physical postulates and primitive metaphysical notions
Fredrik Andersen (*Norwegian University of Life Sciences, Norway*)

In this talk I will use relativity theory to illustrate possible pitfalls in deriving a metaphysical theory directly from physics. I will question whether relativity physics provides us with a viable metaphysics of space-time, and to which extent physics in general can inform us about seemingly primitive metaphysical notions such as space, time and causation. Using coherence as a touchstone for the plausibility of any given world view, I will point toward a seemingly unjustifiable dualism between the measuring apparatus and all other physical entities in the set up for special relativity. The main argument will be that our views concerning the justifiability of methodological choices made in constructing physical theories should be decisive in evaluating their claims to truth. The position defended here will be that, although our metaphysical notions must be able to save the phenomena, they cannot be derived from physics directly.

P16

Arte, Ciência e Filosofia. O Teatro no Cruzamento dos Mundos
Carlos Fragateiro (*University of Aveiro, Portugal*)

Tendo como referência o projeto desenvolvido no domínio do Teatro e da Ciência no Teatro da Trindade em Lisboa, pretende-se com esta comunicação apresentar os eixos possíveis duma intervenção que, no domínio da produção e criação artística, revelasse o triângulo mágico do conhecimento – Arte, Ciência e Filosofia.

A journey over the slight abyss: brief visit to João Maria Gusmão e Pedro Paiva
Lucília Maria Pinho Lopes (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

Questioning the limits of representation's possibilities and reality's perceptions constitutes a relevant issue that touches the boundaries of knowledge in all areas and at all times. João Maria Gusmão and Pedro Paiva's work inquires the experience of the real, as well as our appropriation of the phenomena we observe. Subtly, they guide us to a new challenge and a new look on a seemingly simple phenomena, disturbing, with a soft humor, our "secure laws" to understand the physical reality. The artists use a variety of scientific knowledge in the fields of optics, mechanics, magnetism... Together with the artists, we can think about the relativity of our knowledge, the possible mistake of our perceptions and also be asked

about the plausible explanations that science provides us. Maybe it's about the relativity of the world itself, which might not even be the one we know or then a world that hides itself in other inaccessible realities. The attempt representation apparent paradoxes is achieved with short 16mm silent films – with deep and seemingly simple narrative - as well as other resources which protrude into the dark chamber on which the phenomena are revealed opposing to our expectations.

A feeling of a slight astonishment, both mental and emotional, unbalances the spectator journey. The work of this artist duo tries to situate itself in the representation of impossibility. To the scientist, safe about the fundamental laws of physics, their art hit us and challenges our perspective on reality to which we belong. I propose to embark on a surprising journey to some of the work of these artists, currently being presented at the Biennial of Venice and a little all over the world. A world full of impossibilities or perhaps improbable phenomena makes us smile, reaches us and touches us deeply.

Science of processes and the moving image
Pedro Caldas (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

Modern Science progressively began to lose interest in *what things are* to be increasingly interested in the way *this* becomes *that*. Nowadays science no longer studies the essences but the processes. For this purpose it needs instruments capable to see beyond the possibilities of the sense organs. Since the mid-19th century science has expressed the need for tools allowing it not only to see the phenomena, but to register the occurrence of phenomena over time. Edweard Muybridge and Etienne-Jules Marey were pioneers of a new technology that corresponds to the situation of the emerging science of processes. The decomposition of the movement and its recomposition (chronophotography-cinema) meet the new needs of science. Etienne-Jules Marey invented instruments that enabled the graphic recording of the decomposition of movement and that helped in the study of the physiology of movement. Muybridge managed to get the photographic record of consecutive moments, i.e. sequences of photographs that allowed to see the decomposition of motion over time. But when doing the archaeology of the image in science, we have come to the conclusion that this relationship between *science of processes* and *sequences of images* is old after all, as at the beginning of the seventeenth century, when modern science fully emerges, we already find in Galileo this need to use images in order to analyze the phenomena over time.

Deleuze's theory of intensive space
Nuno Carvalho (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

The philosophy of Gilles Deleuze is well known for its complex theory of time but also reflects a constant concern with the notion of space, and the aim of this paper is to draw the main lines of his theory. We will begin with an analysis of *Difference and Repetition* and acknowledge how this work establishes, at an ontological and transcendental level, a dis-

tinction between extensive space (*partes extra partes*) and an intensive space that lies at the heart of being. This intensive space (or *spatium*) is, in later works, the object of a theory that gradually becomes more practical and concrete, and we will devote our attention to its embodiment, in *A Thousand Plateaus*, in specific domains like aesthetics, mathematics or physics. Our conclusion is reserved to the «any-space-whatever» of *The Movement – Image and The Time- Image*, in an attempt to see how Deleuze saw in cinema a way to accomplish the promise of *Difference and Repetition*: to experience a space strictly defined by intensity.

Beauty and the objectivity of science

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The special epistemological status of science is based on the assumption that science is an objective endeavor, due in large part to its empirical nature. A well-known challenge to this assumption is the way in which science must appeal to extra-empirical criteria in the process of theory choice; that is, if "the facts" do not solely determine which theory is the accepted scientific description of the world, then subjective factors of social bias and various prior commitments must come into play in decision-making in science, which seems to undermine its special epistemic role. I hold that scientists can admit that extra-empirical criteria play a role in theory choice while also being committed to the objectivity of scientific methodology. To do so, I argue that appealing to the extra-empirical criteria of aesthetic virtue can preserve the objectivity in theory choice. In the first part of the paper, I point out that underdetermination is in fact a problem in science by highlighting examples concerning both the Special Theory of Relativity and various interpretations of quantum mechanics. Extra-empirical virtues, therefore, must be a determining factor in theory choice. In the second part of the paper, I set out an argument in favor of the objectivity of aesthetic evaluations as these extra-empirical virtues, thus preserving the special epistemic status of science. Specifically, scientific theories can possess the properties of simplicity, symmetry, and elegance to a greater or lesser degree. The aesthetic virtue of a scientific theory, furthermore, is known by rational reflection. Insofar as we can grasp the aesthetic evaluation of a scientific theory through this rational insight, our judgment of the aesthetic virtue of a scientific theory is free from the biases and presuppositions that prevent the objectivity of scientific methodology.

Redundant causation in the social sciences

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Redundant causality has received much attention among philosophers because of the difficulties it generates for theories of causation, especially for so-called differencemaking accounts (e.g. Lewis 1973; Woodward 2003). Yet redundancy also plays an important role in stabilizing effects, strengthening the degree of counterfactual-support and robustness of causal relations. Philosophers typically distinguish between two forms of redundant causation: overdetermination and preemption. Attention to the natural and social sciences, however, suggests a more fine-grained distinction between various kinds of interacting processes and how they figure in causal explanations. The goal of this essay is to provide a classification of redundant causal processes and to show some applications in social sciences such as economics and sociology. In the first part, we introduce a distinction between four kinds of causal processes, depending on their degree of stability and counterfactual support. More specifically, we argue that simple (non-redundant) causal processes can be stabilized through mechanisms of overdetermination, preemption, and aggregation, which have different roles and effects on the system. The second part of the essay illustrates how this fourfold taxonomy can be employed in a general analysis of causal processes in the social sciences. We begin by considering the measures for providing economic stability to a small business, focusing on the backup mechanisms insuring the company against possible accidents and making the business plan more robust. Our second example, based on body image (Grogan 2008), illustrates how redundancy reinforces and stabilizes conditions that are unjust and detrimental to people. The goal of the simple scenarios discussed here is t gesture at how the various kinds of redundant processes analyzed have the potential to be applied to realistic examples, such as Stiglitz's (2012) insightful discussion of the mechanisms that generate and reinforce inequality in the U.S., or Bicchieri's (2006) analysis of the establishment of social norms.

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Emergence of robust contingent regularities

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There is a tradition both from philosophers and physicists disputing the traditional fundamentalist governing conception of laws of nature. Most of them, it can be said, share a deflationist account of what the notion of physical necessity is. Nowadays, amongst them the most extended view is probably humeanism. Instead, in this talk I am going to defend those who do attempt to provide an explanation of the occurrence of stable regularities, something the humean accepts as a brute fact. That is, an explanation of those regularities that are usually labeled as 'nonaccidental' or 'physically necessary'. In this talk I flesh out the shared trait of these approaches, namely the idea that physical necessities are no more than contingent but robust regularities. It is this robustness that gives the counterfactual strength characteristic of the alleged nonaccidental regularities as opposed to the accidental ones. I supplement this point of view providing a reason by which some regularities are robust and stable, a crucial point in the explanation missing in the existent literature. To this end, I recur to some studies in complex systems theory about the emergence of patterns in higherlevels. The key of my contribution is a new application of the insights brought to light by Michael Strevens in "Bigger than chaos. Understanding complexity through probability".

Keywords: Physical Necessity, Chaos Theory, Emergence.

Downward Causation from a new Relational Perspective

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If ontological emergence is to be accepted, emergent phenomena must bring with them new causal powers that contribute to the evolving causal structure of the world. Otherwise, emergent phenomena would be mere epiphenomenal, manifesting only inherited powers that already exist at the level of previous or more basic agents. It is at this point that downward causation plays an important role on the theory of ontological emergence, since for emergent properties to play any causal and explanatory role they must be capable of causally influencing processes at lower levels. Downward causation has been, however, accused of conceptual incoherence, and implying a potential circularity, for how could properties or phenomena have causal effects on the very processes that make their emergence possible and without which they could not even exist? (Kim 1992; 1999; and 2000). Firstly, I will address and criticize the well-known objections of J. Kim against downward causation: the principle of the 'causal closure of the physical domain' (Kim 1998), and the principle of 'causal/explanatory exclusion' (Kim 1988). Secondly, I will evaluate and confront two recent replies to Kim's objections: Craver and Bechtel (2007) and Kistler (2009). Finally, I will conclude that there is only one way to avoid Kim's objections. We need to explicitly acknowledge and refuse the metaphysical foundation of Kim analysis: the Atomistic meta-

physics. I argue that Craver, Bechtel and Kistler fail to recognize this metaphysical foundation of Kim's argumentation, and that is why their replies are globally insufficient. Therefore, I will propose a new way of conceiving downward causation from the point of view of a relational ontology, and in terms of a strict horizontal view of causation, thus avoiding the traditional vertical perspective of seeing causal forces moving upwards and downwards.

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Is chemistry emergent? (And if so, in what sense?)

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In the past decade or so, some of the discussions about reductionism and emergence have shifted from the philosophy of mind to the philosophy of science (e.g., Batterman 2002, 2011). Of these, most have occurred in the philosophy of physics, but more recently a number of philosophers have considered emergence in chemistry (e.g., Hendry 2006, 2010, 2012; McIntyre 2006; Scerri 2007, 2012). The first part of this paper looks at the existing accounts of emergence in chemistry and analyzes their shortcomings. I argue that both the traditional British emergentist view of chemistry based on "configurational forces" (Broad 1925) and the contemporary account based on "configurational Hamiltonians" (Hendry 2006, 2010) are incompatible with the causal closure of physics and for this reason they are at odds with the principle of conservation of energy. Also, I argue that the "fusion" account of emergence in chemistry due to Humphreys (1997a, 1997b, 2008) assumes a sharp contrast between ionic and covalent bonding that is not supported by current physical chemistry (see e.g., Atkins and Jones, 2002). In the second part of this paper I outline an account of emergence in chemistry which is free from the problems above. The account, which I call "functional emergence", is based on the idea that many chemical properties are defined not

by a shared microphysical constituent, but by their functional role in chemical reactions. I argue that properties like acidity are emerging from the underlying microphysics as patterns of chemical behaviour. Insofar as it is compatible with token-reductionism (physicalism), functional emergence does not challenge the causal closure of physics and the conservation of energy. However, functional emergence is incompatible with type-reductionism, and this makes room in our ontology for genuinely novel, sui generis chemical properties, which occupy a distinct ontological level.

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Realism and Emergence: a case study in current neuroscience on fear conditioning

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According to Kim (1999) and the orthodox received view in Philosophy of Mind, if one claims to have a certain (say mental) emergent property M, such that M causes physical property P, then either 1- the property M is determined by its supervenient physical basis, thus committing us to elimination of M as an emergent autonomous property (causal exclusion principle), or, 2- if one assumes the causal efficacy of M, one is committed to downward causation of the mental over the physical, violating the causal closure of the physical and obliging us to consider emergent property M as non-dependent at all on physical properties. Besides philosophy, these ideas also underlie, to a certain extent, current neuroscientific practice (LeDoux (1996), Bickle (2003))

In this talk I claim that the above 'dilemma' is only valid within a Metaphysical Realist background. I sustain that by adopting an epistemic-pragmatic (non metaphysical) brand of realism (Putnam (1990) El-Hani & Pihlström (2002)) a very different picture arises. Instead of metaphysical concerns dealing with the description of the basic and ultimate structure of reality, we face a pluralism of non-incompatible epistemic perspectives such as the Phenomenological and the Neuroscientific (El-Hani & Pihlström (2002)) As an illustration I reconsider some recent behavioural-neurocientific empirical results on 'Instrumental Fear Condition' (eg: Kinsheski et al 2012). Based on those results, the following causal claim is sustained: 'Feeling of Fear causes non-stereotyped avoidance motor behavior'. Adopting the epistemic-pragmatic form of realism, it is shown that we can commit ourselves to an emergent property like 'The Feeling of Fear' and identify its determination neural base (Firing at frequency x of cells in the Dorsal Pariaqueductal Gray) without the threat of 'causal exclusion' and further, that against both philosophical and neuroscientific orthodoxies, this 'downward' causal claim is a well sustained and useful empirical hypothesis in the advancement of our scientific understanding of Instrumental Fear Conditioning.

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Quantum logic and a dynamic perspective
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Quantum Logic (QL) is a singular non-classical logic created in the last century by Birkhoff and von Neumann in connection with quantum theory. For a long time it has been discussed whether QL is a real logic, or if it is only a simple extension of algebraic results in the study of certain mathematical structures (more specifically, the set of all closed subspaces in a Hilbert space). Today it is clear that QL should be taken as a logic, since it can be seen as possessing a similar status to certain non classical logics. On the other hand, the so called Dynamic Epistemic Logic (DEL), which culminates the epistemic logic project initiated by Hintikka, can be seen as one of the best tools for tackling the van Benthem's logical dynamics program. Then we shall show how this dynamic point of view is useful for understanding concepts that are typical of QL and could be expressed in terms of DEL.

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Sets and Everything
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Cantor famously employed an argument by diagonalization to show that the real numbers are uncountable, concluding that there must be more real numbers than natural numbers. Since there are infinite natural numbers, Cantor's proof would show that there are at least two distinct infinite collections, namely, that of all the naturals and that of all the reals. On the other hand, Brouwer (1907) came to a different understanding of Cantor's proof, arguing that this shows that the natural numbers are not actually infinite but only potentially so. Nowadays, Cantor's understanding of the diagonalization argument is widely accepted. In fact, the idea that there are infinite cardinalities of different sizes came to be developed in a mathematically rigorous manner, giving rise to powerful new theories (most famously, ZFC) that for the first time in history provided a unified picture of all mathematical practice. At the same time, it should be noticed that these new theories also gave rise to a number of other philosophical questions. One of these concerns the proper way of understanding the collection of all sets.

Dummett (1991), for instance, understands the set-theoretical antinomies as showing that the collection of all sets cannot be completed. According to him, such a collection should be understood as being indefinitely extensible. This Dummettian suggestion recently came to have a strong impact on the debate on absolute generality. In my talk I set out to do two things. Firstly, I will argue against Dummett's understanding of the collection of all sets. Secondly, I set out to explain the relevance of Brouwer's views on mathematics to the contemporary debate on absolute generality.

An overview of type theories
Nino Guallart (*University of Santiago de Compostela, Spain*)

Martin-Lof's intuitionistic type theory is one of the most promising logic systems in recent decades. It can be studied as an alternative to set theory but also as an abstract model of functional programming languages. Although created in the 70s, its distant origins can be traced to the birth of type theories after the discovery of naïve set theory's paradoxes. These theories propose a hierarchy of types in a way that avoids the problems of self-referential sets. Church's simply-typed lambda calculus will serve as a basis for more complex type theories that add features to it such as polymorphism, dependency, type constructors and subtyping. Among these systems it is worth exploring some of them in depth, particularly intuitionistic type theory and Cocquand's construction calculus. One of the most important paradoxes in type theory, Girard's paradox, states that a type theory cannot quantify over all propositions and identify types and propositions at the same time. Therefore, one of these two points has to be left aside in order to maintain the validity of the other one. We will draw a comparison between intuitionistic type theory and construction calculus. Whereas the first one leaves aside universal quantification, the second one takes away the identification between types and propositions. We will study the logical implications of these choices in the formulation of each logical system, showing in both cases the relationship between type theories and proof theory shown by Curry-Howard isomorphism.

Keywords: higher order logic, type theory, intuitionistic logic, lambda calculus.

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The logical and the psychological approaches to *a priori*

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The a priori, in Kant, is genetically formal. On the contrary, in Husserl, the a priori is genetically material. That is, in Kant, the *a priori* is innate and, in Husserl, is a kind of experience – *intuition of essences*, i.e., the grasping of concepts. The *a priori* is not grasped directly in sense perception but the construction of concepts needs the data from sensations. This idea clashes with the traditional (i.e., Kantian) thesis that *a priori* is the type of knowledge obtained independently of external perception. As Leibniz has already said, there are two aspects of the concept of *a priori* – a logical one and a psychological one. There is a tendency to look to the a priori in a psychological or temporal approach – before sense perception. But this view of the a priori is wrong. The right interpretation of the a priori is the logical one – the theoretical possibility of grasping a certain truth without the use of the data of external perception. The fact that the *a priori* is obtained after sense perception do not retire is a priori status. Kripke and Kaplan with their concepts of *a posteriori* necessity and *a priori* contingency put again in the agenda the problem of the nature of the *a priori*, but once again they mix the logical and the psychological senses of *a priori* and, worse than that, they underline the psychological one. As the Portuguese phenomenologist Delfim Santos wrote, there is a difference between *a priori knowledge and knowledge of the a priori*. The psychological interpretation of the concept of a priori is an anthropologization of objective knowledge, which implies relativism and therefore skepticism, and it is as bad as the rationalism interpretation that leads to metaphysical dualism – formal "reality" versus material reality.

On the boundaries of a pragmatic treatment of the knowability paradox

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The Knowability Paradox (1963) is a logical argument showing that if all truths are knowable, and there is at least an unknown truth ⁓ i.e., that we are non-omniscient ⁓ the undesirable conclusion that all truths are known follows. Traditionally, the paradox is considered a problem especially for antirealist conceptions on truth. Many strategies have been suggested in order to avoid the paradoxical conclusion. In particular, a family of solutions – called *logical revisions* – proposes to revise the logic underneath. A defence of intuitionistic logic as the right logic for solving this problem belongs to the above-mentioned family. In general, the success of logical revisions is based on their capacity to explain an argument like that (A): *a* is true if and only if it is possible to exhibit a direct justification for *a*. If a justification is something connected to our linguistic capacities, namely not transcending our epistemic

capacities, an antirealist can infer that (B) If it is possible to exhibit a direct justification for A, then it is possible to know that A. Putting (A) and (B) together we get (KP): If *a* is true, then it is possible to know that *a*. The *Logic of pragmatic* (LP) formulated by Dalla Pozza and Garola in (1995) is based on the idea that we need a justification for asserting a certain sentence *a*. LP is presented as a pragmatic interpretation of intuitionistic logic in terms of assertions, and intuitionistic semantics is given in a two-layers formal system where classical semantics is also represented. For the above-mentioned reasons the logic of pragmatic seems to be – *prima facie* – at least a good candidate as other logical frameworks to the solution of the knowability paradox. Aim of the paper is to analyse *pro*, *cons* and *intrinsic* limits of the logic of pragmatic in its interpretation of the knowability paradox, and, more generally, as an antirealistic logic for justification and knowledge.

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Must science be autonomous to be useful?
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A defense of the autonomy of science can be twofold. First, autonomy can be considered as a necessary condition for the epistemic and practical successes of science. In other words, when left free to define its research agenda, science would be better able to deliver knowledge useful to society. Second, the autonomy of science can be defended on the ground that only when protected from outside influences, especially from special interests (commercial, political, etc.) can science deliver the neutral and impartial expertise necessary for the proper functioning of a democracy. In that case, autonomy appears as a necessary condition for the epistemic authority of science. My aim in this talk is to identify and critically discuss several important assumptions underlying these lines of defense, in order to formulate precise forms of limitation of autonomy that would be both epistemologically acceptable and socially desirable. I will for instance discuss the link between autonomy (in the sense of freedom of research) and epistemic productivity and challenge the "unpredictability argument" by showing that what matters most in terms of epistemic fecundity is not that science is left free to define its priorities, but that a condition of diversity of research problems and approaches is fulfilled. This first part of my talk will allow me to propose several conditions that any form of limitation of the autonomy of science must fulfill to be epistemologically acceptable and socially and politically desirable in a democratic country. In light of the previous analysis, I will evaluate possible ways (as well as actual ways) to limit

scientific autonomy. I will explain in particular why public participation – a popular option these days - is far from being the best way to go to democratize scientific research.

Between protests and participatory budgeting devices: which way to high intensity democracy?
Ana Raquel Matos (*Centre for Social Studies, University of Coimbra, Portugal*)

Scientific knowledge and technology are implicated in almost policy decisions alongside ethical, economic, cultural and political concerns. This raises all sorts of questions explored in STS and in political theory. Drawing on two empirical case studies the presentation will review how work in STS resonates with work in political theory that seeks to advance "high intensity forms of democracy" proposed by Santos (1998). It will be argued that a combined approach helps to identify key mechanisms that require consideration by academics, activists and democratic reformers. The first case study analyses the protest movements against the closure of maternity wards in Portugal in 2006 and 2007 at the initiative of the government, which was founded on an expert evaluation of existing arrangements. The second case study analyses the use of a participatory device in urban planning in Belo Horizonte, Brazil. Confronting these cases raises important questions about how 'participatory citizen' and 'citizenship' get constituted and evolve and which understandings about science, politics and expertise inform such processes. Case studies analysis allows for a sharper understanding how various forms of knowing come to flow together in the process (alignment) or, on the contrary, get juxtaposed with one another (proliferation), and what does that imply for actors' identities and institutional framings and mechanisms in operation. How do some forms of experience become 'substantive', 'relevant' or 'true' while others are ignored or dismissed as 'emotional', 'unfounded', 'irrelevant', 'disturbing' or 'non-scientific'? What do the mechanisms implied mean for understandings of citizenship and democracy?

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Literary technologies of science: Structures of academic writing
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This paper will focus on transformations of academic cultures related to the democratization of the research process and changes of the relation between science and its audience(s). More specifically, it will be analyzed how changing academic cultures are reflected in distinctive styles and practices of academic work, which are transforming not only the forms of research results' dissemination, but also the very ideas of the nature of scientific activity and grounding of scientific thought. These issues will be analyzed in relation to social activities included in the processes of creating and evaluating academic texts. More generally, this paper primarily concentrates on the changing practice of historical research, academic culture, styles of thinking and writing in science. The focus on issues related to the chang-

ing structures of academic writing brings accounts of scientific research practices together with the issues of accumulation, synergy and public relevance of knowledge. The core ideas of the so-called "new" sociology of ideas, which is behind the whole project aiming at the historical analysis of social practices manifested in processes of the "production, evaluation and application" of knowledge, are also presented in detail.

Toward a new conception of scientific progress
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The main goal of this paper is to discuss the implications that a political philosophy of science (Rouse 1987) has for the conception of scientific progress, integrating, in particular, internal (scientific) and external (societal) considerations about science. In order to represent a rational succession of historical facts in science, it is necessary to appeal to a theory about the relationship between facts and their succession over time. We may even say that there are no *facts* in history, since despite of the intention to describe past events, the historian of science always mediates each evidence choice and analyzes sources that are capable of supporting the plausibility of the narrative as a whole. But the idea of *progress* suggests more than merely connections between *facts*, because it includes a goal to be achieved. Karl Popper claimed that scientific theories aimed toward *truth*. Thomas Kuhn has provided a less normative perspective of progress that suggests, on the one hand, the paradigmatic progress of science, and on the other an aimless development of science which he relates to the development of natural species and their struggle for survival. From this classical debate that occurred in the 1960s–70s, at least two ideas remain relevant: first, the distinction between the *internal and external* development of science and, second, the tendency to include the social role of science and social demands as an important aspect of scientific rationality. However, beyond the dichotomy at stake in the debate between Popper and Kuhn, we might be witnessing the rise of a third conception of scientific progress that suggests an interaction between cognitive and social values. This new conception takes into account how values are embedded in our social practices; it follows from the interplay between philosophical, historical and sociological considerations about science.

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Contemporary theory of democracy on referenda involving scientific results

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The paper focuses on the relationship between direct democracy and scientific research. Contemporary debates in the theory of democracy provoked by referenda on issues involving important scientific results, such as nuclear energy, medical research, GMO, etc., have revealed unsolved problems in lawmaking procedures. In the classical conception of Hans Kelsen, a democratic state of law should guarantee the protection of human rights, as well as the freedom to conduct scientific research. Yet, already in the 1960s, Charles Frederic Strong pointed out that legislation had become so highly specialized that even a well-informed citizen could hardly hope to grasp the details of all the Bills submitted for popular consideration, and that this would lead either to the enthronement of ignorance or to an indifference which would render the practice futile. Therefore, groundbreaking applications of democracy, both in direct voting and through elections, pose new serious problems for political and social life in the early 21st century. For instance, Giovanni Sartori's idea that democracy through referendum is far from direct democracy is particularly interesting in the context of scientists operating within a democratic framework. Of course, the mechanisms of democracy as a procedure are much different than those of science, where there is no equal position, and the scientific community is more of an oligarchy based on a hierarchical system. We would like to present some case-studies, i.e. a short report on some of the most important European referenda (European Union and Switzerland) concerning questions related to the results of scientific research and its consequences for the contemporary theory of democracy. These case-studies put into a new perspective the issue of limits on and the future of direct democracy, as well as the issue of popular consultation by referen-

dum, the (social) responsibility of science, and the future of lawmaking procedures in modern democracy.

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P20

The role of values in science

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According to an important epistemological tradition, science should be value free. Logical positivists associated value judgements with subjective, non-rational factors, which should be expelled from science. Max Weber, who recognized to some extent the role of values in science, was adamant in claiming that value judgements are not part of the results of science. In the last decades, however, the fact/value dichotomy has been challenged. Post-Kuhnian and hermeneutic studies of science and movements like Critical Theory and postmodernism have contributed in different ways to the view that valuations and factual judgements are inextricably entangled in science. I argue that the fact/value dichotomy is no longer defensible. The pervasive presence of thick terms in our language, terms that are both evaluative and descriptive, and the fact that most categories in the social sciences are not simply discovered in the social reality, but partly constituted by the values and interests of the researcher, indicate that science is value-laden. Values are also present in the relation between theory and evidence; because evidence comes in degrees, values can determine how demanding our evidential standards should be. Causal explanations are also potentially affected by values, because they select, from the large set of factors that produce a phenomenon, a small number of factors in the light of judgements of relevance. However, in recognizing the role of values in science, one must bear in mind that personal biases and ideology can corrupt science. The presence of epistemic values (like empirical adequacy, explanatory and unifying power, consistency or simplicity) does not threaten the autonomy of science,

but non-epistemic values may endanger it. The role of values in science must be counterbalanced by an openness to critical and self-critical dialogue in scientific communities. Values, like prejudices, are often discovered and corrected not by introspection, but by confrontation.

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Western rationality and its victims. Some questions in axiology of science

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The aim of our paper is to present a project for rational reconstruction of axiological competence in science on the basis of a socio-regulatory conception of culture. Scientific knowledge is considered a domain of culture characterized by the rationality of its procedures (though not necessarily of its institutions). In our model, axiology is an inherent element of the dynamics of scientific knowledge, as well as according to neopragmatism and the conception of "trans-science" developed by Keiichi Noe, where the cognition of facts are inseparable from value judgments. In his project Philosophy and science after the East Japan disaster, Noe refers to the problem of responsibility by means of "intergenerational ethics". To cope with responsibility within the axiology of science, we would like to reflect on Reyes Mate's conception of justice, in which he points out a distinction between injustice and inequality. Responsibility corresponds only to the former, for it involves the existence of the wrongdoer's guilt and a victim, while inequalities are natural, timeless and morally neutral. Reyes Mate thus questions western rationality. Moreover, there are links between the development of western rationality and the escalation of violence. If Zygmunt Bauman is right, the Holocaust was a test of the hidden possibilities of our societies. Hence, it seems reasonable to analyze the problem of responsibility and/or the moral obligation of

science today, and in the future within social contexts. We therefore propose to investigate three models (a perfectly normal situation, the situation of constraint, and that of exasperation) introduced by Leszek Nowak within the framework of non-Marxian historical materialism. Following from this, systematic studies beyond rationality (and "rational values") are proposed and models of irrationality and counterrationality are outlined. The following questions are posed in Reyes Mate's setting: Is the enslaved individual (or group, social movement etc.) a victim in Reyes Mate's sense?; Is the exasperated individual a victim?

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Should science become more democratic?
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Philip Kitcher (2011) has argued that the key task of the philosophy of science is, in the present context, finding a better alignment of science and public knowledge with the requirements a democratic society. This implies (1) a conception of how scientific knowledge reinforces democratic practices and attitudes, as well as (2) a conception of how democratic practice sustains science and promotes public knowledge. For the last half century, these points have been hotly debated both within and beyond the scientific community, one of the central points of contention concerning the role of values in science (Putnam, 2002, 2004).

This paper claims that both (1) and (2) risk ending up in theoretical dead ends, undermining both epistemic quality and democratic life. While (1) can be reduced to technocratic governance based on an ideal of value-free, positive science, (2) can be diverted toward an ideal of epistemic equality which proves unable to discriminate between competing knowledge claims. I argue that both challenges can be addressed by reinforcing the reflexivity of science, understood as a collaborative process of acknowledgement, critical deliberation and mutual learning on values and assumptions. My point of departure is Kitcher's pragmatist-deliberative approach, according to which values have a legitimate role in science insofar they are they are established through reasoned discussion under conditions of mutual engagement, and "commitments to factual claims and to value-judgments coevolve" (Kitcher, 2011, p. 36). The paper is structured along two lines of inquiry: (a) what are the specific reflexive processes that intervene in clarifying normative commitments, and (b) how can 'well-ordered science' integrate pluralism and dissent while maintaining epistemic authority and being able to inform social practice. Recent cases of transdisciplinary research will be used to illustrate the arguments.

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Looking for a definition of random genetic mutation at the molecular level

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The chance character of genetic mutation has been often analyzed and defined from the evolutionary point of view, i.e., looking at the relationship between mutation, selection and adaptation. Chance mutation in this sense means that the mutation is not specifically provoked with a view to the adaptation of the organism concerned ((Beatty 2008, Merlin 2010, Millstein 2011). Biologists qualify genetic mutations as "random" or "chancy" events from the molecular point of view too, but no philosophical analysis of the use of the notion of chance in this context has been developed until now. Which notion of chance do they invoke in this non-evolutionary context? In this paper, I will provide an answer to this question by looking both at the assumptions of statistical models used by biologists in order to estimate mutation rates (Foster 2006) and at recent research developments in the study of the mutational process and its biased character (Wang et al 2007, Garcia-Villada and Drake 2010). On the basis of a comparative analysis, I will introduce two notions of randomness I label "strong randomness" and "weak randomness" and show that they are invoked by biologists respectively in the context of statistical modeling and in verbal (non formal) descriptions and analyses of the mutational process. Then, I will analyze the specificity of each notion in its context of use and particularly evaluate whether the way biologists characterize genetic mutations as "strongly random" is a legitimate idealization with

respect to recent developments in the study of the mutational process. I will argue that, if biologists aim at providing a realist and precise account of the mutational process at the molecular level, the empirically right way to characterize genetic mutation as random today corresponds to the notion of "weak randomness" which should then be integrated into statistical models of mutation rate.

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Following McTaggart's argument up against B-time
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It is my purpose to argue against B-time. B-time is time understood as the series of positions of things running from earlier to later, or perhaps conversely. My argument against B-time has McTaggart's original simple form: (i) If there is no change, there is no time. (ii) There is no change in the B-series. So the B-series is timeless. Like McTaggart, I will assume the first premise of this argument, and argue for the second. However, my defense of the second premise will also bring new light for a better understanding of the first. I shall argue that McTaggart's claim that events do not change in B-time can be broadly understood as the claim that nothing changes in B-time: states, temporal parts, facts, or things cannot change in B-time, if change is explained in terms of "having different properties-at-a-time." States, temporal parts, facts, or things cannot change because, like events, they define the B-series. Thus, any change in them, in time, would not be a change, but just another item in the series. So it is the morphology of B-time itself, the fact that the series is made and ordered by its terms, the reason why nothing can change in the series. This idea will then help me in understanding premise (i), and in proposing that change is what makes time. That is, time is not a necessary condition for change; rather, change is a metaphysically necessary condition for time. I will then sketch two different metaphysical models that could implement

this idea: one with robust (Aristotelian kind of) substances; another with real external causation.

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Art and intentionality: a semiotic framework

José F. Quesada (*Department of Computer Science and Artificial Intelligence, University of Seville, Spain*)

One of the most fascinating and intriguing abilities of the brain is its capability to create meaning. Meaning, at this moment, is a kind of axiomatic and root notion where mind, world and language remain intertwined.

Nelson Goodman systematically changed the mimetic vision of art into a creative procedure able to make the world. This change of perspective is closely connected to the parallel replacement of the essential and ontological question about "What is art?" in terms of "When is art?" Recently, van Alphen have emphasized the power of art to visually think, proposing an approach where art is conceived as a historical agent or cultural creator that propels thought and experience forward.

From the pioneering works by Peirce and Cassirer, Mukarovský developed a vision of art with a critical prevalence of communication. For Susanne Langer, art (like many other human activities) is essentially the active termination of a symbolic transformation of experience.

Using this framework as the theoretical foundation, this paper explores the links between art and intentionality (using the seminal sense proposed by Brentano). Two main ideas are deeply developed: Art as a communicative device (which can link and connect art with the global semiotic paradigm mentioned); and Intentionality and Effectiveness in Art (which emphasizes the productive and creative nature of art and its naturalization as an epistemic dynamic human appliance).

Finally, the paper explores an innovative approach to the application of a semiotic framework to the analysis of art. Exemplified by the syntactic reductionism of the informational aesthetics by Bense, or even the symptomatic vision of Goodman, classical studies have focused on what we could describe as the structural aspects of art. By contrast, the well-known ideas of linguistic competence and productivity, and even the perlocutionary effect are the inspiring insights for the notions of aesthetic competence.

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Body, topological deformation, desire

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It is common sense that there are more "desirable" shapes than others, i.e., shapes tied to a heightened activation of specific instances of desire. In human body's case, our time offers a privileged ground for exploring its shape by catalyzing several "modes" of desire; both actually and virtually. Under the apparently inept exploitation of size in Lolo Ferrari's infamous breasts there was a "view" on breast's desirability, severe technical challenges (implying all the body structure to conform to it), skin's elasticity in coping with the deformation,... Videogames software reshapes the body's topology capitalizing it under ideas of form linked to the stimulation of multi-layered processes of desire. What conceptions of desire does this re-writing of the body summons? Is there desire at all, or sheer curiosity towards somehow peculiar cases? Or are we heading to that teleology of excess through shape's transformation that Bataille's eccentric morphology suggested? The *telos* of the body shape and its restructuring by working over its *topos* to unravel unknown faces of the eros seems to be at stake. As the prophetical Vaughn from Ballard's Crash suggested, we're in the process of «*reshaping the human body by modern technology*». But what happens then to the ideas of "good-form", especially if one thinks that these interventions have wide impact on the "social" perception of shapes? Can the mathematics of morphology bring intelligibility to this exploration of the body as plastic material for inscriptions and deformations? Or are we still lacking a mathematical understanding of "affective" perception of shape (where shape's "desirability" would fit into)? But even if «*mathematics is embodied in the graphic*» (R. Thom), the question won't be appeased by a *topology of desire*. Beyond mathematical and ethical questions, perhaps the main point is an ontological one: doesn't shape's "deformation" affect form's *being*? We'll essay a brief reflection linking topology to a wide aesthetical perception of body's shape, under the ideas of function, of design, and of desirability.

When art collides with science

Gülce Sorguç (*Department of Philosophy, Ege University, Turkey*)

In today's world every discipline, every field somehow converges with each other. Thinking solely in a closed, limited area is out of date. For a theorist, this situation is quite intimidating because demolishing the usual categories and building new ones, setting new boundaries is no small matter. Actually the theorist has to be willing to change his own epistemological paradigm. Contrary to expectations, theorists are notably conservative and because of that, attempts to fill the gap between theory and praxis are unable to go beyond fruitless efforts. Since the 90's a new movement makes tremendous impact over the art world: Bio-

Art. The ethical debates aside, to define this field is a big issue on its own. Nowadays in the galleries or artists' ateliers, scientific laboratories are constructed. Artists act like scientists and they exhibit their experiments as works of art. In the meantime, those experiments can also be done by scientists and we call them scientific research. My aim in this presentation is to argue that the boundaries between art and science are diminishing by examining some powerful examples such as Stelarc, Eduard Kac, Tagny Duff, etc. and to contemplate what makes these experiments works of art or scientific research. To accept art as an open concept can be one answer, however that can make this issue more complicated.

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Maps and knowledge
José Braga (*Portugal*)

This presentation reflects a new course in Cartography. Based on the ideas of Peter Sloterdijk, establishes this work aims to establish between cartography and scientific knowledge. Based on some chapters of one of his books (*Palácio de Cristal - Para uma Teoria Filosófica da Globalização*), this presentation supports that the evolution of cartography and the existence of maps of different scales serves as a metaphor for the evolution of knowledge and its obstacles. Sloterdijk uses globalization as a metaphor for omniscience. The process of construction of knowledge corresponds to the decentering of the subject itself and the awareness of the other. The process of surveying the earth and the building of complete image of the world corresponds to absolute knowledge. Globalization as omniscience assumes the role of modern god. Building the image of Earth is seized from the progress of cartography: the evolution of the world map and image that Man builds of the Planet corresponds to the evolution of scientific knowledge. This thesis is sustainable although requiring some attention. It is to be achieved while adding reflections which are deemed important: the author does not take into account how the constructed image will in turn influence knowledge and action. The emotional aspects are neglected. The image is also often handled with a political-religious purpose. This communication is divided into five parts. Beginning with a reflection on what is a map and its significance; moving on to discussing the phases that the author establishes for the evolution of the image of the world and the knowledge and the importance of 'decentralization'.

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Cognitive continuity in Philosophy of Science: situating knowledge without 'deconstructing' it

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The emergence of the embodied cognition research program has shed new light onto human cognition, now increasingly seen as constituted by processes that are (essentially or significantly) *embodied*, environmentally and socially *embedded* (or situated), and *physically extended* (or distributed). While these ideas have been object of intense discussion in philosophy of mind, the various theories of embodied, embedded and extended cognition ('E-Cog' for short) remain mostly ignored in the fields of epistemology and philosophy of science. Following the 'continuum hypothesis' that "*the cognitive practices of scientists are extensions of the kinds of practices humans employ in coping with their physical and social environments and in problem-solving of a more ordinary kind*" (Nersessian 2002), in this paper I explore the prospects of applying the E-Cog framework to a philosophical understanding of scientific practice and knowledge. Recent studies suggest a strong influence of embodied, embedded and extended cognitive processing in tool manipulation and visual learning; these results about ordinary cognition pertain to science as well, particularly (but arguably not exclusively) in the contexts of training with equipment and social interaction. In the less problematic interpretation, E-Cog simply provides a new approach to the format of scientific representation; in the more extreme interpretation, it encompasses the content of representations, such that the claims that scientific knowledge is *socially situated or embedded* revive the threats of relativism and constructivism. Here I argue in favor of the former interpretation, and propose that it does not necessitate the latter. I complement my position with the mathematical 'weighted-feature matching' account of scientific models, according to which the importance of relevant features of a model "*is weighted relative to the goals of the scientific community*" (Weisberg 2013); thus, I articulate an empirically-sensitive cognitive account which includes extraempirical and non-epistemic values in science without making it irrational.

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Genres as boundaries in scientific writing

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The role of text and writing has been fundamental in the development of modern sciences. With the advent of printing technology, their significance has been only enhanced. (Eisenstein, 1980; Frasca-Spada and Jardin 2000) Whereas in history of science and ideas the text has originally been seen as transparent medium for communicating substantive topics, sociology of science has highlighted the practices and interests that intervene in the construction of inscriptions and texts. (Latour, 1987; Gross 2002) Text and language, in this perspective, are no longer a transparent source of substantive ideas, rather, they generate or rather, assert knowledge, most often by the use of tropes, the organization of speech acts in written and oral scientific communication, and the organization of linguistic means in persuasive and narrative forms. (White, 1978; Gross, 2006; Myers 1985) Although they were not necessarily intended for that purpose, such views have also been used to undermine the epistemological distinctiveness of scientific endeavors. The proposed paper will

argue for the possibility of maintaining literary categories in understanding science without giving up entirely the idea of demarcation of scientific knowledge, if both the former and the latter aspects are reinterpreted in terms of social action. In the literary humanities, non-traditional approaches to genres often focus on the topic of significance of genres in scientific and academic practices (Bazerman 1988; Bazerman, Bonini and Figueiredo 2009; Bawarshi and Reiff 2010) Genre-oriented approaches in the research on scientific practices, however, still lack a thorough appreciation of their epistemological implications. Some sociologists suggested that every scientific discipline engages itself in "boundary-work", in other words, it produces its own ideology that effectuate its practical demarcation from other domains of knowledge. (Gieryn 1983, 1999; Lamont and Molnár 2002) Joining these two lines of inquiry would facilitate the understanding of how the essential textuality of science allows for classification of different types of knowledge. The claim shall be illustrated by the example of genre analysis in the notorious „Sokal Affair".

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A universal measure of complexity: approximations and applications

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A central issue in the study of complex systems is the need for universal complexity measures. As many phenomena in science and society are considered complex, and the tools used to study them are frequently the same, the underlying idea is that there should be a common scale to measure the complexity in different domains. But looking at the current literature on complex systems, one observes a spread of tailored measures, that barely work in domains different to those they were defined for. In this presentation we focus on two different fields with a jungle of ad hoc complexity measures: psychology and physics.

Why don't then use a universal measure? There is a robust and mathematically well established measure of complexity: Kolmogorov-Chaitin complexity (K). For any object O, K(O) is defined as the length of the shortest program producing O in some reference universal Turing machine. K(O) gives also a measure of the algorithmic randomness of O. When proposing tailored measures for complexity, authors often argue that K is not computable. It is what one can expect from a universal measure of complexity. But there are good approximations to K. In this presentation we comment two approximations: lossless compression and the Coding Theorem Method. We show the connections of K with Levin's universal distribution and Bennett's logical depth. Finally, we comment the applications of the approximations to K in psychology and physics. In psychology, K provides a universal reference to be compared with human capabilities to generate pseudo-random behavior. In physics, K serves to classify complex networks with independence of their size, connecting with important topological properties. The main purpose of the talk is to defend that algorithmic information theory is a field where scientists and philosophers can connect their interests and work together.

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The "ontological turn" in epistemology as actual political philosophy of the technosciences

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The objectives of this work are to expose the characterization of what we call "ontological turn" in recent epistemology and to argue that the theoretical assumptions underlying such ontological interest shown by some polemic philosophers and sociologists enable, instead of a-critical approaches (such as the ones they are accused for), a renewed philosophy which main focus are technoscientific practices seen as inherently political. On the one hand, we identified a new turn since there have been fundamental changes in the metatheorical interests on science: firstly, with respect to its main object of study; secondly, with respect to which are the processes that the analyst has to pay attention to; and finally, with respect to what the analyst thinks are the final causes of the scientific products and the determinant variables that are part of the scientific practise. Our Ontological Turn's definitory features will be exposed. On the other hand, and on the contrary of what social epistemologists and others propose as the best philosophical position to attend to the political dimensions of the technosciences, the ontological turn implies the reinvention of the Humanism. In fact, it is originally based on the Latour's metaphysics of the "a-Modernity" and on the political implications of the epistemological symmetry thesis of Haraway, among other authors' contributions. In this sense, if, according to the Ontological turn, Science has not any sense free of politics, thus philosophy of science may be redefined. A new political philosophy of technoscience appears then as a necessary enrichment to any public deliberation about science and technology. So, the relevance of the classical epistemological questions will not be denied. This work's intention is to constructively contribute to the debate not only about which is the most appropriate way for doing philosophy of technosciences, but also which could be a good way of looking at the natural, artificial and social world surrounding us.

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Approaching the singularity - Transcending biology from nano to life through engines of creation

Filipe Luig (*Faculty of Sciences and Technologies, New University of Lisbon, Portugal and Escola Superior de Tecnologias da Saúde de Lisboa, and Instituto Português do Sangue e da Transplantação, Portugal*)

To explore the outcome dialectics between biological evolution with the technological progress ultimately resulting in an event dubbed as The Singularity that will arguably transform human society. Scientifically powered through emerging areas as nanotechnology, artificial intelligence and bioelectronics amongst others there are on debate several thoughts arguing its impact would be comparable to other grand milestones of mankind's history (both natural as technological) consisting in a unique evolutionary moment to what we're approaching exponentially. One of the most fascinating angles of this dialectics is the universal dimension of some of its premises and to the paradigms it delivers. The resemblance in the way Information is processed whether on a natural basis in biological evolution via DNA or on an artificial basis processing Data via computation gives rise to a field of unprecedented reflexions: Nature has evolved through millions of years different forms of recombination of Information (atoms-molecules-DNA-cells-organisms-neural networks) only to bare us the capability of processing that same Information in an exponential way through technological tools meanwhile created by man.

a) Can we infer from here that biology served us to carry Information until a more efficient way giving us the means to initiate a substitution process from the more vulnerable cellular format into a more robust digital format?

b) Is it ridicule or absurd to consider the hypothesis that maybe we just evolved from a biochemical form into a physical form in which we could in fact resume the whole Info and data that define us as human beings and in this manner somehow eternalize that same Information?

c) Until what extent is the Event's probability measurable and with what criteria (Moore's Law / Turing's Test / Law of Accelerating Returns)? knowing progress to be inevitable will the Singularity merely be a timing technicality?

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Limits to infinite progress: an environmental reading of techno-science

Bruno Rego (*Faculty of Letters of the University of Lisbon and Center for Climate Change Impacts Adaptation and Modelling, Portugal*)

In spite of the relevant contribution given by the techno-scientific realm to the acceleration of phenomena like climate change and to the loss of the planet's biodiversity, the absolute faith in the techno-scientific rationality is still one of the dominant paradigms of our time. Authors like Peter Diamandis, Byron Reese or Ray Kurzweil take this absolute faith a step further and claim that, in the future, the techno-science will not only address alone and successfully our greatest civilizational challenges (Reese) but will also be able to transcend the limits of the human condition and improve it in unprecedented and infinite ways, into what is known as post-humanity condition (Diamandis and Kurzweil). This is an example of what Victor Ferkiss denominates technological Gnosticism, based on a radical focus on the absence of limits of the scientific work and also on the idea of progress itself.

In this paper, we wish to assert that:

1) The global environmental crisis that we are facing contemporarily is subjecting the techno-scientific realm to a process of reflexivity, that is, of confrontation with the failure of its own models and the disempowerment of the authority and expertise it had in previous stages of modernity;

2) The prospects of technological gnosticists like Diamandis or Kurzweil are based on an unrealistic conception of science and of the idea of progress, in which an anthropocentrism totally disrespectful of nature prevails, and that does not take into account the limits discourse imposed by environmentalism;

3) In order to overcome the environmental challenges ahead, we need a new focus on the modern idea of progress by considering that even progress is subjected to planetary physical boundaries and that it is incompatible with the principles defended by environmental sustainability.

Materialism before physicalism: cultured brains and reductive materialism from Diderot to J. J. C. Smart

Charles T. Wolfe (*Sarton Centre for History of Science, Department of Philosophy and Moral Sciences, Ghent University, Belgium*)

Materialism is the view that everything that is real, is material or is the product of material processes. It tends to take either of two forms: a more 'cosmological' claim about the ultimate nature of the world, and a more specific claim about how mental processes are brain processes. Of course, both seem to indicate a privileged relation between materialism and scientific inquiry – actually, a privileged role for scientific inquiry. In the twentieth century, the science that predominated in this vision was physics. Materialism became synonymous with 'physicalism'; the entities that were considered to be real were those described in the physics of the time. This has spawned some new problems, both for materialism (what happens to an ontology of material entities in the era of quantum physics?) and for ontology in general (is physicalism an ontological claim? A claim about the suppleness of the relation between philosophy and science?). However, here I shall not be concerned with the interrelations and shifts in relation between materialism and physics, but instead with the second species of materialism, regarding minds and brains. In the mid-to-late eighteenth century, the French materialist philosopher Denis Diderot (1713-1784) was one of the first to notice that any self-respecting materialist had to address the question of the status and functional role of the brain, and its relation to our mental, affective, intellectual life. After this the topic grew stale, with repeated, knee-jerk reiterations of 'psychophysical identity' notably by nineteenth-century German scientists (Vogt, Büchner et al.), and equally rigid assertions of anti-materialism. In the 1960s, a group of primarily Australian philosophers took up brain-mind materialism afresh, under the name 'identity theory', i.e., they were arguing that there is an identity between mental processes and cerebral processes (Place 1953, Smart 1963, 2000/2007). They in fact waver in between being brain theorists – with surprisingly little invocation of neuroscientific evidence, as Bickle and Mandik have noted (Bickle and Mandik 1999, 2010, and Faucher and Poirier 2013 for a further reflection on reductionism and Bickle's neurophilosophy) – and metaphysicians bringing the rest of the world into line with physics. If we contrast Diderot's materialism with that of the Australian identity theorists, several notable features emerge, chiefly that Diderot allows for a much more culturally saturated or sedimented sense of the brain, which he describes in his late manuscript the Elements of Physiology as a "book – except it is a book which reads itself"; he also expressed his materialist credo in the form of an experimental philosophical novel, Le Rêve de D'Alembert (1769, unpublished in his lifetime). I have examined elsewhere both the identity theory as an episode in the history of materialism (Wolfe 2006) and Diderot's idiosyncratic form of materialism (Wolfe 2009). Here I suggest a more comparative approach towards key episodes in the articulation of materialist thought from the Enlightenment to the recent 'identity theorists', in order to address some basic questions about the nature of materialism and the extent to which it can allow for a 'cultured', 'social' understanding of the brain (Wolfe 2010).

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Citizenship as factor of the promotion of capital social

Alfreda Cruz (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

This paper aims to fit together in R&D´ perspective the public policy' problematic and the promotion of social capital with the procedure as a positive factor for the development of the Knowledge Society based on the educational and training strategy involved in a socialization oriented through the improvement of research-action methodologies in order to assure the empowerment of a conscious citizenship.

According to that perspective, the main purpose of the Project Social Citizenship in development at CFCUL aims a territorial dissemination of their goals through the implementation of a observatorys´ network   based on the municipalities' adhesion to promote the general participation democratic at the public policies, including the large access at learning and training supported by mediators rightly qualified to all intents and purposes of citizenship.

Individual training is determined by personal motivation and awareness about own project of life related to social participation and after that the mediation is the key of their success because training for empowerment must to take part in consideration at the local policies public.

Finally, the setting up and the training to improve citizens' abilities to manage the use of networks and to understand requirements for developing the citizenship participation in public affairs, must be understood as a Knowledge Society responsibility in the context of the solidarity involved on account of either novelties in progress at the Social Contract.

A social account of science from the year 1667: Thomas Sprat's "The History of the Royal Society"

Jaana Eigi (*Department of Philosophy, University of Tartu, Estonia*)

The growing interest towards the epistemic significance of the social organisation of science has been an important development in the recent philosophy of science. The origins of this interest are usually seen in the work of Thomas Kuhn and the subsequent development of the social studies of science that were perceived as posing a challenge to traditional philosophical approaches to science and required a philosophical response. In the paper, I analyse a much earlier argument for the importance of the social organisation of science—the account developed in the first official history of one of the first modern scientific institutions. Thomas Sprat's "The History of the Royal Society of London" (1667) approached science as an essentially collective enterprise and argued for the crucial importance of its social character for the objectivity and credibility of scientific knowledge. While some researchers have commented on this aspect of Sprat's work (see, e.g., Wood 1980), the modern scholarship has mostly focused on the apologetic function of the book and the political and ideological motivations behind it (see, e. g., Webster 1967; Morgan 2009a and 2009b). In the paper, I suspend the question of the author's motivation and read Sprat's book as a normative account of the social organisation of scientific inquiry. Without assuming a direct connection, I suggest that there can be seen some important similarities between Sprat's argument and some modern philosophical developments, in particular Helen Longino's (1990 and 2002) account of the social nature of objectivity. I suggest that exploring historical precursors of modern social accounts of science can constitute an important task for philosophy of science. Making the perceived view of the development of socially oriented philosophy of science more accurate is important both for the better disciplinary self-understanding and the better understanding of the historical development of science.

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The crisis in economic theory. Shifting to a new paradigm in Economics?

Maria Ângela Dionísio (*Centre for Philosophy of Science of the University of Lisbon & Universidade Europeia, Portugal*)

Economists have failed to predict the financial crisis of 2007-8, they have failed to find a solution and, even worse, they may have contributed to it. However, this crisis represents and reflects a crisis of knowledge and a failure of the economic theory itself. The "good news" is that this crisis provide a perfect justification for fundamental rethinking about economy and society. It is an opportunity to move forward, beyond mainstream thinking. Many researchers argue that contemporary economic models suffer from serious epistemological flaws and they are now engaged in developing alternative approaches, developing methods other than those of mathematical deductivist modeling, trying to address problems related with unrealistic assumptions. Mainstream economics and the "neoclassical benchmark model" is facing growing criticism because it has failed to bridge formalistic-axiomatic deductivist models to the complexity of the real world. Economic systems are fundamentally complex systems and, as such, cannot be understood by reduction and simplification. Heterodox economists reject the classical reductionism in economics and there has been increasing demand for new methods and methodologies, new models and theories to address the systemic complexities of our world. On the other hand, new trends in economic thinking recognize the limits of knowledge and the imperfect knowledge factor in economics.

It seems that a new economic thinking is now emerging. Is there a shift in the economic paradigm? This paper will address this issue by reviewing the Kuhnian and Lakatosian approaches to this fundamental reflection in the economic science.

Keywords: knowledge, paradigm, economic theory, crisis, neoclassical economics.

The public use of applied scientific models

Jens van't Klooster (*University of Antwerp, Belgium*)

Applied scientific models from disciplines such as ecology, economics and sociology are widely used to present controversial policy issues as input to public debates. My talk argues that a conception of applied scientific models as mere neutral arbiters is one-sided. To this aim, I will give a guided tour of the SAFFIER-II model (CPB, 2012) and its us in the Dutch general election. According to a pragmatist account of modeling, the representational success of scientific models cannot be understood in terms of a mere two-place relation between the model and the target system (Giere, 2004; Suarez, 2004; Knuuttila, 2011). Instead, the representational success of a model depends on the purpose for which it is used: A model M successfully represents a target system T relative to a purpose P. In the case of fundamental research, this purpose can be specified in terms of aspects of the target system that a scientist is interested in. Specifying such a purpose in the context of a public debate is more difficult, as I will illustrate by discussing the use of an applied economic model in the Dutch elections of 2012. My focus will be on the representation of a proposed increase of the retirement age. As I will demonstrate by looking into the underlying assumptions of the model and the procedure in which it is used, the question whether the model successfully represent the causal effect of an increase of the retirement age is difficult to answer. The question is difficult because the purpose of learning about the future outcomes of policy decisions does not dictate the variables that the scientist should consider. Without taking up a position regarding a range of other topics, some of which were controversial during the elections, it is not possible to ascribe representational success to the model.

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On dual nature of consciousness and alternative types of thinking

Igor Nevvazhay (*Philosophy Department, Saratov State Law Academy, Russia*)

In my paper I am going to show that both realism and constructivism are insufficiency as the theories of knowledge. I think that the conflict between two points of view – constructivism and realism – reflects fundamental distinction between the given and the created. Both constructivism [Glasersfeld von] and the theory of autopoiesis by Humberto R. Maturana and Francisco J. Varela criticize "the myth of the given" (Wilfrid Sellars) [Maturana&Varela]. But on the other hand representationalism criticizes constructivism because constructivism ignores the fact that objective reality exists irrespective of consciousness. Thus we need to search for another models of knowledge connected with reconsideration the concept of the actually given and revision of beliefs about the nature of consciousness [Nevvazhay]. I discuss two abilities of consciousness – responsiveness and intentionality [Waldenfels], which determine two alternative types of culture of thinking. The first type of culture is a culture of expression, and the second one is a culture of rules. The culture of rules is determined by an attitude to a sign as something conditional concerning its referent. Here the consciousness exists as an intentional act which defines a meaning of a sign. A sign and its usage define its meaning, so the norm is "that exists what is right". It means that what is entered by means of rule it is really. Thus, the consciousness works here as a factory of reality.

In the culture of expression the consciousness is directed at searching for the "right" expression of the already given content. Due to that the external reality becomes an event of our consciousness. Here there is the norm "that is right what exists". My point of view allows understanding legitimacy of claims of alternative ways of thinking in different spheres of scientific knowledge.

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Carnap's reconstruction of theoretical content and structural realism

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The debate on scientific realism has recently devoted growing attention to Carnap's use of Ramsification. This attention is mostly due to the classification of Carnap's contribution as an ante-literam form of Structural Realism (SR). This paper aims to show that such association is misleading and to explore the details and the significance of Carnap's position for the current debate. First, I look at the interest for Carnap's version of Ramsification in the current debate on SR. Psillos (2000) interprets Carnap's views as aiming through Ramsification at a metaphysically neutral third way between realism and instrumentalism. The ones that criticise Carnap's project have hold it flawed because his version of Ramseification is prone to the Newman's Problem (NP) (Demopoulos, 2003; Psillos, 2000). On the other hand, attempts have been made to salvage Carnap's view by arguing that it is not affected by NP (Uebel, 2011). In this context I side with Friedman (2011): NP is a feature of (certain versions) of Ramseification, including Carnap's, but it is a problem for realists and it is not for Carnap. I also agree with Friedman (2011) that Carnap's work on theoretical terms should be seen in the context of his wider program of the Logic of Science. Second, I will clarify the agenda associated with SR. This will show the distance of my view from Friedman's one. Friedman's idea is that Carnap's approach can yield a form of Structuralism without metaphysics. I will show that the viability of Carnap's project depends upon the fulfilment of certain formal requirements. Once that is clarified it will be clear that such requirements have precise consequences that are undesirable for someone pursuing SR's agenda and allow to locate Carnap's work in the context of the current debate.

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Fitch's paradox and anti-realism

Ekaterina Kubyshkina (*Université Paris-1 Panthéon-Sorbonne, IHPST, France*)

Fitch's paradox (or the knowability paradox) is often presented as a challenge for the anti-realism position, as it seems that it refuses one of its basic principles: the knowability principle. This principle tells us that all truths are knowable. The knowability paradox is a

logical result suggesting that, necessarily, if all truths are knowable in principle then all truths are known in fact. But we can raise two questions related to this paradox. Firstly, if the formal way of deducing this paradox is admissible. And secondly, if it is the case, how this result impact on the anti-realism position. In my presentation I'd like to speak about Fitch's argument in the light of the modern critics and to show three lines of protecting the anti-realism position from the paradox: by limitation the knowability principle (or the principle of verificationism); by syntax modifications of the logical system we use to deduce the paradox; and by choosing the right semantic interpretation of the logical system we are working on. I also intend to present in a short way a new logical system, named the logic of a rational agent, my semantic solution of the paradox and to discuss the advantages and disadvantages of this system for anti-realism and also for realism positions.

Can we have an ontological commitment about the internal existential sentences?

Aurélien Tonneau (*Pantheón-Sorbonne University, France*)

An important question that we ask when we are interesting to the debate between realist and antirealist in science is to know if we can have an ontological commitment to certain entities that we postulated in our best scientific theories. Realists think that we can, antirealists think that we cannot. Ney (2012) defends a realistic position in using the Carnap's 1950 distinction between the existential sentences that we can evaluate internally (i.e. sentences that we can evaluated as true in a system with clear syntactic and semantic rules) and the existential sentences that we can evaluate externally. More precisely, Ney (2012: 56) considers that we can have an ontological commitment about entities that we find in existential sentences that we can evaluate internally and that derive from our best scientific theories. I will show that it's wrong and that the interpretation of Ney about the distinction of Carnap (1950) is not good. Indeed, the existential sentences that are evaluated internally are reduced to two types of sentences in Carnap (1950): empirical sentences and logical sentences. In both cases, I will show that this does not mean that we can attach any ontological sense to such existential sentences. Indeed, if they are empirical, then the notion of existence is empirical, scientific and non-metaphysical, because it comes down ultimately to determine the existence of an entity on the basis of an observation considered by definition as evidence for such an existence. In addition, if they are logical, then either the existential sentences are trivial, or they are not trivial. Trivial existential sentences are tautologies. If they are non-trivial, then the existential sentences are either true or false. In both cases, I will show that we cannot make any ontological commitment towards such existential sentences if we are rational, because we cannot consider the truth or falsity of such sentences may depend on the philosophical stance, unlike the existential sentences which we attribute an ontological commitment.

Keywords: Metaontology, scientific realism/antirealism, logical positivism.

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Symposia

S1 | Imagination and diagrams in scientific discovery

Organized by **Ahti-Veikko Pietarinen** (*University of Helsinki & Tallinn University of Technology, Finland*) & **Francesco Bellucci** (*Tallinn University of Technology, Finland*)

Introduction

Einstein famously said, "Imagination is more important than knowledge". In MS 905 written in 1908 Peirce writes: "And thus the whole stage Deduction consists of two sub-stages, the first of logical analysis and the second of mathematical reasoning, which I take to include syllogistic reasoning. I may add that the second is again divisible into what I call corollarial and theorematic reasoning, of which the latter requires the invention of a new icon, or imaginary object diagram, while the former proceeds directly by syllogisms, results of previous logical analyses and mathematically reasoned conclusions." The iconic moment is clearly stated here, as well as the imaginative character of theorematic reasoning. But translating the propositions into a suitable diagram language is also needed: "The word 'diagram'", Peirce held, "is here used in the peculiar sense of a concrete but possibly changing mental image of such a thing as it represents. A drawing or model may be employed to aid the imagination; but the essential thing to be performed is the act of imagining" (MS 616, 1906). This symposium investigates the aspects of scientific reasoning and discovery that seem irreplaceably dependent on understanding the nature of both imagination and diagrams.

Abstracts

Ubiquity of Diagrams: Peirce on diagrammatic reasoning
Francesco Bellucci (*Tallinn University of Technology, Finland*)

This paper explores Peirce's doctrine of diagrammatic reasoning with regard to his famous division of inferences into deduction, induction and abduction. For Peirce all deductive reasoning is diagrammatic. Does this imply that diagrams, while crucial in deductive inferences, play no role in non-deductive ones? I will try to answer this question by reconstructing Peirce's later view on the matter.

Peirce emphasised the role of iconicity in abduction since his early works on the logic of science and types of reasoning (1865-66); each leading principle is irreducible to the others and homogeneous in itself, and each is capable of a semiotic description: hypothesis (later: abduction, retroduction) is iconic, and ampliative reasoning in general requires the introduction of icons. Later (1906-1908) he put the matter differently. Abduction, deduction and induction become now three stages of a unique, general form of reasoning, and abduction and induction become phases or steps of deduction itself: diagrammatic reasoning has its own abductive and inductive phases. But on the other hand, Peirce also thought that, in a sense, induction and *a fortiori* abduction ultimately depend upon deduction. Therefore, diagrammatic reasoning both requires inductive and abductive phases and at the same time constitutes the remote ground of their own validity.

Moreover, diagrammatic deduction presupposes logical analysis. But logical analysis requires an adequate logical notation. Notations can be more or less iconic, and the more iconic a notation is, the more easily analysis is performed. So icons also enter "methoudeutically" into deduction, as instructions as to the construction of good logical notations.

The later theory is richer than the earlier one, and is in part still unexplored. Iconic thinking is for the late Peirce transversal to different processes of discovery; in a way, diagrams are ubiquitous in all reasoning.

New Light from Peirce's Unpublished Works on Retroductive Reasoning
Ahti-Veikko Pietarinen (*University of Helsinki & Tallinn University of Technology, Finland*)

What are the conditions of "facile" and "natural" in the first stage of inquiry in which the logic of retroduction is at work? Retroduction encompasses observation, imagination and guess, and it operates with "visual and muscular experiences" as its material. If these experiences can be rendered diagrammatic, we could get closer to that logic. I look into a number of suggested explanatory conjectures for electricity deriving from the turn of the 20th century that show the workings of the logic of retroduction and its theoric steps. Similar examples are found in the development of Feynman diagrams and in the discovery of the amplituhedron based on twistors.

The second stage, deduction, begins with the "logical analysis", which involves hypostatic abstraction. How does logical analysis, recommended by Peirce to be carried out in existential graphs, relate to the diagrammatic in the first, retroductive, stage of inquiry? I try to make some headway with this. At all events, deduction, which aims at computing the consequences of scientific guesses amenable to comparison with experience, consists of three parts: analysis, corollarial and theorematic reasoning.

S2 | The relevance of Gaston Bachelard's thought today
Organized by **Zbigniew Kotowicz** (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

Introduction

To present a philosopher of science who has been dead for over half a century at a conference that addresses questions of the 21st century needs some justification. The sheer originality of Bachelard's thought as well as his massive influence would to an extent justify such a presentation. In this symposium we will seek to present Bachelard as pertinent for questions that science addresses today.

Abstracts

Never heal ourselves for having dreamed at water's edge

Ana Gaspar (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

This presentation will explore, concentrating principally on the image of water, the possibilities of using Bachelard's meditations on the poetic image in psychoanalytical thought.

Image and visualization in Gaston Bachelard's work: the particular case of atomism

Lídia Queiroz (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

Bachelard assevera, em *As intuições atomísticas*, que "todo um mundo mesclado de imagens e razões estaria (...) já em potência nas primeiras doutrinas do atomismo". Da metafísica da poeira ao atomismo axiomático, característico da contemporaneidade, o autor acompanha o homem "a caminho de um conhecimento do impalpável e do invisível".
O átomo não é uma coisa e também não é uma imagem. No entanto, reconhece Bachelard, "não nos parece que se possa compreender o átomo da física moderna sem evocar a história das suas imagens, sem retomar as formas realistas e as formas racionais (...). (...) o átomo é exactamente a soma das críticas a que se submete a sua imagem primeira".
Conforme afirma Max Planck, "a actual cosmovisão científica oferece um aspecto estranho e realmente insólito. (...) Ver, ouvir e tocar não desempenham nela nenhum papel" (in *Autobiografia científica e últimos escritos*).
Nesta comunicação, exploraremos a questão da visualização do invisível da matéria e o paradoxo da utilidade das imagens a partir de diversas obras de Gaston Bachelard.

The relevance of Bachelard for today's philosophy of science

Zbigniew Kotowicz (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

Abstract not available

S3 | Causal Powers and Relational Ontology

Organized by **Rani Lill Anjum** (*Universitetet for miljø- og biovitenskap, Norway*)

Abstracts

Causation, Tendency, and Dispositional Ontology

Rani Lill Anjum (*Universitetet for miljø- og biovitenskap, Norway*)

In the book, *Getting Causes from Powers* (OUP 2011), we develop a theory of causation based on an ontology of dispositions or causal powers. In this talk I will present the main idea of

this theory and show how it differs from the standard two event model of David Hume. In particular I will argue that causation is a primitive notion that cannot be reductively analysed into some other notions, such as Hume's constant conjunction, temporal priority and contiguity.

The theory of causation that will be defended is called causal dispositionalism. It includes a *sui generis* modality of tendency rather than necessitation. Essential for causation on this conception, it will be argued, is that any causal process can be counteracted and interfered with. Other essential features is complexity, context-sensitivity, compositional pluralism and simultaneity.

Compositional pluralism, Emergence, and Relational Ontology
Gil C. Santos (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

I propose to discuss the 'compositional pluralism' advocated by Mumford and Anjum in their book, *Getting Causes from Powers* (chapter four, "Reductionism, Holism and Emergence"), focusing particularly on strong emergence as a mode of composition of causes.

I will defend that strong (ontological) emergence should be distinguished from cases of mere epistemological complexity (weak emergence). Furthermore, I will argue that from an ontological point of view, only strong emergence differs from the atomistic principle of additive composition of causes.

Furthermore, I will argue that ontological emergence, and therefore any ontology of powers able to account for ontological emergence, can only be founded on a 'constructivist relational ontology', as opposed both to atomism and to holism (Santos, 2013). In this sense, the existence, the identity and the behavior or causal role of each entity (a thing, a property, etc.) are always to be conceived as constructed by specific systems of qualitatively transformative relations, that is, as generated by specific relational contexts, and not as deterministic, self-sufficient and *a priori* essences.

Santos, G. (2013). Ontological Emergence: how is that possible? Towards a Constructivist Relational Ontology. *Kairos*, Special Issue (1): Emergence and Non-Fundamentalist Metaphysics (forthcoming).

Relational Ontology and Contemporary Physics at the Quantum Level
João Cordovil (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

I will analyze the metaphysical premises and consequences of three recent approaches in Physics – Quantum Gravity, Nonlinear Quantum Physics, and Quantum Field Theory – from an ontological point of view, and in the light of the debate about realism.

Through this analysis, I will defend that those three approaches are best viewed from the point of view of a relational ontology, against any atomistic or holistic perspective, according to which the ontological primacy is not to be given to individual entities, as self-

sufficient elements with their own intrinsic and immutable identities, nor to structures, as self-imposed entities that come into existence in an unexplainable way, but to relations themselves. In this sense, structures are born as complex and mutable networks of relations, and the individuals are entities whose identities and behaviors are qualitatively transformed by their very relations.

Finally, I will try to show how Quantum Gravity, Nonlinear Quantum Physics, and Quantum Field Theory, as well their ontological meanings, can be equated in the context of the debate about Structural Realism.

S4| Understanding and conserving biodiversity

Organized by **Elena Casetta** (*CFCUL, Portugal / LabOnt, Italy*)

Introdution

Since the coinage of the term 'biodiversity' in 1986, the biodiversity crisis has become a top priority of the societal agenda, and it is becoming one of the main concerns for governments, decision makers, and the general public. Conservation of biodiversity has rapidly become the center of numerous international political treaties and studies, amongst which there are: the 1992 Convention on Biological Diversity (as well as the related Cartagena Protocol on Biosafety); the titanic effort of the Millennium Ecosystem Assessment, released in 2005; and finally, the UN declared the period from 2011 to 2020 the UN-Decade on Biodiversity. In spite of all the attention devoted to the subject, the tools to manage the biodiversity crisis are far from obvious and clairvoyant. Better policies are required, as witnessed by the failure of the 2010 Biodiversity Target "to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level" to which the Parties of the Convention on Biological Diversity committed themselves in 2002. In order to achieve more effective conservation policies, we argue that what is required is a deeper understanding of what biodiversity is, why it is valuable, how it is produced, and which types of evolutionary mechanisms and natural laws are in play. The proposed symposium unites scientists and philosophers, and aims at providing guidelines in that direction. In particular, the symposium will address three main topics. First, we look into the nature of extinction and the evolutionary and natural processes that cause loss in biodiversity, giving a special emphasis to climate change and the influence it can have on a species' ecological niche, and phylogenetic and ontogenetic mechanisms that sometimes prohibit species to remain adaptive to their environment. Secondly, we address the patterns of biodiversity: does species diversity (meaning the number of species and their relative abundance) change in predictable ways when we increase the size of the area sampled and, if so, how can we use this knowledge to address species conservation and, in particular, reduce species extinction risk? Finally, we will tackle the relation between ethical theories on species on the one hand, and the target of conservation policies on the other, focusing, in particular on the difference between species-centered and habitat-centered approaches to biodiversity conservation.

Natural and Evolutionary Causes for Species Extinction

Nathalie Gontier (*Director AppEEL-The Applied Evolutionary Epistemology Lab, Center for Philosophy of Science, University of Lisbon; Post-Doctoral Researcher FCT*)

The majority of multicellular life forms as we know them evolved in the Cambrian, in a period designated as the Cambrian Explosion. It is during this period in time that the major eukaryotic phyla or "body plans" evolved. Soon after the Cambrian explosion, there was a rapid extinction phase (a real decimation) in the amount of phyla that had evolved, but at the same time, the number of genera and species within the surviving phyla diversified and increased, causing the biodiversity as we know it today. Nonetheless, during certain time periods, entire species and genera go extinct. In this talk we look at the natural and evolutionary causes that explain species extinction, and special emphasis will be given to (1) climate change and the influence it can have on a species' ecological niche; and (2) phylogenetic and ontogenetic mechanisms that sometimes prohibit species to remain adaptive to their environment.

Patterns of Biodiversity from Local to Global Scales

Luís Borda-de-Água (*Post-Doctoral Researcher, CBA-Center for Environmental Biology, University of Lisbon, Portugal*)

Species richness is not equally distributed on Earth, equatorial regions are the richest and richness decreases when one moves towards the poles. This is a pattern at global scales. However, there are also patterns at smaller spatial scales. The most renown one is the species-area relationship: the number of species increases when the area sampled increases. Probably even more remarkably, the number of species increases with area as a power law with exponent smaller than one, meaning that the rate of increase in the number of species slows when are increases; a pattern that has been often used (and misused) in conservation studies. Diversity, however, is not only species richness, the relative abundance of species is another component.. Are there similar patterns to the species abundance distribution similar to those observed to the species richness? The answer is "yes". Small samples exhibit a monotonically species abundance distribution, well described by a logseries, and larger samples exhibit a distribution with bump for intermediate abundance classes, and is usually described by a lognormal like distribution. Although, the species abundance distributions have different shapes depending on the scale of analysis, we have recently uncover a pattern related to the spatial scaling of the moments. Here we will discuss the importance of this new pattern, as well as, the importance of patterns in general to theoretical and applied work in ecology.

From Ethics to Policies: US Endangered Species Acts and EU Natura 2000

Elena Casetta (*Post-Doctoral Researcher FCT, CFCUL - Center for Philosophy of Science, University of Lisbon*) & **Jorge Marques da Silva** (*Assistant Professor, Department of Plant Biology - Center for Biodiversity, Functional and Integrative Genomics, University of Lisbon*)

Two macroevolutionary phenomena—radiation and extinction—have governed the increasing and decreasing of biodiversity in evolutionary timescale. This talk focuses on extinction, and in particular on the relation between the ethical theories on species value and the policies on species conservation aimed at facing the new mass extinction we could be entering, the first involving our own species as primary cause. Comparing the US Endangered Species Acts and the EU Habitats Directive, we would like to explore the hypothesis that two different views on biodiversity value underlie the two policies, resulting in two different conservation approaches.

S5| "Science" and "Control" in the 21st century. Critical approaches towards techniques, technologies and "enhancements" of the mind

Organized by **Alexander Gerner** (*CFCUL, Portugal*)

Introduction

"Science" and "Control" in the 21st century. Critical approaches towards techniques, technologies and "enhancements" of the mind questions the fundamental role the concept of *control* has in science in the 21st century, especially in the mind sciences.

The importance of the concept of *control* in techniques and technologies seem obvious since the introduction of the science of *cybernetics*, in which a controller navigates by manipulating the inputs to a system to obtain the desired effect on the output of the system changing within a feedback loop, be it a machine or a living system (Von Neumann, Wiener, Shanon). In the beginning of the 21st century we seem far away from a *science of self-governance* as proposed in Plato's Alchibiades influenced today by continually evolving information and communication technologies (ICTs) that seem to invade nearly every aspect of our contemporary human practices, political and social innovations, thus making explicit the importance of cybernetic issues of control. The classic enlightenment ideal how to apply science and technology to enable us to live a better or even an enhanced experience of life for the good of society, nowadays seems to change in direction to the following issue: How does science and technology give *a few* a better control/grip or more security of government at hand over *the many* in situations such as illnesses, accidents, war/aggression; political or financial crisis. The art of securing efficient and economic operations applied to all human endeavors poses the following questions:

- Until which limit can or should science and technology help us control the unexpected, exclude the undesired, or control the 'other'?
- Is the cybernetic control paradigm of the 20th century actually desired inside the social and individual human realm in the 21st century?
- On which technological level of complexity is "control" actually achievable?
- What is the relation of 'uncertainty' and 'control' in mind technologies and scientific "enhancements" in the 21century?
- What consequence does an amplified and intensified cybernetic control concept have on the production of subjectivity, and its social, political legal consequences?
- Should we enhance artificial agent's intelligence (beyond human (intelligent) control)?
- What should we expect from the relation of 'wisdom' and 'control' in the mind-sciences in the 21century?
- How does science and technology lead to control mechanisms that do/don´t empower self-autonomy or enhance the desired richness of our experience as by training (Sloterdik 2013) leading for instance to the "hyperproletarization" of the majority (Stiegler) rather than to an general "enhanced" species?

In a pilot study in 2013 at the University of Washington in which the "direct communication" of one brain to another is tested, the challenge was how the "brain of the other" can be controlled. In which sense are these inter-brain computational "communication" studies (Rajesh/Rao 2013), not simply remote control studies that question fundamentally individual personhood, autonomy and justice? What is their military purpose?

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Abstracts

Eternal Sunshine in 'spotted minds'? On the enhancement of forgetting and optogenetic control mechanisms

Alexander Gerner (*CFCUL, Portugal*)

Will we have a *right to forget* by the end of the 21st century as part of a value of *cognitive liberty* (Boire 2000; Sententia 2004; Bublitz 2013) based on a mind science & braintechnologies of technically enhanced forgetting?

What is cognitive liberty other than the right to mental self determination that is to obtain control over one´s own consciousness, the right to think for her/himself in a not interfered way, choosing what I myself want to belief, to choose what to think and what not to think, to direct one´s own brain´s underlying mental processes or capacities as I wish- if not harming others as in *crimes against minds (Bubitz/Merkel 2012)*- to attend to and to reason about and to remember, and equally important: to *change one´s mind* (Bublitz 2013) including to delete what I decide to discard, to forget. In the biocybernetics and "brain politics"(Blank 2013) of the 21st century should we consider as well a right to forget, the right to step outside of pre-controlled feedback loops? May one of our future values be the possi-

bility and mental liberty of even becoming a *mnemonic "idiot"*, disconnected from memory/storage?

In the debate on storage and big data we come across arguments on why to store information about x means to have power over x, to control or use x, and that we thus should be able to restrict this power of interfering parties over personal private data storage: but what about the idea depicted in Michel Gondry's movie "Eternal Sunshine of the spotless mind" in which two people that have had a difficult love relation, decide to call for professional technological help in order to forget one the other while all their friends get the notification of erasure."*Clementine Kruczynski has had Joel Barish erased from her memory. Please never mention their relationship to her again. Thank you.*" Should we, if we could, grant this will -in mutual consent(?)- in making one another forget each other?

This science fiction plot seems less fiction than we might think it is: The possibility of a mind science and technology of forgetting seems announced by a 21century neuroscientific interventive technology: Optogenetics.

"*Optogenetic technology combines genetic targeting of specific neurons or proteins with optical technology for imaging or control of the targets within intact, living neural circuits.*"(Deisseroth et al 2006). Optogenetic methods are a powerful toolkit not just for „*performing causal studies on the roles of specific genes and cells within functioning neural circuitry*"(ibid). They are as well therapeutically "*explored as components of prototype neural control prosthetics capable of correcting neural circuit computations that have gone awry in brain disorders*"(Boyden 2011). Even beyond these two applications of optogenetics as in basic neuroscientific research or medical treatment- optogenetic methods may be candidates to be used for the manipulation and enhancement of certain brain mechanisms, functions or individual´s capacities such as memory or forgetting. Thus neurotechnologies in relation to a variety of brain interventions (Müller/Clausen/Maio 2009) in our case optogenetics (Boyden 2011) can be seen as technically induced enhancement tools, that have been already tested in relation to memory /forgetting (Liu 2012) and even the implantation of artificial "fear memories" in mice (Ramirez 2013). This talk will critically survey optogenetic control mechanisms, in which neural activity is "*driven or silenced by light*" (Boyden 2011) and ask: What consequences would an amplified and intensified application of optogenetic control tools in the human realm have on the future production of subjectivity, and its social, political or legal consequences, specially in relation to an technologically induced "enhancement of forgetting"?

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Minds of Our Own. Exploring the final boundaries of privacy

Sean A. Hays (*Centre for the Study of the Sciences and the Humanities, University of Bergen, Norway*)

This paper explores recent development in brain-machine communication, and brain-to-brain communication. The exemplary research projects analyzed are all DARPA funded for military use. It takes up the issue of privacy and security in what remains, for now, the last truly secure data storage site, the human brain.

Technics of Debt as Control Mechanism. New forms of the production of subjectivity by economic politics

Nuno Nabais (*CFCUL, Portugal*)

As M.Lazzarato underlines "debt represents an economic relationship inseparable from the production of the debtor subject and his "morality." The debt economy combines "work on the self" and labor, in its classical sense, such that "ethics" and economics function conjointly." (Lazzarato, 2012) . In what extend is the economic technology of debt the primordial ground for all technological production of the self? This is the biggest opposition between two actual traditions in reading Nietzsche's understanding of anthropotechnics: the biopolitical (Sloterdijk and Agamben) and the economic political (Negri and Stiegler). The first tradition approaches the "work on the self" analyzing those humans who engage expressly in practice that embody their mode of existence by training plans and peak performances, exercises that are necessary to become, and remain, a human being. The second one is inspired by the second essay from Nietzsche's Genealogy of Morals, where the origin of the self is discovered in a debt relationship. We want to clarify those two traditions, in order to understand the nature of technological control in economy.

S6 | New realism: ontology and epistemology

Organized by **Mario de Caro** (*University of Roma 3, Italy / Tufts University, Mass., USA*) and **Maurizio Ferraris** (*LabOnt, University of Turin, Italy*)

Introduction

Scientific realists buy into a positive epistemic attitude towards the output of our scientific theories. According to them the world and entities exist objectively and are external to, and independent of, us: world «is not constituted by our epistemic values, by our capacity to refer to it, by the synthesizing power of the mind, by our imposition of concepts, theories or languages» (Devitt, *Realism and Truth*, Princeton University Press, 1991, p. 15).

Postmodernist philosophers such as Michel Foucault and Jacques Derrida and sociologists such as Bruno Latour, claiming that the external world is somehow, in different ways and to different extents, constructed by means of our theories, conceptual schemes, and cognitive activities at large, promote quite a different view towards the content of our scientific theories. Interpretations tend to replace facts, and scientific theories to become narratives in the same way as literary works. In such a scenario, what would be the role of science, and what its value? And what would make our beliefs justified? The dangerous consequence of such an attitude – whose apotheosis is the very popular Nietzsche's quote according to which «There are no facts, only interpretations» – is to demote science to a «mere cognitive style.» (Bereiter, "Implications of Postmodernism for Science, or, Science as Progressive Discourse", *Educational Psychologist* 29(1), p. 3)

Against postmodernism, philosophical realism is becoming ever more fashionable, on both continental and analytic tradition. On the analytic side, at today the situation is very different from what it was in the heyday of Feyerabend, Goodman, Davidson, Kuhn, Dummett, van Fraassen, and Hacking – as is shown by the growth of analytical metaphysics and of alternatives to anti-realism in semantics and philosophy of science. On the continental side, a New Realism is manifesting itself, contending that postmodernists' mistake was to confuse ontology with epistemology, what there is with what we know about what there is. The philosophical landscape is now polarized between the (mostly analytic) view according to which only natural science can tell us what really exists and another (mostly Continental) view according to which only an anti-naturalistic stance can do justice to socio-political phenomena.

The aim of this symposium is to reflect on this twofold scenario.

Abstracts

Realism and Liberal Naturalism
Mario De Caro (*Università Roma Tre, Italy/Tufts University, Mass., USA*)

Nowadays we are faced with a dual, complementary one-sidedness. On the one hand, common sense realism takes very seriously the beings and properties of our everyday life but tends to do so to the detriment of the unobservable entities of science, which are downgraded to useful fictions. On the other hand, scientific realism, only accepting scientific ontology, tends to dismiss the foundation of the world of common sense. The unsatisfactory side of these two views lies in their respective negative components, which are dictated by the relative ideological one-sidedness. But why should it be impossible to reconcile the positive components of common sense realism and scientific realism, getting rid of their negative components, in order to conceive of an inclusive reality in which both the ordinary world and that of microphysics *truly* exist? A liberal form of philosophical naturalism seems, in this sense, very promising, as I will argue in this talk.

Can a Doctor Be an Antirealist?
Maurizio Ferraris (*University of Turin / LabOnt, Italy*)

Today it is clear—much clearer than it was in the last century—that not everything that is true is scientific, especially if by 'science' we mean physics: we are perfectly willing to admit that our current knowledge of physics may change, and that some of the laws we know will turn out to be false, while it will remain true until the end of time that Madame Bovary was called 'Emma' and that there is no colour that does not have an extension. At the same time, again if by 'science' we mean physics, it is not obvious that science systematically plays a foundational role, more important than any other practice or knowledge, in our lives. Things are different if we refer to a science generally neglected by philosophers, namely medicine: if a community of Ptolemaics can have the same laws as a community of Copernicans, it is very likely that a community convinced of the harmfulness of smoking should draw political consequences from this.

Fictional Entities, Theoretical Models and Figurative Truth
Manuel García-Carpintero (*Departament de Lògica, Història i Filosofia de la Ciència / LOGOS, Universitat de Barcelona*)

I will examine two parallel cases for which a fictionalist treatment is arguably defensible: the case of explicit reference to, and quantification over, fictional characters; and the case of reference to imaginary models in science and their components, frictionless planes and the rest. I will argue that an anti-realist, fictionalist reading of statements explicitly referring to fictional characters is more adequate than realist proposals. In parallel, I will be contrasting the fictionalist proposal about fictional characters with a similar view about the models and

their components that many scientific theories appeal to, arguing also for a fictionalist view about them.

Are Gender and Race Social Constructs? Some Arguments for and Against
Teresa Marques (*Centro de Filosofia da Universidade de Lisboa, Faculdade de Letras / LOGOS, Universitat de Barcelona*)

It is widely agreed that certain categories—such as, typically, gender and race—are social constructs rather than "real" natural joints. There are different ways to understand social constructivism, but a plausible distinction is that made between causal and constitutive social constructivism. Causal constructivism is a thesis about there being *social causes* for the existence of certain types, facts or properties of individuals or groups; constitutive constructivism is a thesis about certain types, facts or properties of individuals being *constitutively social*. Constructivism is usually seen as an anti-essentialist position, but whether or not this is so may depend on which kind of constructivism is held. In this talk, I'll review some arguments for the social construction of gender and race, and some arguments against the social construction of gender and race. I will try to assess some of the practical consequences of endorsing causal constructivism vs. constitutive constructivism.

S7 | Territories/Diagrams of omitted knowledge
Organized by **Andrej Mircev** (*Art Academy Osijek, Croatia*)

Introduction

Using and performing diagrams as a tool for cross-disciplinary research on the convergence of different media the panel will demonstrate a specific methodology that generates new knowledge and situates it in a discourse beyond the impasses of a dualistic thinking where categories such as: theory/practice, science/art, ratio/emotion, time/space are reified and separated by an unbridgable gap. What is achieved is a movement towards the in-between, which, by dismantling hierarchies, re-affirming realms of omitted and supressed knowledge opens up points of intersection for science and art. Outlining new territories of potentiality, the panel aims not to reproduce and represent certain concepts of knowledge, but to outline a discourse that is fluid, reflexive and unfinished.

Abstracts

Diagrammatic performance of images
Andrej Mircev (*Art Academy Osijek, Croatia*)

This talk exemplifies a pedagogical strategy, which deploys images, diagrams and maps as tools for critical thinking about a regime of spatiality, located between the archive, education and an art event. During the course in *Theory of Space and Modelling*, held at the Art academy (Osijek, Croatia), my students created an artistic intervention out of slides, films, maps and various paraphernalia for protection against nuclear attacks from the times of Yugoslavia. The work generated a complex territory of images juxtaposed with restaged images, performed by in public space. The talk is intented to analyze this experimental use of images, diagrams and maps in education, outlining a relational, topological approach to visual/spatial theory

Rudolph Laban: diagramming dance between science and art
Paola Crespi

For the sake of this presentation I will focus on what I call Rudolph Laban's diagrammatic approach to dance. Besides his notation, as documents in the NRCD in Surrey (UK) testify, Laban was working with diagrammatic inscriptions in a variety of ways and his methodology may also be seen as 'diagrammatic'. Recent interest in diagrams spans from the analytic to the continental philosophical traditions and functions, therefore, as a point of connection, intended both in a dualistic and non-dualistic or immanent way. Looking at Laban's diagrammatics, I will propose, shows ways in which science can meet art or, rather, how art and science differ in degree and not in kind.

S8| The many faces of artificial societies: natural, artificial, and alternate reality

Organized by **Porfírio Silva** (*Institute of Systems and Robotics, University of Lisbon, Portugal*)

Introduction

Three presentations will explore, from different theoretical standpoints, different dimensions (challenges and opportunities) of the scenario of "artificial societies" (where a significant number of machines are interspersed in our social interactions and they regularly are taken as intentional agents).

Abstracts

Between Realities
Patrícia Gouveia (*Lisbon*)

This presentation will focus on Alternate Reality Games (ARG's) and Urban & Serious Play (USP) to inquire the way humans can play in a mediated space, half real, half digital (online

and offline). Digital games and networks can help us to change reality and generate concrete changes in social environments. This presentation aims to research the application of playful techniques and spaces to address the challenges of our present world. These gaming experiences can be useful to engage players in solving real world questions. Focusing on research from Jane McGonigal (2011), Sherry Turkle (2011), Jesper Juul (2010; 2013), Mary Flanagan (2009) and Edward Castronova (2005), as well as classical authors such as Henri Bergson, Marshall McLuhan, Susan Sontag, Hal Foster, among others, this presentation will debate why digital games and playful environments can solve real world problems.

Artificial Life and Synthetic Biology
Rodrigo Ventura (*Lisbon*)

It was in the late 1980's that the Artificial Life expression was coined by Langton (1986) and the first artifacts were proposed. If these artifacts can or cannot be called "life" is a question that I will not discuss in this presentation. Rather, I'll focus on two issues. First, on a brief overview of these realizations (software and hardware). And second, on the advent of synthetic biology – the design and construction of biological devices from organic materials – that opened the door to the engineering of life forms made of materials indistinguishable from natural life as we know it (Andrianantoandro et al, 2006). Two relevant advances of this endeavor were Synthia, the first synthetic organism by a team led by Venter (Gibson et al, 2010), and the BioBrick initiative (Knight, 2003), opening the door for a large community of students and researchers to engineer synthetic life forms from LEGO-like standard parts.

Humans, Machines and Fungibility
Porfírio Silva (*Lisbon*)

The wider context of a research on "artificial societies" is the on-going "metamorphosis of objects", a scenario of natural and artificial creatures building unprecedented relations of sociability based on a huge network of "smart things" (Uckelmann et al. 2011). Some sociological and philosophical debates of recent decades are important to understand this scenario. For example, Latour erases classical distinctions between the sociality of humans and of other entities, claiming for a "symmetrical anthropology" (Latour, 2007; 2005). Based on our previous research on artificial societies, we will consider how different lines of research in robotics may contribute to such a scenario. In order to address the issue of the relationship between subjects and objects within "artificial societies" we will focus specifically on the problem of fungibility and we will propose to frame it by certain aspects of the thought of the Japanese philosopher Watsuji Tetsurō (1889-1960).

S9 | On the indispensability of visual information in science
Organized by **Nicola Mößner** (*RWTH Aachen University, Germany*)

Introduction

In 2012 the community of particle physicists was excited about the CERN announcement that most probably the Higgs Boson was detected at the LHC (Large Hadron Collider). The announcement of this event was accompanied by, at least, four recurring image types: There were the diagrams showing the important data peak of the experimental measurement at around 125 GeV, the theoretically predicted value. Computer graphics of the particle collision were distributed and photographs of the collider, likewise a comic strip explaining the Higgs mechanism via an easily understandable analogy. Visualisations such as these are an essential part of our current scientific practices not only in particle physics. Scientists include them in their presentations and publications and in quite a few cases the outputs of measurement processes are computer graphics or diagrams, just as the detection of the Higgs Boson illustrates.

The question that we will consider then is what the *epistemic status* of these visual representations in science may be. Obviously, there are at least three possible approaches: Firstly, we could deny that visualisations play any epistemic role whatsoever. Explaining their integration in scientific communication would then amount to the thesis that they are mere *decorations*, added maybe for psychological purposes only such as attracting attention (see Carney and Levin 2002). Secondly, we could take a more moderate stance and admit that visual representations in science serve important *heuristic means*. Integrating them into communicative acts allows arranging complex data in a comprehensible way, highlighting the essentials and presenting all the relevant details at first glance (see Kulvicki 2010). Thirdly, we could defend the more controversial thesis that (at least some) visual representations are *indispensable* in scientific publications and presentations as they can make accessible certain information which cannot be transmitted otherwise (see e.g. Elkins 1998).

The first alternative can relatively easily be dismissed by pointing to the growing literature on the epistemic value of scientific images (see e.g. Baigrie (ed.) 1996, Frigg and Hunter (eds.) 2010, Gross and Louson (eds.) 2012, Mosley (ed.) 2007). Thus, next to being eye catchers, they apparently fulfil further more important tasks. The question, however, remains what exactly their status in science might be.

In this context, we will defend the thesis that visual representations can be used both as heuristics and as indispensable sources of information. Obviously, the choice between these alternatives is deeply intertwined with the question about the translatability of information presented in different representational formats (numerical, linguistic, and pictorial). Is it e.g. possible to fully translate verbal information into pictorial and vice versa? What about the Fregean puzzle that images cannot express propositions? We will be especially concerned with the question of an assumed indispensability of visual representations, inquiring about the possibility whether there is any kind of information that can be transmitted in the visual format only. The aim of this symposium is to approach the topic from different angles, thereby also paying respect to the diversity of knowledge seeking and distributing practices in science.

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Abstracts

Our graphic minds
Patrick Maynard (*University of Western Ontario, London, Ontario, Canada*)

Abstracts not available

Visual variety: why do scientists use so many different kinds of figures?"
Laura Perini (*Pomona College, Claremont, USA*)

Abstracts not available

Visual information and scientific understanding
Nicola Mößner (*RWTH Aachen University, Aachen, Germany*)

Abstracts not available

Diagramming: connecting cognitive systems to reason
Valeria Giardino (*Institut Jean Nicod, Paris, France*)

Abstracts not available

S10| New philosophical and scientific issues in the life sciences: the 'revolution' of epigenetic in our representation of living beings

Organized by **Luciano Boi** (*Centre de Mathématiques, EHESS, Paris, France*)

Abstracts

Epigenetics mechanisms in biological systems
Paul-Antoine Miquel (*Université de Toulouse Le Mirail 2, France*)

This presentation will focus on two examples of multilevel explanation, in which epigenetic regulations are also involved: aging and the chromatin structure.

Yet, what we will emphasize is not epigenetic mechanisms of regulation, but how they are involved, as mere elements, in a more complex and circular causal structure. We will try to understand how, in such a structure, there are not only interactions of objects, but also interactions of levels.

We will show, that through such interactions, physical and topological parameters play not only a structural, but also a functional role in biological systems. And we will ask the following question: how such extensive physical properties can be epistemologically characterised?

From gentics to epigenetic and beyond
Luciano Boi (*EHESS-Centre de Mathématiques-Equipe Mésologiques*)

In a post-genomic era, the importance of epigenetics has become increasingly apparent. Its definition is constantly evolving to encompass the many phenomena that cannot be accounted for by the simple genetic (DNA) code, and the term now refers to extra layers of instructions, informations, processes and meanings (especially related to the cellular, organismal and environmental layers) that influences genes expression and cells activity without altering the DNA sequence. In this context, the chromatin-chromosome/ epigenetics/ environment interface is one of the foremost frontiers of recent research in biology. Philosophically, we are thus in the need of a deep and global rethinking of some fundamental concepts like "gene code", "molecular mechanism" and "genetic information".

At least, they require to be supplemented by the concepts, respectively, of "histone code", "multilevel regulatory mechanims" and "epigenetic information".

It appears that the chromosme and the organism itself are the true carriers of biological information and meaning. Thus, a new, deeper and larger definition of the "living systems" has to be carried out.

On the notion of person, from the biological and ethical points of views

Flavio Keller (*Università Campus Bio-Medico, Roma, Italy*)

Abstract not available

S11| Science, Ethics and Bioethics: myth and reality

Organized by **António Barbosa** (*Centre for Bioethics, Faculty of Medicine of the University of Lisbon & Centre for Philosophy of Science of the University of Lisbon*)

Abstracts

Bioethics and Epistemology

António Barbosa (*Centre for Bioethics, Faculty of Medicine of the University of Lisbon & Centre for Philosophy of Science of the University of Lisbon*)

The possibilities of a moral epistemology are questioned which allows to distinguish true and false ethical statements and rely on instruments indispensable to form valid judgments about prescriptions and actions. We describe new theoretical approaches and more comprehensive methods than the current principlist bioethics posture, enabling more appropriate responses to current problems and expanding the conceptual horizon using methods that facilitate an understanding of everyday ethical issues.

Therapeutic myths and informed consent.

Fernando Martins do Vale (*Faculty of Medicine of the University of Lisbon*)

History of Science is a cemetery of false theories and errors, but also of a list of scientific progress obtained by the correction of errors, as Popper said. What distinguishes science from pseudoscience is not the absence of errors, but the Science capacity of auto-analysis, with transparent diagnosis of errors and their causative bias factors, trying their elimination by the rigorous scientific method.

The recognition of errors implies the critical Cartesian doubt with its uncomfortable insecurity, which is well reflected in Osler aphorism "Medicine is the Science of uncertainty and the Art of probability". The evolution of Medicine from a paternalistic pattern to a participative model, with an increasing empowerment of patients, implies the transparent disclosure to patients of facts, including uncertainties and adverse effects of treatments, because autonomy demands trustworthy information to do wise informed choices.

The success of modern medicines (antibiotics, insulin, etc) has increased life expectation/quality, but many disastrous cases (thalidomide and others) must also be remembered to implement rigorous regulatory measures (actually applied to medical therapies) to avoid their repetition. Informed risks of medicines are uncomfortable for many patients that prefer the virtual security of myths like those offered by "miraculous medicines or therapies".

Alternative Therapies (Homeopathy, Herbal medicines) have very permissive regulations, but they should be subjected to the same rigorous regulations as Medicine and pharmaceutical products, because is the only way to obtain trustworthy information to do informed choices, and because traditional therapeutic use does not eliminate errors, as demonstrated by History of Medicine's ghosts (bleedings/purges).

The binominal vision-brain
Joaquim Monteiro

Vision seems so effortless that we take it for granted. Images seem easy to deal with and are used as powerful symbols in society. However the visual process is complex and what we see isn't always what we get.

Visual processing involves distinct brain areas: information about color and movement is processed in different cortical areas and binocular vision implies complex biologic and psychological components.

The brain is constantly interpreting and correcting the visual input from the eyes. Visual illusions deceive the brain into incorrectly perceiving something that is present or that does not exist.

Visual illusion is a brain construction that reveals the limits of visual perception and can be used to understand normal vision by illustrating organizational mechanisms.

Neuroimaging and cognitive neuroscience are improving the understanding of the binominal vision-brain and showing that vision emerges from the collaboration of different areas in the brain.

Beyond the cultural myopia: the challenge of bioethical imagination
Tatiana Marques

In the second half of the 20th century, the consolidation of the interdisciplinary field of bioethics both in Europe and in the United States of America was accompanied by strong criticisms coming from the social sciences that have persisted and been reconfigured ever since. This presentation begins with a discussion of an important criticism formulated by Renee Fox and Judith Swazey (1984) about the «cultural myopia» of bioethical thinking that generally manifests itself in the form of a systematic inattention to their social (beliefs, values and norms) and cultural (traditions) sources. It was argued that such inattention could be rectified through the relocation of social scientists in general, and sociologists in particular, from the periphery – where they still are – to a central place in the field of bioethics. In order to analyze this distant and controversial relationship between the social sciences and bioethics, their different approaches, respectively oriented by descriptive and normative ethics, were examined. The specific intersection of sociologists with bioethical thinking was also examined in accordance with an analytic continuum that illustrates an evolution from a collaborative position – sociology *in* bioethics – to an independent and free position – sociology *of* bioethics – adopted by those social scientists. At the end of this presentation, it was suggested the incorporation of «sociological imagination» (Wright Mills, 1959) in the processes of ethical deliberation on moral problems that emerge in biomedical

research and clinical practice. In this regard, an epistemological reflection was called up, examining about the influence of social and cultural sources of morality in the way such problems have been challenged by the bioethical imagination.

S12 | The Political Philosophy as Living Art within the Knowledge Society

Organized by **Alfreda Cruz** (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

Introduction

Focus on the Community

Community as a concept corresponds to the mediator instance between the individual and the collective in which he/she participates. Therefore, we may question the identity and identification criteria, alongside with values and contracts that aspire to well-being and which are faced with communitarian fractures arising from the interaction of the rules within the collective, in the presence of others with which they strive, either in similar or in different scales. This is clearly the case with the impotence of national identities facing the flows of the global economy and the imposition of the values that underlies it in the large sociopolitical market, before which the logics of communities oscillate between emancipation and resentment, embracing the former speeches of the recognition of differences, implicated in convergence policies like multiculturalism, and the latter, the dissent, supporting perspective repression and declination of the participation in the *res publica*

The Discovery of Social Reality

The awareness of social reality undergoes the attribution of form by questioning its development and exposure methods. This context justifies the design of instruments for observation, exploration and evaluation of a situation based on surveys propitiated by methodologies and technologies appropriate to the identification and parameterization of descriptors of measurement and narrative justification of the states involved in the dynamics of the preservation or processing undertaken in the *res publica* context.

It is in this perspective that Observatories arise, allocated to social research through which it can be consistent the questioning and the participation of individuals as subjects (owners of a leader project) as citizens (since they put it into the service of the "City"), through "identity exposure values" (face, function or biography) expressed in the bond set with the diachronic line of reality to which they are connected in the dimensions of knowledge and designed and deployed action.

The Alert Citizen Intervening Capacity

Equating an opinion on this perspective and promoting it in any of the contexts of mediation implies appealing to intervene in local agendas, simultaneously attentive to the impacts,

meanwhile assessable within the parameters of moral philosophy and sciences, lured to the diagnosis and prophylaxis of the desired – and already recognized and assumed - public policies sustainability.

Promoting the mediation for the recipients predisposed to behavior intervention enables mediators to distinguish the target groups focused on the corresponding skills and interests, from different categories, depending on whether they hold or not the training to the handling of information and communication technologies as a means of universal access knowledge in the various stages of its appropriation. In the case of scientific knowledge, that mediation should boost the conviviality of the Internet users with the wellspring of digital sources, taking as paradigm of the corresponding generalization the www.tvciencia.com site and, in all cases, the various libraries and digital encyclopedias available in the digital corresponding addresses.

Equating and disseminating opinion from the mediation sounding board implies starting to praxis intervention, simultaneously attentive to the impacts in the meantime assessable within the parameters of moral philosophy and sciences, lured to the diagnosis and prophylaxis of desired public policies sustainability, pondered and poured into the *glocal* agendas.

Abstracts

Thematic presentation of the Symposium
Alfreda Cruz (*Centre for Philosophy of Science of the University of Lisbon, Portugal*)

Abstract not available

Territorialisation of public policies
Engrácia Cardim (*ISCSP – University of Lisbon, Portugal*)

Abstract not available

Public Policies and Democracy
Paulo Trigo Pereira (*ISEG – University of Lisbon, Portugal*)

Abstract not available

Europe for Citizens Programme, 2014-2020
Maria Ângela Dionísio (*Centre for Philosophy of Science of the University of Lisbon & Universidade Europeia*)

Abstract not available

S13 | The notion of proof

Organized by **Reinhard Kahle** (*New University of Lisbon, Portugal*)

Introduction

We already witnessed the moment where chess computers surpassed humans. It might seem to be only a question of time that computers will also surpass humans in mathematical theorem proving. In fact, the traditional notion of mathematical proof faces in the beginning 21st century what we will call "the computer challenge". There are, however, three different aspects to consider:

    i)   proof search;
    ii)   proof check;
    iii)   proof representation.

Proof search has its known limitations due to undecidablity and complexity results. However, special areas, like semi group theory is already subject to computer generated proofs. Proof check is recently the "hottest" area, not least due to the attempt to formally verify the proof of the Kepler conjecture by its author Hales. Proof representation seem currently be the stumbling block for convincing the mathematical community to accept computer aided theorem proving as a viable alternative.

In this symposium we like to discuss the current state of the art of computer aided theorem proving, approaching the topic from the philosophical and mathematical side as well as from computer science. Special focus is put on the last two items mentioned above, addressing the more concrete question: a) in which way can (will) proof check convince the mathematical community from the correctness of a proof? b) does computer generated proof representations match with our intuitive notion of mathematical proof. The answers to both question should give us a deeper insight in the challenges and tasks for mathematical proofs and computer aided theorem proving in the 21st century.

Abstracts

Introduction: the notion of proof

Reinhard Kahle (*Lisbon, Portugal*)

Abstract not available

Proof Checking

Jesse Alama (*Vienna, Austria*)

Abstract not available

Hilbert, intuition, and mathematical proof
Alexei Angelides (*Stanford, USA*)

Abstract not available

S14₁ Eurhythmy – Complexity and Evolution

Organized by **José R. Croca** (*Centre for Philosophy of Science of the University of Lisbon & Faculty of Science of the University of Lisbon*)

Abstracts

The Principle of Eurhythmy about ten years after its initial formulation
J. R. Croca (*Department of Physics, Center of Philosophy of Sciences of the University of Lisbon, Faculty of Sciences of the University of Lisbon*)

At the First International Lisbon Colloquium for the Philosophy of Science - Unity of Science, Non-traditional Approaches, Lisbon, October, 2006, I presented for the first time publically the communication *The Principle of Eurhythmy a Key To The Unity Of Physics*. Now, almost ten after its initial formulation, this principle has undergone a huge development, form pure physics to include all other sciences. Indeed, this organizing basic principle allows us to connect and unify in a beautiful practically all sciences from the so called hard to soft sciences.

Traditional physics is philosophically founded on the Cartesian linear method where the whole is assumed to be the sum of the constituent parts that mix without modification and consequently the action is proportional to the reaction. The eurhythmic approach to understand Nature assumes the inner complexity of the physical entities. Furthermore assumes that the whole is in general more than the simple linear composition of the constituent parts and that a small action may, under certain conditions, give rise to a huge reaction. This is a consequence of the fact that the parts that make the whole due to the reciprocal interaction change themselves in a greater or lesser degree. Only when this change may be neglected, at the scale of description we are interested in, the linear approach may prove adequate.

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From Physics to *Physis*

R. N. Moreira (*Center of Philosophy of Sciences of the University of Lisbon, Faculty of Sciences of the University of Lisbon, Portugal*)

We focus our attention on the ontological and epistemological implications of the more recent results on the study on the foundations of quantum physics. We defend that quantum physics deal with physical systems that are complex, in such a way that they are permanently interacting with their surroundings, and reacting accordingly to the information changed and accordingly to their own structure. The principle of eurhythmy, introduced by Croca, and the worldview associated to it, constitutes the fundamental tool we use in our study.

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Some comments on the reality of particles and fields

Mário Gatta (*Department of Mathematics, The University of the Azores & Centre for the Philosophy of Science of the University of Lisbon, Portugal*)

In the present day debate concerning realism and antirealism in Science, a major component is provided by competing interpretations of quantum mechanics. Among these, the dominant ones may seem to lead to a non-realistic position concerning the underlying ontology, not only of particles but also of fields. In fact, considerations of spatial localization, of quantum statistics and of quantum entanglement, among others, in nonrelativistic quantum mechanics, create considerable difficulties for the concept of elementary particle as an objective physical entity to which characteristic as well as dynamical properties can be attributed. On the other hand, quantum field theory seems to deprive quantum fields of any physical reality as well, since these are fields not numerical-valued functions of spacetime coordinates, but rather fields of quantum operators acting on a definitely non-

spatial state vector. Consequently, no physical reality would ultimately correspond to our common notions of either particle or of field.

However, the possibility given to us by the exploration of new approaches to the quantum phenomena, in the spirit of some of its founders, such as de Broglie, and pursued nowadays by a few researchers along different lines of development, may furnish new elements that could surpass the above mentioned difficulties and return to a vision more in line with an ontology of substances and properties.

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Localização e globalização em física: uma abordagem com coerência

A. Rica da Silva (*CENTRA - Instituto Superior Técnico, Physics Dept., Av. Rovisco Pais 1, Lisbon Codex 1049-001, Portugal*)

Wavelet local analysis has recently brought to observational physics many contributions not only because of the unique characteristics of the type of analysis but also because it has allowed the deconstruction of the global Fourier analysis that pervades practically all linear physical models.

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Language and Reality

Ricardo S. Salomão Lopes (*Universidade Aberta, Portugal*)

The first assumption of Hyperphysics is that "there is an objective Reality. This Reality is observer-independent, yet, it is understood that the observer interacts with the very same reality being able to change it and of course of being changed in a greater or lesser degree." This principle of the existence of an objective Reality explicitly includes ideas, as J. R. Croca recently defined.

Language Planning has evolved from his first steps dedicated to "nation building" to a present framework that was first enunciated by Robert L. Cooper as a tool for Social Change, and recently by Bernard Spolsky as a broader, more flexible management tool, understanding the change of, either societal or diverse sizes of communities, always including, obviously, the individuals responsible for the proposed change.

Language as been the object of study of a science – Linguistics – that has difficulties accepting the inherent social nature of his object, pushing out this social nature of language to an hyphenated science: Sociolinguistics. This is far from peaceful. As A.-J. Calvet has stated, it is impossible to exclude the social nature of Language, therefore, there is no Linguistics that is not Sociolinguistics.

The proposed concepts of Hyperphysics and especially of Eurhythmy can provide an important breakthrough in the understanding of the relation between speech and language, individual and social – use or change through words and languages - and also human immaterial production and Reality.

S15 | Epistemic dynamics and philosophy of science

Organized by **José Francisco Quesada Moreno** (*GILLIUS, University of Seville, Spain*)

Introduction

The idea of knowledge is one of the most complex and pervasive notions to be defined. Broadly speaking, knowledge can be linked with concepts like beliefs, desires and intentions. Besides, knowledge and language, although traditionally studied in separated and isolated fields, should be integrated in a global perspective. Additionally, knowledge and language play a crucial role in science; together with reasoning these concepts are essential in scientific practices.

Most approaches to the study of Formal Models in general and of Philosophy of Science in particular, have emphasized (and usually, presupposed) a rigid, fixed and static idea of knowledge. Despite the formal advantages of such approach for the development of representation schemes and reasoning devices, many recent studies have accentuated the importance of the epistemic actions that change this knowledge.

An important task of Philosophy of Science is the study and understanding of the diverse reasoning processes used in science: How do we build our theory about the behavior of a particular subject? How do we change our theory in the light of incomplete information? How do we change our theory in order to match surprising/contradicting observations? All these questions emphasize the dynamic nature of the scientific method.

The dynamic epistemic nature of the different reasoning processes used in science should

be emphasized, and this might shed some light on the connections between them. Reasoning processes relevant to philosophy of science, as deduction, default reasoning and abduction, have been studied separately, but they can be put under the same umbrella when they are understood as epistemic actions that affect the knowledge and beliefs of a cognitive agent.

Natural Language Engineering, as a multidisciplinar field where Linguistics, Logic, Computer Sciences and even Psychology meet with the goal of understanding and generating human languages, should take into account and benefit from this new approach. So we should explore possible insight lines of application of the dynamic epistemic approach to the fields of Language Technologies and Knowledge Management.

Our main goal is to present the idea of Epistemic Dynamics as the strategic foundation for the study of the knowledge, and its derivation in three main areas: Logic, Language and Information.

According to that, the symposium will be structured in four main sections, starting with a brief introductory overview. Using the troublesome relations between the academic fields of Logic and Philosophy of Science as a historical background we will address the new trends on Logical Models and its connections and relationships with Science, Language and Knowledge. In the first section we will present the Epistemic Dynamic approach to Logic as a reference background. Given the aforementioned dynamic nature of the knowledge, one of the most relevant task is to analyze the properties and models that will allow the representation and reasoning over such dynamic schemes.

The other three sections will cover the application of this approach to three main fields, namely,

– A dynamic epistemic approach to three forms of reasoning commonly used in scientific practices;
– The theory of language; and
– Language technologies and knowledge management.

Abstracts

Logic and Philosophy of Science: Dynamic Epistemic Logic

Ángel Nepomuceno-Fernández & **Fernando Soler-Toscano** (*GILLIUS - Research Group of Logic, Language and Information, University of Seville, Spain*)

Abstract not available

A Dynamic Epistemic Approach to Deductive, Default and Abductive Reasoning

Fernando R. Velázquez-Quesada (*GILLIUS - Research Group of Logic, Language and Information, University of Seville, Spain*)

Abstract not available

Knowledge and Language

Francisco José Salguero-Lamillar (*GILLIUS - Research Group of Logic, Language and Information, University of Seville, Spain*)

Abstract not available

DEL in Language Technologies and Knowledge Management

José Francisco Quesada Moreno (*GILLIUS - Research Group of Logic, Language and Information, University of Seville, Spain*)

Abstract not available