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Lisbon ICPOS

THIRD LISBON INTERNATIONAL CONFERENCE
ON PHILOSOPHY OF SCIENCE: CONTEMPORARY ISSUES

ABSTRACT BOOK

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Keynote lectures

Keynote speakers

Individuality, autonomy and the connectedness of life

Arantzazu Etxeberria Agiriano (Dept. of Logic and Philosophy of Science & IAS Research Centre for Life, Mind and Society, Euskal Herriko Unibertsitatea, UPV-EHU, Donostia – San Sebastián)

In my presentation I examine some arguments in favour and against giving up the notion of autonomy in biology taking into account recent work on biological individuality. First, I consider that, in the past, two biologies were conformed around two main traditions of how to conceive individuals. One broadly developed after the work and philosophical conceptualizations of Claude Bernard on physiology and centred on the organization of the individual organism, whereas the other was built around Charles Darwin's legacy and focused on the evolutionary processes of genealogical lineages connecting living entities. As will be contended, the two traditions are associated with different not coextensive, yet strong, notions of individuality. Then I observe that, in current biology, life forms are studied in ways that contradict the received views about individuality of both traditions and in particular appear to be at odds with the notion of biological autonomy. Most of the issues arise from new views about the connectedness of living entities, as new data and phenomena stress the need to take into account the interdependence of life forms in ways that may hardly be accommodated to the previous conceptions of individuals, although the challenges presented are different for each of the aforementioned traditions. Accordingly, the philosophy of biology confronts now the task of looking for new frames to reconcile received views along with newly found phenomena so as to understand living individuals and organisms within connectedness. I propose that the goal of this pursuit is to devise a more naturalistic understanding of biological autonomy.

Ockham's Razor -- When is the Simpler Theory Better?

Elliot Sober (University of Wisconsin, Madison, USA)

Ockham's razor, the principle of parsimony, says that a theory that postulates fewer entities, causes, or processes is "better" than a theory that postulates more, so longer as the simpler theory is compatible with what we observe. But what does "better" mean? It is obvious that simpler theories are easier to remember, manipulate, and test. The hard problem is to say why the fact that one theory is simpler than another is relevant to deciding what the world is like. In this lecture I'll describe two "parsimony paradigms" within which this hard problem can be solved.

The symbiosis of Picture and Nature. A Return of Manerism?

Horst Bredekamp (Humboldt-Universität zu Berlin)

Many elements of our contemporary culture demonstrate a negation of the dividing line between nature and culture as between picture and body. In many spheres, and even so also in the sciences, pictures are not only used as a tool of knowledge, but become parts of the object which is to be detected. This process is specially evident in microbiology, optogenetics and xenobiology. In these forms of transformation concepts are coming up again, which were especially treated in the epoch of the historical mannerism, between approximately 1520 and 1600. The lecture will ask if our time can be seen as a special form of neomannerism.

Explanation by idealized theories

Ilkka Niiniluoto (University of Helsinki, Finland)

Idealized scientific theories tell how natural and social systems behave under counterfactual conditions, so that their descriptions of actual situations are known to be false. Therefore, by Hempel's classical standards, the use of such theories as covering laws in explanations of empirical facts and regularities is problematic in two ways: they don't satisfy the condition that the explanans is true, and they may fail to entail the empirical explanandum. An attempt to deal with the latter problem was proposed by Hempel and Popper with their notion of approximate explanation. A more systematic perspective on idealized explanations was developed in the method of idealization and concretization by the Poznan school (Nowak, Krajewski) in the 1970s: idealized theories can provide explanations if their hidden ideal assumptions are first made explicit as antecedents of idealizational laws and then these assumptions are eliminated or relaxed by modifying the consequent. In this way the gap between an idealized theory T and empirical data E can be narrowed: to explain E by T one has to concretize T into a new theory T' and then derive E from T' . Nowak formulated idealizational laws as material conditionals, so that they are trivially true. In this paper, it is suggested that idealizational laws should be treated as counterfactual conditionals, so that they can be true or truthlike, and the concretizations of such laws may increase their degree of truthlikeness. Further, by replacing Hempel's truth requirement with the condition that an explanatory theory is truthlike one can distinguish several important types of approximate, corrective, and contrastive explanations by idealized theories. In particular, one can study whether explanatory theories may contain non-Galilean idealizations which cannot be concretized or de-idealized, or whether explanation presupposes successful representation. The conclusions have important consequences to the debates about scientific realism and anti-realism.

Should we care about robots?

Mark Coeckelbergh (University of Vienna and De Montfort University, UK)

This talk discusses and tries to understand the phenomenon that people are able to empathize with robots from a philosophical perspective, introducing a phenomenological and relational way to think about the moral standing of robots, reflecting on the use of artistic work for reflecting on this topic, and stressing the political dimension of the question.

First the phenomenon of empathy with robots is introduced by means of references to research in empirical psychology and robotics and artistic projects. It is shown that people are indeed able to empathise with robots, and even with "things" and machines that are less automated and less human-like than, say, humanoid robots.

Then a philosophical argument is made about the moral standing of robotics as moral patients (receivers of moral consideration, objects of moral status ascription). It is argued that we usually ascribe moral standing to any entity by using a "properties" approach and that this approach is problematic since it creates distance to the entity in question by means of the operation of a kind of ontological and moral anatomy. In response a more relational, phenomenological-hermeneutic approach, and transcendental approach is proposed, which questions the distance and shows how our ascriptions of moral standing are always already interpretations and involve epistemologies in which subject and objects interplay and entangle, and how the language and technologies we use already pre-constructs and pre-configures the entities and their moral standing, and indeed make possible the very moral-ontological exercises under discussion.

It is also argued that given the limits of language, including philosophical language, to grasp what happens in human-machine encounters and interactions, we may well need artistic work that opens up the discussion and enables us to explore questions regarding moral standing of machines and

robots in more open way. I propose an epistemology that is more patient and open, postponing closure by means of ethics and allowing more explorations and experimentation. More generally, artistic perspective can bring in understandings of human-robot relations that attend us to non-linguistic and material dimensions of those relations.

Finally, it is stressed that the question regarding moral standing is not only a question about how individuals should relate to robots; it is also at the same time a question regarding the future of our society. We should ask how we should organize human collectives that includes increasingly intelligent and autonomous machines that create all kinds of appearances (e.g. the appearance of suffering), that change our practices, and that take over tasks from humans. Robots also help us to question our current social institutions and societal arrangements. To conclude, the question regarding the moral standing of robots it is also a political question.

Contributed papers

Contributed papers

Wave-corpucle duality and the category of contradiction

Ana Pato (CFCUL, Portugal)

Contact: anahpato@gmail.com

Keywords: quantum mechanics, contradiction, materialist dialectics, wave-corpucle duality

Wave-corpucle duality is one of the biggest problems inherited from 20th century physics (Moreira, 2009: 137).

The discovery that matter –whether it be particles or radiation – exhibits either a wavelike or a corpuscular behavior, but never both simultaneously, placed physicists before a dilemma (Bohr, 1933: 5).

As a consequence, Niels Bohr introduced the complementarity principle with the objective of dealing with that contradiction. The orthodox interpretation of quantum mechanics, which is presently accepted even if as merely tacit or operational, considers the wave-corpucle relation in a complementary manner: either wave or corpucle

However, in contrast with the orthodox interpretation, in the spirit of Louis de Broglie's theoretical program, there are proposals that consider the quantum particle as a complex object, constituted by an extensive part and a singularity. The wave-corpucle relation is seen as wave and corpucle. (Croca, 2003).

I hold that the introduction of complementarity is a consequence of not having considered the wave-corpucle relation as a dialectical contradiction, i.e., as an objectively founded contradiction. Being mistaken for a logical contradiction, that "apparent contradiction" (Bohr, 1955: 90) had to be removed, at all cost, in order to fulfill certain demands of rationality. It was then necessary to find a description of the phenomena in which the contradictory poles, wave and corpucle, were put side by side, without interpenetration, without mutual conditioning. The complementarity principle denies the possibility of knowing reality in its unity, and imposes theoretically the disunion of a united reality.

In contrast, the category of dialectical contradiction, founded upon a materialist basis, allows us to think this contradiction between wave and corpucle as a real, material contradiction, which for that very reason cannot be eliminated but should instead adequately find its corresponding theoretical reflection. This allows us to overcome the abstraction of considering the wavelike and the corpuscular phenomena unilaterally, as absolutely separate, by allowing us to understand their relative difference, and as belonging to a certain unity, to a totality with its own structural laws. This allows us, therefore, to go beyond the mere phenomenal appearing, questioning the essential relation between those two aspects of reality, their "internal connexion", an imperative requirement of scientificity.

References

Bohr, Niels, «Light and Life» (1933), in Atomic Physics and Human Knowledge, New York, Dover Publications Inc, 2010 (republicação integral de Atomic Physics and Human Knowledge, New York, Science Editions Inc., 1961)

Bohr, Niels, «Atoms and Human Knowledge» (1955), in Atomic Physics and Human Knowledge, New York, Dover Publications Inc, 2010 (republicação integral de Atomic Physics and Human Knowledge, New York, Science Editions Inc., 1961)

Croca, José, Towards a Nonlinear Quantum Physics, New Jersey / London / Singapore / HongKong,

World Scientific, 2003

Moreira, R. N., «Instrumentalismo Versus Realismo, a Crise na Física do Século XX», in Olga Pombo, Ángel Nepomuceno (eds.), *Lógica e Filosofia da Ciência*, Lisboa, Centro de Filosofia das Ciências da Universidade de Lisboa, 2009.

Epigenesis and Preformationism on Phenotype Conformation: Exploring Their Prevalence as Scientific Perspectives

Anayansi Sierralta-Gutierrez (Facultad de Ciencias, Universidad Nacional Autónoma de México, Mexico)

Contact: anayansi.bio@ciencias.unam.mx

Keywords: Preformationism, Epigenesis, Genocentrism, Phenotype, Development

Preformationism and Epigenesis are two opposing views on the development of organisms. They had their origin back in the seventeenth century, but it is possible to recognize key elements of each of them in modern biology when it comes to the problem of phenotype conformation. Gene centered approaches for understanding the phenotype assume the preexistence of guiding information to form a living being, this resembles Preformationism because development is considered simply the expression of information already carried by a zygote. On the other hand, views which prioritize the processes that take place during development and don't assign higher causal power to genes, resemble Epigenesis in the sense that they don't presume that the information preexists the interactions which give rise to phenotype conformation.

One of the questions arising from the simultaneous persistence of both of these perspectives in nowadays biology is if that coexistence takes place because they are equally able to give satisfactory explanations for phenotype construction. Nevertheless, there's room to think that the current use of Preformistic approaches is not because they have an equal or complementary heuristic power to approaches from Epigenesis.

I evaluate the explanatory power of present day Preformationism and Epigenesis, represented respectively by contemporary genocentric views on one side, and modern epigenetics and developmental systems theory on the other. Key elements of these views can be identified to different extent in authors such as David Haig (2007), Hopi E. Hoekstra and Jerry A. Coyne (2007) in the case of Preformationism, and in Susan Oyama (2002), Eva Jablonka and Marion J. Lamb (2008) in the case of Epigenesis. I intend to analyze the scopes and limitations of the preformistic and neoformistic (epigenetic) perspectives regarding their understanding of causality and the relation between subject and object. I'm doing this analysis from a dialectical point of view based on the work of Steven Rose (1998), Richard Levins and Richard Lewontin (1985). Once analyzed the differences in heuristic power of each of this two research fields, I explore some of the possible so called extra-scientific factors that may be playing a role in the continuity of this two research perspectives.

The genocentrism-epigenetics split represents a good example of the nature of the internal logic of scientific perspectives and how they're not being driven only by their ability to cope with reality. It's also good example of the relevance of the structure of scientific interests and communities in the increased buoyancy of certain dominant views within a field of study. In order to better comprehend and explain reality, it would be required to transform scientific practice, which in turn is a part of such reality.

From science to dance ENSAIO between lab and studio

Ângelo Neto (Faculdade de Ciências Sociais e Humanas, Portugal)

Contact: angelocidneto@gmail.com

Keywords: Art, science, transversality, dance, choreography, neuroscience

This work is a reflection in action of an artistic process based on scientific research. ENSAIO is the choreographic project that resulted from the translation mechanisms of laboratory concepts to a studio approach where it proposes a possible mainstreaming of artistic and scientific processes combined.

This project joined Escola Superior de Dança, Polavieja lab in Champalimaud Foundation, to the Faculdade de Ciências Sociais e Humanas. And it aims to reveal the creative choreographic and performative potentials hidden in this scientific research concerning neurosciences. By identifying cross materials to artistic and scientific processes it was possible to design a structure of the creation process and the construction of a choreographic performance. The common platform has been found in the process of translation and the definition of the same concept substrate, which made possible the approach of the two instances: studio and laboratory. One of its key features is the promotion of the communication among its agents: scientists and dancers. And the possibility of modeling and absorption from what it comes from this sharing. The methods and the choreographic procedures chosen mirrored and promoted this sharing and, therefore, the involvement of the body. Thus, the body is the agent able to reflect and trigger this process, a body under an essay that is continually in research. A body able to coordinate between various media and to expand the reflection on himself.

Although science and art are individual instances that inevitably specialize and segregated away. Thus, this work focuses on examples of cross-thinking of both scientific and artistic cultures. Where they articulate the theoretical and practical bodies in a practice as research on the development of a creative process.

Cancer cells: from an evolutionary to a functional analysis

Anna Maria Dieli (University of Rome "Tor vergata"/ University Paris 1)

Contact: annamariadieli@gmail.com

Keywords: cancer, evolution, units of selection, Darwinian individuals, function

Cancer is a disease involving aberrant proliferation of cells and the ability to invade other tissues. In cancer, cells grow out of control and become invasive; mutation, competition and natural selection between cells are thus the main components of the phenomenon of cancer (Nowell 1976). Cancer cells may thus be described as a Darwinian population subject to natural selection. In this framework, cancer cells fulfil the criteria for Darwinian evolution by natural selection, which is heritable variation in fitness: investigating cancer in a Darwinian perspective has generated new insights into disease aetiology, pathogenesis and treatment.

This talk aims to analyse whether the Darwinian framework is useful to understand cancer cell identity. It will be maintained that it is correct – to some extent – to describe cancer cells as Darwinian individuals; notwithstanding, cancer cells cannot be described merely from a cellular point of view. A cancer cell has to progress into a normal tissue in order to be considered as pathological: there is a strong dependence from the context. For instance, it has been proved that transplanting a cancer cell in a normal tissue not always gives rise to a tumour. A tumour arises from the interaction between cells, tissues, organs and the whole organism.

Different descriptions of cancer as a Darwinian process will be analysed, in order to understand whether they are useful for the description of cancer as a pathological phenomenon. For example, Germain (2012) asks whether cancer cells satisfy the formal requirements for being Darwinian individuals (Germain 2012). The aim of this author is to understand "how Darwinian" cancer cells are. In cancer cells, individual differences in fitness are less dependent on outside signals and more dependent on intrinsic features: therefore, because of the strong dependence of fitness differences

on intrinsic characters, cancer cells cannot be considered to be paradigmatic Darwinian individuals. Another example of the application of Darwinian paradigm to cancer cells is Lean-Plutynski's article (2015). According to these authors, cancer is both a subject to selection at multiple levels and a by-product.

To conclude, it will be stated that it is correct – to some extent – to describe a tumour as a population of cells which evolve under the pressure of natural selection, at the expense of the whole organism. However, this picture is misleading: a cancer cell cannot be understood individually, without any reference to its context. In effect, cancer was originally considered to be a deregulation of the normal growing program of the cell. The default state of a cell was thought to be quiescence: therefore, a cell that replicates too much becomes cancerous. However, this is a simplistic view: the Darwinian explanation of cancer has given a big contribution in understanding that cancer is not only a cellular pathology. Nowadays, cancer is seen as derived from a deregulation of the connections between the tissue and the cell. In conclusion, a Darwinian perspective on cancer cells has to be integrated with more systemic views.

How our concept of addiction could survive to behavioral addiction acknowledgement

Anthony Ferreira (IRePh/ Université Paris X Nanterre La Défense, France)

Contact: a.a.ferreira@laposte.net

Keywords: Addiction, Neuroscience, Behavior, Neuroskepticism.

The new DSM V, introduced behavioral addiction. Pathological gambling is fully acknowledged, while other types should « wait for more research results ». This move was awaited and surprising at once. Behavioral addiction are at the center of a ragging battle between pro and anti disease thinkers of addiction(Leshner,1997;Levy,2013). On one hand, the pro-disease, who see addiction as a brain disease, where the phenomenon should be described and explain under biological models and features, and one the other hand, anti-disease thinkers for whom addiction is a behavior, rejecting the etiological commitment implied under the word « disease » ; that addiction should strictly be a biologically grounded phenomenon. Behavioral addiction is a key point in the argument because it is a kind addiction without drugs, and it leads to a view of the phenomenon more as a relation between someone and something than as the consequences of a drug upon brain receptors(Peele,1998). In between, practitioners are treating behavioral addictions since long time ago. The fact that the DSM V introduced, at least, behavioral addiction is an interesting thing, and the way it is done is too.

I will consider the question of behavioral addiction first by defending the fact that there are behavioral, as pharmacological addictive conducts, and that we can talk about addiction as a unique phenomenon ; that there is such a thing as addiction whose behavioral and pharmacological kind of ones are part of.

Then, I will explore the consequences of this move. Behavioral addiction could potentially drive the whole addiction concept to its dilution, that is why it was an anti disease thinkers weapon, a skeptical one(Szasz,1974) : i.e. If everything could be object of addiction, let's face the fact that only political and normative choices defined what is and what is not what we call addiction (as a disease). I will show how it was supposed to kill the addiction concept itself but also that it is not the case. Addiction will survive to this holism but the concept itself will at least be deeply modified. One of the reason is that behavioral addiction highlights moral issues at the core of the addiction concept and these issues can't simply be rejected as false problems : there is a moral part in the definition of addiction we can not get rid of and science have to deal with it(Ferreira,2016).

Another point is that behavioral addictions were shown as a treat to biological explanations of addiction (Heyman, 2009), but I will try to show it is not. Behavioral forms of addiction are sometimes used to highlight the impossibility to give causal account of addiction on biological ground. In this context, it raises the question of the scientific investigation of addiction and its tools and how the addiction problem could help us, with the use of a moderate neuroskepticism (Forest, 2014), to find a way to make neuroscience without playing the mind against the brain.

Rhetorics of Science: a Philosophical Approach to the Scientific Discourse

Carlos Sacadura (PhD member of CFCUL/ Teacher in Cape Verde University, Cape Verde)

Contact: cabas@sapo.cv

Keywords: rhetorics-argumentation-discourse-scientific method-theory

The gap between hard sciences and humanities mentioned by Charles Snow in his work intitled "The Two Cultures" as one of it most revealing formulation in the separation between rhetorical discourse and scientific discourse that happened since the scientific revolution of the XVI-XVII century and the rise of experimental method. Since then, hard sciences rely in demonstration and experimentation, and humanities in rhetorical and argumentative discourse. The New Rhetorics of Chaim Perelman stresses this enormous gap nowadays, with the dissotiation between logical and rhetorical/argumentative discourse. My proposal of communication points towards a new vision, with na approach that studies the rhetorical stuctures os science, revealing a "third actor" in science knowledge building: the relation between knowing subject and the known object that is the basis of scientific method forgets another, and third elemento in the building of knowledge: the argumentation that is the ground validating the theoryes or conjectures proposed by the scientific researchers. It's not only demonstration or experimentation that verifies or validates a theiry, but also the arguments rhetorically expressed in wich is grounded. The hetorical-argumentative grounds of science uses metaphorical or imagetic ressouces that are often restiticted to literature or art. So we have to move towards a new paradigm, a "third culture" relating scientific and humanistic discourses. We hope that the study here exposed in his main topics can be a contribution to the opening of this new path.

Awareness logic: an epistemological defence

Claudia Fernández-Fernández (Universidad de Málaga, Spain)

Contact: cfernandez@uma.es

Keywords: Epistemic logic, Awareness logic, logical omniscience, epistemology

In recent years, some mainstream epistemological positions have made the case for epistemic logic, coming up with some very interesting and valuable arguments that support new developments in epistemic logic. At the same time, epistemic logic has experienced a tremendous growth over recent decades, driven by the need to model 'real' knowledge, that is, knowledge of epistemic agents with limited resources, such as most machines with limited memory and computing capacities, and, of course, human beings.

This motivation to model real knowledge is a direct result of the drive to solve the problem of logical omniscience, which affects the foundations of epistemic logic, as laid down by Hintikka in the 1960s. The awareness logic I am interested in is part of these new directions in which epistemic logic is being taken. Awareness logic proposes widening the system of epistemic logic to include a new

syntactic operator that acts as a filter on the set of knowledge. Knowledge branches into implicit (ideal) and explicit (real) knowledge, with the latter being selected out from implicit knowledge by applying the awareness operator.

I wish to argue that awareness logic is a perfectly adequate solution to the problem of logical omniscience from an epistemological point of view. From a logical point of view, awareness logic is similar to other solutions that are also applicable to multi-agent and multi-modal systems, but in comparison to these, this is the most intuitive. However, to the best of my knowledge, no point has been made from an epistemological point of view, which upholds the value of awareness logic when solving epistemological issues.

Thus, I will advocate that awareness logic offers a suitable conceptual frame for defending Plato's old thesis, namely, that knowledge is justified true belief (JTB), referring to agents with limited resources. One of the supporting arguments for JTB includes an awareness requirement in order to provide justification to knowledge. My argument focuses on this approach and incorporates concepts of awareness logic. The awareness operator fulfils the role of the awareness requirement and explicit knowledge is the only knowledge capable of being justified in this epistemological sense. Thus, by analysing the conceptual framework of awareness logic, I hope to not only enrich the epistemological debate around JTB, but also to lay an appropriate philosophical foundation for awareness logic.

Shifting from metrical to total gravitational structure. Should only dynamics matter for spacetime structuralists?

Damian Luty (Adam Mickiewicz University, Poland)

Contact: damianluty@gmail.com

Keywords: Spacetime Structure, Structural Realism, General Relativity

In my presentation I would like to address the problem of spacetime structuralism. Even though S. French recognized that active diffeomorphic transformations lead to a view where spacetime points are stripped from primitive individuality and that this gives aid to the general structuralist claim about ontological priority of structure (expressed in general covariance of general relativity). As French needed only an example of a position in the discussion on the ontological status of spacetime which is akin to structuralists motivation, he ended up with endorsing sophisticated substantivalism. By this maneuver he opened the path to consider ways of how exactly spacetime points are individuated in the presence of the metric field. M. Esfeld and V. Lam, in their moderate ontic structural realism, proposed such a way – by relying on Bergmann-Komar coordination method, thus actually dismissing diffeomorphic transformations. Furthermore, Esfeld and Lam stated explicitly that their proposition is neutral to spacetime substantivalism and relationalism – that both positions are compatible with their concept. Waving between eliminative and non-eliminative structuralism in the context of the philosophy of spacetime led to only more confusion in understanding the primary role of structure in structuralists ontology.

The goal of my presentation is twofold. First, to criticise two versions of spacetime structuralism (abovementioned Esfeld's and Lam's version and E. Slowik's epistemic spacetime structuralism). Second, to consider a possibility in which spacetime structuralist could describe the ontologically primitive structure by referring not only to non-dynamical structures (I take a hint on this one from E. Curiel). I follow J. L. Anderson in denying the metric field its fundamentality. This leads me to an analysis of such non-metrical structures which serve to define how come spacetime points can be considered as taking values of the gravitational field. My main claim is that spacetime structuralist should acknowledge the set of all structures (let's call this „total gravitational structure”) as ontologically relevant, as long as they are needed to show how physical situations are posed at all from the perspective of general relativity.

Should Special Science Laws Be Written Into The Semantics of Counterfactuals?

Daniel Dohrn (HU Berlin, Germany)

Contact: Daniel_Dohrn@yahoo.com

Keywords: Counterfactuals, Conditionals, Special Science Laws, Laws

Abstract: In the simplified standard semantics for counterfactuals, a counterfactual is true iff all antecedent worlds which are maximally similar to the actual world are consequent worlds. I confine my attention to deterministic worlds. Lewis famously presented a set of criteria of similarity:

- (1) It is of first importance to avoid big, widespread, diverse violations of law [big miracles].
- (2) It is of second importance to maximize the spatio-temporal region throughout which perfect match of particular fact prevails.
- (3) It is of third importance to avoid even small, localized simple violations of law [small miracles].
- (4) It is of little or no importance to secure approximate similarity of particular fact, even in matters that concern us greatly. (Lewis 1986, 47-48)

Lewis clarifies that only preservation of the fundamental laws and particular matters of fact contributes to overall similarity of worlds. But shouldn't the laws of the special sciences also contribute in a distinctive way to overall similarity?

In the first part of my talk, I scrutinise Jeffrey Dunn's (2011) proposal to mend Lewis's criteria as follows:

- (4') It is of fourth importance to avoid violation of the special science laws.

I discuss Dunn's evidence: first, he wants to account for Elga's (2001) counterexample against Lewis where a counterentropic world comes out closest according to Lewis's criteria. However, Dunn's approach is preempted by the Schaffer-Kment proposal that facts which are explanatorily downstream from the antecedent do not contribute to similarity (Kment 2006). Since we need this amendment anyway to account for refinements of Fine's future similarity objection, it strikes a better balance of revision and explanatory power.

Second, Dunn presents the intuitive example:

(C1) If the apple farmers' crop yield had outrun demand, the price of apples would have gone down.

For (C1) to be true, he says, we need to uphold the economic law of supply and demand. Yet acceptance of (C1) can be explained without special science laws: we have a high credence that, given determinism and the antecedent, the particular facts and fundamental laws underlying the behaviour of economic agents determine the price of apples to go down.

In the second part, I consider a better motive of giving the special science laws a role in the semantics of counterfactuals. It is common practice of scientists working in some special science S to treat certain laws of S as exceptionless. I propose that S creates a special context which overrides the default criteria of similarity. The context is implemented by rewriting Lewis's (1) and (3) such as to become 'violations of fundamental law and the laws of S'.

References

- Dunn, Jeffrey 2011. Fried Eggs, Thermodynamics, and the Special Sciences. *The British Journal for the Philosophy of Science* 62, 71-98.
- Elga, Adam 2001. Statistical Mechanics and the Asymmetry of Counterfactual Dependence. *Philosophy of Science* 68, S313-S324.
- Kment, Boris 2006. Counterfactuals and Explanation. *Mind* 115, 261-310.
- Lewis, David 1986. Counterfactual Dependence and Time's Arrow. In *Philosophical Papers II*. Oxford: Oxford University Press, 32-66.

Topological controllability of the brain: a case of non-causal interventionism

Daniel Kostic (IHPST (CNRS/ Université Paris I Sorbonne, France)

Contact: daniel.kostic@gmail.com

Keywords: Interventionism, Topological models, Network control theory, Controllability of the brain, Non-causal interventionism

On Woodward's view, to explain an event or outcome is to provide "information about the causes of that outcome" (Woodward 2010: 291). Causes are understood along interventionist lines: two features are causally related just when, given some background circumstance, there is a possible intervention on the state of one feature that changes that of the other. The causal information is explanatory precisely because it can be used to answer what-if-things-had-been-different questions.

Topological approach also utilizes notion of interventions, in which features of network topology allow us to understand the system dynamics as a function of its structure. For example, the Watts and Strogatz (1998) small-world network model was built in such a way that starting from a ring lattice it has n nodes and k links. The structural properties of such a network are quantified by using its characteristic path length, which measures a typical separation between two nodes in the network, which is expressed as $L(p)$; and the clustering coefficient $C(p)$, which measures the cliquishness of a typical neighbourhood of nodes. The small-world networks are characterized by low $L(p)$ values, which is due to a few long-range links. Such 'short-paths' connect nodes that would otherwise be much farther apart and in effect shortening the path lengths between the whole neighbourhoods, and neighbourhoods of neighbourhoods. An explanation of why infectious disease will spread more rapidly through a population which instantiates a small-world topology, appeals to these structural features: pathogens can reach much larger number of nodes more rapidly if the $L(p)$ is low and the $C(p)$ is high. This explanation is specifically non-causal because the explanans cites only mathematical values of the model, not the causes.

Recent work in network neuroscience builds upon these ideas and conceives interventions through network control theory. It investigates how structural features of the brain networks determine temporal features of its cognitive dynamics (Bassett et al 2015). On this view neural system has a trajectory, which is a temporal path of the brain through various states, "...where a state is defined as the magnitude of neurophysiological activity across brain regions at a single time point." (Bassett et al, p. 2). Controllability is understood as a possible intervention on the mathematical measures of the structure that allows particular nodes (brain regions) that are at key locations in brain's topology to reach some other nodes. This measure allows us to find the brain region which is a control node, one that affects global topology, which ultimately affects temporal dynamics.

The significance of interventions is that they allow us to find explanatorily relevant variables. The only difference between the causal and non-causal interventions is what kind of explanatorily relevant variables they allow us to find. In the traditional interventionism it's causally relevant ones, in topological interventionism it's the properties of topology through which some activity drives the system to diverse states. Explanation of activity that drives the system and topology through which it's driven are distinct, the former is causal and the latter is non-causal, but both are interventionist.

Ontological commitments of meta-theoretic methods of theory reconstruction: the case of frames

David Hommen (Heinrich Heine University Duesseldorf, Germany)

Contact: hommen@phil.hhu.de

Keywords: theory reconstruction, frames, ontology, universals, tropes

According to Quine, the ontology to which a theory is committed is determined by the values of the variables bound by the quantifiers occurring in the sentences expressing the theory. However, alternative methods of theory-reconstruction might be committed to different ontologies, because of differences in their basic semantic parameters. Hence the question to which ontology a certain meta-theoretical method of theory reconstruction is committed.

In this talk, I shall assess the ontological commitments of frame-based views of theories. Frames decompose concepts into recursive attribute-value structures. Attributes are the general properties by which a concept is described (e.g., COLOR). Their values are specifications (e.g., red). Attributes in frames assign unique values to objects and thus describe functional relations (e.g., COLOR(o) = red). Attribute values can be specified by additional attributes (e.g., COLOR(o) = red & SHADE(red) = scarlet).

The question of this talk is: Are attribute values to be interpreted as universal properties (abstract entities which can be instantiated by multiple objects) or as tropes (particularized properties which uniquely pertain to the object in which they inhere)?

A problem for universals realism seems to arise when frames are recursively specified. In a frame of a scarlet red colored object, e.g., scarlet would be predicated of the universal red. This seems problematic because it is wrong to assign a single shade to the universal red; for two red objects might exemplify different shades of red. The SHADE attribute, however, can assign only one value to its argument. Trope theory seems to circumvent this difficulty, because in cases of different shades of red, the SHADE attribute has different arguments: e.g., red_1 might be scarlet while red_2 might be crimson.

I shall argue, however, that the advantages of trope theory over universals realism are merely apparent. Universals realism and trope theory are both compatible with frame-based representations as far as terminal values are concerned, and face similar complications in the case of non-terminal values. Terminal values are the most specific properties of objects. Since they are not further specified, the problem of recursive specification does not arise. Their determinacy, however, does not imply particularity. Terminal values can be tropes as well as universals of the lowest possible degree of generality.

Non-terminal values can be construed either as classes of determinate universals/tropes or as universals/tropes realized by determinate universals/tropes. On the first construal, to say that an object o is red is to say that o has some universal/trope which is a member in the class of red colors. On the second construal, to say that o is red is to say that o has some universal/trope that realizes redness. Either way, the concrete value is determined only relative to o. Whether they are universals or tropes, scarlet is determined as the realizer of red only when both properties inhere in the same object. Hence, both universals realists and trope theorists have to admit that attributes of non-terminal values are functional only relative to the context of the objects they refer to.

Bachelard on the Idea of a Problematic

David Webb (Staffordshire University, United Kingdom)

Contact: D.A.Webb@staffs.ac.uk

Gaston Bachelard regards science as a constructive practice, and this can be seen in two related aspects of his account of scientific rationality. First, intellectual intuition runs ahead of sensible intuition and scientific rationality leads to new ways of thinking that are not derived from everyday experience. Second, the phenomena of science are produced rather than simply discovered, an idea that Bachelard conveys with the concept of 'phenomenotechnique.' However, the constructivism of

scientific rationality is not completely free and works with and around limits set by the specific problem it is addressing at any time. As Bachelard states, 'rationalism is a philosophy which continues; it is never truly a philosophy that begins' (*Le rationalisme appliqué*, 54). This idea of construction within limits is conveyed by Bachelard's concept of the 'problematic.' In this presentation I will consider the problematic as a form of critical practice, and specifically as a transformative critical practice. As I do so, I will ask what becomes of sensibility in Bachelard's account.

Categorial Similarity

Emilio Gómez-Caminero (University of Seville, Spain) / **Nino Guallart** (University of Seville, Spain) / **A. Nepomuceno** (University of Seville, Spain)

Contact: egcaminero@yahoo.es

Contact: nguallart@us.es

Contact: nepomuce@us.es

Keywords: Category theory, logical system, similarity

In this communication we shall treat of applying category theory to logical and epistemological studies. We are interested in logical systems used in epistemology. We shall present how a logical system can be analyzed in terms of category theory. From the study of the notion of identity, from a categorial point of view, a new one can be defined, namely "categorial similarity", from which, we shall propose a form of analyzing logical systems in order to determine the possible specificity, expressiveness in order to give account of epistemological phenomena, etc. of such studied logical systems, particularly, extensions of propositional systems or first order systems with certain restrictions.

First Order Epistemic Logic for Epistemology: a Small Step

Emilio Gómez-Caminero (University of Seville, Spain) / **Nino Guallart** (University of Seville, Spain) / **Angel Nepomuceno** (University of Seville, Spain)

Contact: egcaminero@yahoo.es

Contact: nguallart@us.es

Contact: nepomuce@us.es

Keywords: epistemic logic, finite domains, double necessitation rule

Epistemic logic is the backbone of contemporary epistemology, but first order systems are not usually taken into account. We will introduce a system of first order epistemic logic with a semantics in which epistemic states are ordered in a way that there is an initial state whose domain is finite, and each state s is related with s' if and only if the domain of s is enclosed (not in strict sense) in the domain of s' . It will be defined a predicate of existence as follows: "exists a" shall be understood as an abbreviation of "there is x such that x is equal to a ". In this system the necessitation rule (respect to the epistemic operator) is defined twice, which will derive the introspection without that has to be considered an axiom.

Mathematical scientific explanation: a proposal

Eduardo Castro (Universidade da Beira Interior and LanCog, Universidade de Lisboa, Portugal)

Contact: ejscasto@yahoo.com

Keywords: explanation, mathematics, DN model, indispensability, causation

Abstract: I cannot to distribute exactly seven sardines evenly among my three cats without cutting any, because there is a mathematical fact that states that seven cannot be divided evenly by three. This example seems to be a genuine mathematical explanation of an empirical event. That is, the mathematical fact that three is not divisor of seven has an explanatory role on the content of the explanation. In this talk, I will argue that mathematical explanation of empirical phenomena has the same nature of scientific explanation. I will rekindle Carl Hempel's model of explanation – the deductive-nomological model of explanation (Hempel 1965). I propose a new deductive-nomological model for mathematical scientific explanation. In this regard, I will inflate Hempel's deductive-nomological model with mathematics and test it against some recent paradigmatic examples of mathematical explanation of empirical phenomena. North American synchronized cicadas have prime number life-cycles (13-year and 17-year), because prime periods minimize intersection (number theoretic theorem) (Baker 2005); Hénon-Heiles Hamiltonian systems preserve almost all regular orbits of the system if sufficiently small perturbations on the value of energy are introduced (KAM theorem); the bridges of Königsberg cannot be crossed exactly once, because the bridges of Königsberg are (represented by) a connected graph that has an odd valence (Euler's theorem) (Pincock 2007). In light of this model, I will analyse the problem of distinguishing between genuine mathematical scientific explanations and ordinary scientific explanations that use mathematics. I will argue that genuine mathematical scientific explanations are qualitative explanations; and ordinary scientific explanations that use mathematics are quantitative explanations. Finally, I will analyse the impact of this deductive-nomological model for mathematical scientific explanation on mathematical indispensability theses and causal/non-causal theories of causation.

References

- Baker, Alan. 2005. "Are There Genuine Mathematical Explanations of Physical Phenomena?" *Mind* 114 (454): 223–38. doi:10.1093/mind/fzi223.
- Hempel, Carl. 1965. *Aspects of Scientific Explanation and Other Essays in the Philosophy of Science*. New York: The Free Press.
- Pincock, Christopher. 2007. "A Role for Mathematics in the Physical Sciences". *Noûs* 41 (2): 253–75. doi:10.1111/j.1468-0068.2007.00646.x.

Models and representation: the role of structures

Elena Castellani (University of Florence, Italy) / **Tarja Knuuttila** (University of South Carolina, University of Helsinki) / **Francesca Pero** (University of Florence, Italy)

Contact: elena.castellani@unifi.it
 Contact: tarja.knuuttila@helsinki.fi
 Contact: francesca.pero@unifi.it

Keywords: models, representation in science, structures, mapping account, pragmatic approaches to representation, morphism,

In this paper, we focus on the notion of structure as employed when considering the issue of

scientific representation, in particular with regard to the functions of models in science. In the case of models, representation is usually cashed out in terms of the relationship between a model and its target. How to conceive such a relationship is particularly challenging when, as is often the case, the model is an abstract mathematical structure and its target is an empirical phenomenon.

Representation is usually described either as a dyadic relationship, holding between the model and its target only, or as involving the pragmatics of model construction and models' users as well -- hence as a triadic relation. In both cases structures play a crucial role. On the one hand, structures are commonly employed to characterize models. On the other hand, structural relationships are used to connect models to the target according to users' intended scope.

Structuralist approaches to scientific theories have a long and respectable tradition in the philosophy of science. In particular, the semantic view of scientific theories and recent versions of structural realism have contributed to the philosophical interest in the role of structures and their connection to models. Which kind of structure to consider with respect to models, and how this structure is used and related to a target system in order for the model to "represent", is a crucial point in the relevant literature. In the paper, we focus on this very point and argue that a source of confusion in current debates has to do precisely with a misleading use of structures.

We find this use misleading in a twofold sense. First, in the literature the two levels at which the use of models (and related structures) takes place are seldom distinguished. Drawing on French's terminology (French 2012), we call these two levels the "object-level" and the "meta-level" of analysis. The object-level is that of working scientists, where scientific theories are elaborated and tested. At the "meta-level" of analysis, on the other hand, the results presented at the object-level are reconceptualized in terms of abstract structures such as sets or categories. The second sense in which the use of structures is misleading concerns the kinds of structures considered and their supposed linkage to the world. We argue for this point by using examples from physics, biology and economics. One particularly interesting case study is provided by the Ising model, because of its wide and interdisciplinary range of applications, from physics to sociology and genetics. With respect to physics, for example, recent works have questioned the explanation of the success of the model in accounting for the macrolevel phenomena that are exhibited by different kinds of systems undergoing phase transitions by appealing to some shared features or some common relevant causes. The situation becomes even more complicated when the Ising model is transferred e.g. to economics, where methods used in physics do not apply, and the traditional paradigm has been one of giving microfoundations to macrophenomena.

Philosophy of technique: Intellectual proximities between François Dagognet et Jack Goody

Eric Guichard (IXXI Enssib, France)

Contact: Eric.Guichard@enssib.fr

A few philosophers know François Dagognet, who was during the second part of the twentieth century a great specialist of technique. Some know Jack Goody, but this scholar was in fact an anthropologist.

This conference will precise the common ideas of these two specialists, their divergences, and mainly their contribution to a main problem of today: the internet, in front of which theorists are often helpless.

Experiment and Experience in the Humanities

Eva-Maria Jung (Department of Philosophy, University of Muenster, Germany)

Contact: eva-maria.jung@uni-muenster.de

Keywords: Philosophy of Experiment, Humanities

In this talk, I will focus on what I call the ‚experimental turn‘ in the humanities. During the last decades the reference to experimental methods has become widespread in many disciplines of the humanities which have usually been regarded as non-empirical. As an example, some new research programs have been labeled ‚experimental history‘, ‚experimental philosophy‘ or ‚experimental philology‘. Recent movements of the so-called ‚digital humanities‘ have furthermore led to the foundation of various ‚laboratories‘ in which so-called experimental research is conducted. But what exactly does it mean when scholars from the humanities regard what they do as ‚experimental‘?

In the first part of the talk, I will analyze how the notion of experiment is used within these new approaches by referring to some prominent examples from literary criticism and philosophy. As I will argue, there is no unique meaning of ‚experiment‘ or ‚experimental‘. Rather, at least three different meanings should be distinguished. First, ‚experimental‘ in its broadest sense can describe an unspecific way of exploring. In this sense, the term is not restricted to controlled method of scientific disciplines, but rather includes many kinds of everyday behaviour. Second, ‚experimental‘ can refer to a mental kind of investigation through thought experiments or mental simulations or other ‚armchair‘ methods. Third and finally, ‚experimental‘ can refer to already established experimental methods from the natural or the social sciences, which are either merely ‚imported‘ or integrated into the real of the humanities.

In the second part of the talk, I will address the question as to which consequences the recent developments in the humanities have for the philosophy of experiment. Drawing on some recent discussions in the tradition of the New Experimentalism, I will argue that the experimental turn in the humanities poses some challenges for the philosophy of experiment and leads to the fundamental question of how to distinguish empirical from non-empirical disciplines.

Physically Unrestricted Composition

Fabio Ceravolo (University of Leeds, United Kingdom)

Contact: prfc@leeds.ac.uk

Keywords: Metaphysics of Science, physical composition, unrestricted composition, natural laws.

Of the many challenges raised by Ladyman and Ross (2007) to the tenability of metaphysical propositions in the face of theoretical physics, the claim that physically informed answers to Van Inwagen’s (1991) special composition question will be highly disjunctive and *sui generis* has attracted little attention. The special composition question (SCQ) asks for circumstances that uniquely entail that some material objects compose. In the model I present, the answer is neither disjunctive nor *sui generis*: It is necessary and sufficient for composition that the existence of a composite does not falsify the natural laws, the predictive consequences and the observations associated with the theory true at the world where composition occurs.

Ladyman and Ross are correct in pointing out that the conditions associated to the application of compositional predicates in physics are highly varied and mutually irreducible. However, that each application of a compositional predicate counts as a legitimate answer to SCQ only follows if we have no other means of saying which things are composites aside from listing the physical

attributions of compositionality. I argue not only that we do in fact possess such means, but also that Ladyman's and Ross' literal approach suffers from an independent problem.

The literal approach is inconsistent with unrestricted composition, the thesis that any two objects whatsoever compose, as indeed physics has no names for sums of any two arbitrary parts. And this inconsistency seems ad hoc, for the attitudes of physicists towards arbitrary sums tend to be agnostic rather than eliminative. Elliot Sober (2015: ch. 1) calls the corresponding agnostic virtue the "razor of silence". I propose that the razor applies when, for a set P of natural laws, predictable consequences and direct observations, and for a set A of sentences stating the existence of a sum for every two objects, P entails neither the truth of all sentences in A ("everything whatsoever composes") nor the negation of some sentence in A ("some two things do not compose").

Elliot's razor opposes the usual eliminative version of Ockham's razor, which commands to eliminate overabundant sums. I argue that the eliminative razor is presently best avoided in the compositional case, as its commands are unclear. Indeed, if the razor instructs to eliminate all sums to which physics does not literally commit, then it contradicts the observation that physics recommends agnosticism rather than elimination. And if it commands the elimination of every object that is not necessary for the (non-trivial) truth of physical laws, then it is likely to eliminate all sums and lead to mereological nihilism.

Therefore, the best chance to combine agnostic judgements over arbitrary sums with a non-nihilist position is offered by embracing all sums insofar as their existence is innocuous to the background laws. I take up this thesis and observe that it is neither *sui generis*, nor disjunctive. Particularly, the view "updates" David Lewis' (1986, 1991) insight that it suffices for sums to exist that they are ontologically innocent, whereby ontological innocence is now understood as consistency with the laws.

Gettier thought experiments and the concept of knowledge

Fatih S.M. Ozturk (Pamukkale University, Turkey)

Contact: fsmozturk@pau.edu.tr

Keywords: knowledge, thought experiments, counterfactuals, metaphysical possibility, necessity

In *The Philosophy of Philosophy*, Timothy Williamson critically reflects on the methodology and subject matter of philosophy and argues that a priori conceptual investigation is not a source of armchair knowledge. Rather, it derives from an offline employment of our ordinary cognitive faculties that involve skills in applying concepts. For Williamson, the epistemology of metaphysical modalities is a case in point. Williamson first offers an imagination-based account of knowledge of counterfactuals and then goes on to argue, on the basis of a familiar logical equivalence between modalities and counterfactuals, that our cognitive skills that enable us to know counterfactual conditionals also enable us to know claims of metaphysical modality. Further, he suggests that this account can also be applied to thought experiments, because the epistemology of thought experiments is also a special case of the epistemology of counterfactuals.

On this view, a Gettier thought experiment is a valid modal argument with possibility claims and non-empirical counterfactual conditionals as premises. Suppose that (1) necessarily, knowledge is justified true belief. But (2) Gettier cases are possible. Also, (3) if there were an instance of the Gettier case, there would have been justified true belief without knowledge. So, (4) justified true belief without knowledge is possible. Therefore, since the premise (1) contradicts (4), (1) is false. For Williamson, the possibilities here are not conceptual but metaphysical. The premises (2) and (3) are neither a priori nor a posteriori. We evaluate them on the basis of an offline exercise of our imaginative ability to discriminate knowledge from its absence. Thus, (4), which is usually thought to have been arrived at intuitively, is to count as offline exercises of our imagination involving skills in reliably applying the concept of knowledge. So the Gettier cases should not be thought of as

inquiries into what's conceptually possible. They tell us only about metaphysical possibility and necessity, because the subject matter of epistemology is knowledge itself, not our concept of it.

In what follows I will argue that Williamson's metaphysical modalities first thesis does not entail that epistemology is not concerned with elucidating the concept of knowledge at all. We may perhaps rephrase philosophical thought experiments in counterfactual terms, but that does not show that they bear upon knowledge, and not our concept of knowledge. I have no quarrel with much of what Williamson says about the linguistic / conceptual wrong-turn in philosophy. My contention is that the claim that it is not full competence with concepts but our imaginative skills to reliably apply them that provides evidential basis for modal thinking does not entail that the concept of knowledge fails to capture the nature of knowledge. For, it is not evident that the state of knowing has a real essence that is not represented by our concept of knowledge. How can imagination reliably apply the concept of knowledge, if that concept fails to capture the nature of knowledge? So, Williamson has not yet shown that knowledge-first epistemology strips the concept of knowledge out of epistemology.

The Nature and Value of Scientific Disagreement

Finnur Dellsen (University College Dublin, Ireland)

Contact: finnurd@gmail.com

Keywords: The Nature and Value of Scientific Disagreement

Disagreement among epistemic peers is legion in science, and yet philosophers of science have paid scarce attention to the vexed epistemological questions that arise concerning such disagreement. These questions have been left almost entirely to epistemologists, presumably on the tacit assumption that the philosophical lessons about peer disagreement will carry over straightforwardly to the case of scientific disagreement. On the contrary, this paper shows that scientific peer disagreement deserves to be studied in its own right since paradigm cases of scientific disagreement differ from the everyday cases typically discussed by epistemologists both with regard to the nature of the disagreement and with regard to what sort of response is appropriate.

We begin by arguing that many cases of scientific disagreement are not best characterized in terms of scientists having conflicting doxastic attitudes (such as beliefs or credences). Instead, scientific disagreement often amounts to scientists accepting competing theories, where acceptance of a theory consists in treating it as given in the context of one's scientific endeavors, e.g. in one's explanations and predictions. One of the virtues of this conception of scientific disagreement is that it helps resolve an apparent paradox concerning scientific disagreement. According to a growing consensus among epistemologists, the rational response to discovering that one disagrees with an epistemic peer on a proposition P is to 'approach' the doxastic attitude of one's peer in some way, e.g. by suspending belief regarding P, or by bringing one's credence in P closer to that of one's peer. This might seem to imply that scientists should, on pain of irrationality, routinely abandon their favorite theories when they discover that a substantial number of their peers accept a conflicting theory. Since this is not what we in fact see in science, this would imply that scientists are systematically irrational according to the epistemological consensus on peer disagreement. However, this implication is blocked once we recognize that one may have reasons for continuing to accept a proposition even in the absence of good reasons for a having positive doxastic attitude towards it.

The latter half of the paper discusses two ways in which 'steadfast' responses to scientific disagreement – i.e. continued acceptance of theories in the face of widespread peer disagreement – may be conducive to the goals of science. First, we consider whether a steadfast policy can be argued, via the Condorcet Jury Theorem, to contribute to the reliability of the majority opinion within groups of scientists on whether a given theory is probably true. Second, we also consider whether adopting a steadfast policy reduces the risk of a true theory being rejected before the theory has

been thoroughly developed and its merits rigorously explored. We conclude that, all other things being equal, these considerations suggest that a policy of steadfastness contributes to the progress of science.

The evolution of complexity in living systems. New ideas for an old problem

Francisco Carrapiço (Centro de Ecologia, Evolução e Alterações Ambientais e Centro de Filosofia das Ciências, Departamento de Biologia Vegetal, Faculdade de Ciências, Universidade de Lisboa, Portugal)

Contact: fcarrapico@fc.ul.pt

The rise of biological complexity is one of the most intriguing problems of the natural world, as it still remains an open question. Associated with the origins and development of life, the manifestations of biological complexity are involved in the major key steps of evolution, namely in the transition of the prokaryotic level organization to the eukaryotic one, and in the emergency of multicellularity in organisms. The transition from the aquatic to the terrestrial environments is also another of its consequences, namely through the crucial role played by cooperative and synergistic mechanisms, which drive evolution in the establishment of biodiversity on Earth. The complexification of living systems was even present in the prebiotic environment of our planet and was also the base for the social humanization of our species. The emergence of evolutionary novelties and complexity requires new scientific concepts in order to be fully understood, and challenges the traditional selectionist hegemony, suggesting the presence of additional evolutionary mechanisms which are correlated with the presence of functional synergies. It was Peter Corning that in his 1983 important book "The Synergism Hypothesis: A Theory of Progressive Evolution" introduces and develops the hypothesis that synergies considerably contribute to the organisms' complexity, driving evolution towards new levels of organization and sophistication. In a simple way, synergies can be found all over the natural world and examples involving cooperative and synergistic relationships between different organisms are very common and enable the emergence of new novelties and competitive advantages. This process involving "synergistic selection" and "functional synergism", as Peter Corning coined them, were also considered or suggested by several other authors such as Constatin Merezhkowsky, Andrea Famintsin, Hermann Reinheimer, Ivan Wallin, Boris Kozo-Polyansky, René Dubos, Lynn Margulis and Jan Sapp. However, Corning demonstrated "that synergistic effects are also causal, and of central importance" in the evolutive process. This type of selection and processes are different from the traditional darwinian or neo-darwinian ones, namely "natural selection", which refers to an individualistic and competitive model without considering the importance of cooperative and symbiotic mechanisms in the web of life. Symbiosis is the main rule in nature and the presence of organisms living symbiotically and communicating each other are the structural base of evolutive success and a new level of hierarchical complexity organization in the web of life. In conclusion, the novelty of biological organization in evolution is the result of cooperative innovation as a whole, in which synergistic and cooperative effects produce a wide source of new and holistic advantages, driving populations and organisms to the emergence of new functional capacities and complexity.

Toward an Essence-based Theory of Disease

François Pellet (University of Muenster, Germany)

Contact: francois.pellet@uni-muenster.de

Keywords: Disease; normativism; naturalism; essence; modification

In the contemporary literature about the nature of disease we distinguish between two main theories of disease: one – labeled “normativism about disease” –, according to which disease is a vital negative value, the other – labeled “naturalism about disease” –, according to which disease is a biological dysfunction. These two theories rely on two different intuitions we have about what disease is.

Normativism about disease accounts for our intuition that attributing to a certain (part of an) organism the property “being diseased” is negatively evaluating this (part of the) organism, that is, attributing to it a negative value, where this negative value is a vital one, for we say that disease is what makes us die.

Naturalism about disease takes into account the intuition that, when we judge that a certain (part of an) organism is diseased, we mean by this that this (part of the) organism functions incorrectly (or is dysfunctional).

It is obvious that any complete theory of disease should take into consideration in a unified and coherent way both of these intuitions, that is to say that a plausible candidate for a theory of disease should be neither normativism nor naturalism about disease but both.

The purpose of this talk is to provide such a hybrid theory of disease - that we may label “essentialism about disease” –, according to which disease is a modification of the essence of a(n) (part of an) organism.

The talk is organized into two parts. The first part presents the above two theories of disease. The second part provides an original hybrid theory of disease.

I argue for the following definition of disease: x is diseased, only if x is dying (pro tanto) in virtue of a modification of x 's essence. Essentialism about disease is a two-fold theory of disease.

First, following normativism about disease, it specifies what a vital negative value is. According to essentialism about disease, a vital value is a thick value (or value-species) coupled with a non-axiological property F (or differentia) and falling under the thin value (or value-genus) “death”. The relationship between thick and thin values has been stated as follows: x has a thick value, only if x has a thin value (pro tanto) in virtue of possessing a non-axiological property F .

Second, after naturalism about disease, essentialism about disease defines a biological dysfunction as a type of biological function, where a biological function of x is defined as an essential property of x (e.g., the function “pumping blood” is part of the essence of the heart). Thus, by investigating the above link between disease and death, where x 's death may be defined as the loss of x 's essence, and by arguing that a biological function is part of the essence of the function bearer, we reach the conclusion that, as a biological dysfunction, disease is a modification of the essence of the disease bearer (which is our non-axiological property F). Put in a slogan, everything that is diseased (pro tanto) dies.

Metaphor and Scientific Knowledge Generation

Georg Friedrich (RWTH Aachen University, Germany)

Contact: georg.friedrich@rwth-aachen.de

Keywords: models, metaphors, epistemic value

Scientists tell us that one day our sun will become a red giant and much later a white dwarf. What is the exact meaning of this statement? Scientists also explain that we store memories in our brains and that one defining characteristic of the human consciousness is its capacity to process information. But how exactly is this possible? It seems to me that we cannot interpret these statements literally

because a literal interpretation would give rise to a whole series of other bothersome questions: What are white dwarfs? Can information be stored on biological material just as data is stored on a hard disk or wheat in a granary? It seems to be a better option to look for what physicists or psychologists really want to say. In other words, we have to offer an explanation of some scientific statements.

What is the real nature of scientific statements about white dwarfs and stored memories? I think that (i) a lot scientific explanations are metaphorical and (ii) that these metaphors make an essential contribution to the process of knowledge generation. Although physicists do not speak about the black hole metaphor or the big bang metaphor and even chemists do not speak about the hydrocarbon chain metaphor, this scientific statements seem to be metaphorical statements. At least, psychologists use the term "computer metaphor". And there are philosophers of science who think that there are scientific explanations which should not be understand literally but metaphorically (Boyd 1980). Boyd addresses the problem and he tries to explain how metaphorical expressions work and how they gain meaning in science. An other important point is that some scientists use metaphors without actually knowing exactly what they mean and that is highly unsatisfactory.

How work metaphorical modals in science? My own starting point is the fact that we use metaphors and understand them mostly. On this basis I can make some important remarks on how we understand metaphors and why we use metaphors. Do we have any advantages using metaphors? Is there any epistemological value using metaphors? In other words: Do metaphors contribute to the process of knowledge generation in science? I think that this is the case. And if metaphors make a contribution to scientific knowledge then I would like to call them knowledge-constitutive metaphors. Following Boyd there are two kinds of metaphors in scientific theories: theory constitutive metaphors and non theory-constitutive metaphors. Both kinds of metaphor are important in science: we need metaphors in scientific explanations. Non theory-constitutive metaphors play an important role explaining scientific theory to laymen. Empirical studies (Moser 2004, 333) suggest that metaphors have a special motivational force that can be used in the transmission of knowledge. Theory-constitutive metaphors are cognitive tools in a much stronger sense. These metaphors form an essential part of scientific theories, they are the basis of some scientific models and have a central position in both, in the formulation and explanation of scientific theories. These metaphors are one starting point of scientific knowledge.

More than Fitness: a robustness-based proposal of classification of evolutionary changes.

Giorgio Airoidi (UNED, Spain)

Contact: airoidi@tin.it

Keywords: Adaptationism, Fitness, Robustness, Natural Selection, Evolutionary Mechanisms

The adaptationist program interprets phenotypic traits as moulded mainly through a fitness optimization process driven by Natural Selection, whose action is exogenous, progressive and lineal (e.g. Optimization Programs, Grafen's Formal Darwinism Project). Against this view that Natural Selection can explain all traits and has unlimited capacity to produce new ones, alternative mechanisms (endogenous, non-progressive and non-lineal) have been proposed to explain novel architectures: either Genetic-based (Wright's shifting-balance theory; Wagner's genotypic networks), or Phenotypic-based (Gould & Vrba's exaptations) or Systemic-based (complex systems laws; developmental constraints).

This abundance of candidate explanations for traits reflects the multiplicity of evolutionary facts needing explanation. Adaptation of the colour of the *B. betularia*'s wings in response to environmental changes is a radically different event than the speciation of the Galapagos finches or the appearance of a novel function like flight. Adaptationist models based on a scalar measure like fitness can track

the former; the latter ones are better explained by other mechanisms acting on robustness, defined as 'disposition to develop new traits, functions and architectures to adapt to new environments' (A. Wagner).

The proposed classification of evolutionary changes is based on a bi-dimensional design space, having fitness on the horizontal axis and robustness on the vertical one. In this space, a population is identified by a 'cloud' of points (each representing an individual). The cloud's shape and position change generation after generation following changes of fitness and robustness of the population individuals due to the action of Natural Selection and other mechanisms and forces. For example, Natural Selection tends to increase the population average fitness (Fisher's fundamental theorem), with no effect on robustness (the cloud moves to the right), and to reduce the population fitness variance (the cloud's surface diminishes). The Zero Force Evolutionary mechanism (McShea & Brandon), on the other hand, acts upon variances, but do not change averages: the cloud does not move, but its surface increases. Exaptations, by definition, increase robustness: the cloud jumps upwards without changing its surface. Complex-systems self-organizing rules act mainly upon robustness, increasing both its average and its variance (the cloud moves upwards and its surface increases).

Evolutionary changes can be thus factorised as consecutive movements along both axis. For example, evolution of flight starts with the appearance of the new trait 'feathers', caused by genetic drift, that grants better thermoregulation, thus increasing robustness (vertical upward movement). Feathers' impact on fitness is decided by Natural Selection, which moulds and spreads the trait within the population (horizontal movement). At some point, the new optimized trait allows for a primitive and rudimentary flight, thus becoming an exaptation: robustness increases again (vertical upwards jump). If flight is advantageous, Natural Selection furtherly optimizes feathers shape and quantity (horizontal movement). The global movement from the initial to the final population phenotype is therefore the sum of several partial evolutionary events, plotted as horizontal and vertical movements, each fuelled by a different evolutionary force: only horizontal ones are due to Natural Selection and are captured by fitness changes alone, as described in adaptationist models.

Reclaiming Objectivism in Art Research

Goran Pavlic (University of Zagreb, Croatia)

Contact: go.pavlic@gmail.com

Keywords: art research, cognitive turn, falsifiability, objectivism, constructivism

Abstract: Since his seminal attempts at introducing cognitive studies perspective in the research of theatre and performance phenomena, Bruce McConachie (2007, 2008) has remained intransigent in advocating falsifiability as the only viable principle of evaluating theories deployed in the field of theatre and performance studies. Although significant progress has been made in that direction, the two most representative editions concerning research methods and theoretical approaches in arts and humanities - *The Routledge Companion to Research in the Arts* (2011) and *Research Methods in Theatre and Performance* (2011) – barely mention either cognitive studies or falsifiability.

I argue that reasons for this omitting lie in the unacknowledged anti-realist prejudice that permeates most of the humanities. In order to be able to cope with ever-growing amount of empirical knowledge, I propose two-step approach: 1) scholars in theatre and performance studies should abandon the radical constructivist premises of their research programs; 2) such an endeavor requires basic re-articulation of the ontological status of the artwork.

The Philosophy of Science and the Rhetorical Paradigm

Henrique Jales Ribeiro (University of Coimbra, Portugal)

Contact: jalesribeiro@gmail.com

Keywords: Foundationalism, interdisciplinarity, philosophy of science, Quine, relativism, rhetoric

In this paper, I study the idea of the end of the philosophy of science, announced by some of the most important philosophical trends in the second-half of the 20th century, as was the case of the theories of Quine, Feyerabend, Rorty, and others. I hold that the problem at stake, in all these cases, was not so much the end of the "philosophy of science" properly so called, i.e. as a branch of philosophical research, but the end of philosophy itself in the classic and foundationalist sense coming from Descartes and Kant in the 17th and 18th centuries respectively. As other fields of philosophy, the philosophy of science has now become "post-modern", that is to say, a field without truly metaphysical foundations or special privilege(s) vis-à-vis other approaches on science, like those of history and sociology that is supposed to contribute to an ongoing interdisciplinary research, which incorporates several and more or less connected inputs. In some sense, this was just what Quine had foreseen, in the 1960s with his views on "naturalized epistemology". Indeed, our old concept of what we are doing when we do "philosophy of science" has become not only very ambiguous but ultimately, and given its historical assumptions from the 17th century onwards unacceptable. On the other hand, it seems to be consensual among philosophers today that a post-modern, anti-foundationalist and relativist concept of science, as that of Feyerabend and Rorty, cannot be entirely accepted, and that learning the lessons of the past it should be reviewed. Following my previous research on the subject, I describe and analyse some recent views and trends in that direction, as the one provided by the rhetoric of science.

Gestalt and anomaly: the aesthetics of theory selection and the logics of art

Ian O'Loughlin (Pacific University, United States)/ Katie McCallum (University of Brighton, United Kingdom)

Contact: ian.oloughlin@pacificu.edu

Contact: k.mccallum@brighton.ac.uk

Keywords: Theory change, aesthetic judgments, truth, incommensurability, particularism

Especially in the wake of Kuhn, researchers have been devoted to understanding the aesthetic judgments practiced in theory assessment. If aesthetic criteria play primary roles in selection, then it appears that either aesthetic judgments must track truth, or theory change must be problematically independent of truth. The former has garnered notable defenses. Peter Kivy argues that aesthetic and epistemic judgments both measure representation of the world; James McAllister argues that successes of past theories refine scientists' aesthetic sensibilities, enabling an "aesthetic induction" with a tendency to track truth. Both are predicated on a relatively stringent realism, but importantly, as Cain Todd articulates in a more recent article, each of these approaches reduces the putatively aesthetic to straightforwardly epistemic considerations, leaving no room for genuinely aesthetic judgments. Thus if we accept Kivy's, McAllister's, or Todd's view, we ultimately fail to heed Larry Laudan's exhortation for the "need to talk about science in categories that go well beyond the merely epistemic."

Robust studies comparing aesthetic criteria in art and science are lamentably rare. The meta-theoretical virtues most commonly cited in philosophy of science and mathematics when discussing aesthetic criteria are simplicity and symmetry, but these cannot encompass anything but a severely impoverished view of the aims of art. However, there are overlooked elements among

the aesthetic criteria for art that are importantly parallel to elements in theory assessment. Proust's dictum that great artworks allow us to inhabit new worlds, perspectives inexorably different from our own, is strikingly reminiscent of Feyerabend's explications of the basic incommensurability of the worldviews conferred by competing scientific theories—and importantly, this continuity has little to do with symmetry or simplicity.

One strain of neo-Kantian aesthetics emphasizes the harmonious internal logic of a piece of art that exists, as Iris Murdoch writes, "in accordance with a rule we cannot formulate." On Murdoch's neo-Kantian view, the artist aims to create something self-contained, independent, and infinitely fertile despite its particularity. The particularist rejection of general principles under which positive judgments of art can be subsumed, following Arnold Isenberg, and Frank Sibley, locates the artwork as something that can be explored, explained, and judged only in its own terms. This characterization, that a work of art aims to offer a coherent perspective that allows fertile and meaningful exploration according to a self-contained logic, is the articulation of aesthetic criteria that are reminiscent not only of Feyerabend's presentation of science, but of other meta-theoretical virtues in theory assessment: fecundity, coherence, and productivity. These judgments may thus be candidates for being genuinely aesthetic and also genuinely truth-apt—especially on coherentist or deflationist understandings of truth—but not because one of these reduces to the other: rather, on this view, judgments about internal coherence and meaningful productivity in accord with the system of the perspective in question just constitute judgments of goodness in art and aptness in theory. If this is so, then at least some aesthetic judgments in math and science are neither in competition with, nor reducible to, more straightforwardly epistemic judgments.

Unveiling scientific concepts: the notion of space

Isabel Serra (CFCUL, Portugal) / Baudouin Jurdant (CFCUL, Portugal)
/ Maria Elisa Maia (CFCUL and IICBRC, Portugal)

Contact: isabelserra@netcabo.pt

Contact: bjurdant@gmail.com

Contact: elisamaia@gmail.com

Keywords: scientific concepts, public understanding of science, space

Abstract: In a letter from Einstein to Hadamard (1949) we can read that "Words and language do not seem to play any role in the mechanism of my thought. Psychic entities that serve as elements in thought are certain signs and more or less clear images which can "at will" be reproduced or combined."

Einstein's words are undoubtedly a good starting point when dealing with the public understanding of science. Actually, communication of scientific knowledge happens not only by words but also by other instruments such as formulas, diagrams, figures or tables often essential in understanding and describing phenomena. What role do all these symbols that complement and often replace words in the description and explanation of phenomena? This is a too broad question to be debated here, but having it in mind, attempts will be made-to clarify some of its aspects.

First of all it is important to state that the symbolism serves to better understand the reality but can also confuse it or even mask it, rather than to clarify. In this communication we will precisely question the epistemological value of some instruments in the public understanding of science.

The Cartesian space, for instance, is a mathematical tool with a long history behind it, and that is used both in the natural sciences and in the humanities. However, being the space a concept from day to day its use in the context of science popularization leads to misunderstandings. In this case, as in many others, science only touches upon the surface of everyday language, thus managing a place inside the common sense. But this place is likely to become a "place of not knowing." In science, the dimensions of space define a continuum from the microcosm to the macrocosm, from

atom to galaxies. Moreover there are also various meanings of the concept of space in science, which become through popularization as many other "places of not knowing".

We will try to present a critique of the popularization of the concept of space using various authors who have studied the problem such as Ernst Mach who developed the notion of physiological space and the difference between physiological space and geometric space.

DNA spillover, or how a genetic test can change the meaning of life

Ivo Silvestro (Università degli Studi di Milano, Italy)

Contact: ivo.silvestro@unimi.it

Keywords: DNA, Genetics, Public understanding of science

Genetic tests are everywhere: no longer confined to particular contexts – such as the forensic use of genetic fingerprinting –, a layperson may encounter, directly or through the media, diagnostic exams for actual and potential diseases, paternity (and, less often, maternity) tests, and many "direct to consumer" genetic tests for genealogy or health-related issues, such as nutrition or athletic activities (Su 2013).

This wide and often unavoidable presence has played an important role in the social perception of genetics, in particular considering the effect known as "DNA spillover" (Nelson 2016), which occurs when an individual's experience with one domain of genetic analysis informs her understanding of other forms.

The problem is that the science behind such tests is not always solid, and in some cases is in fact spurious. So the claim that "DNA don't lie", which is justified when it comes to DNA fingerprinting (at least in the case of uncontaminated samples), is also often applied to less reliable ancestry tests and to (currently) scientifically feeble nutrigenomic tests.

To see the consequences of this allure of confidence and certainty, it is necessary to highlight exactly what all these genetic tests have in common: like the three Norns of Nordic mythology, they tell stories about the present, the past, and the future of an individual, her family, or ethnic group. The idea that DNA represent the essence or the destiny of an individual is widely exploited in the marketing of these tests: "Welcome to You" and "Find out what your DNA says about you and your family" (23 and me), "Discover what makes you uniquely you" (ancestry.com), "Trace Your DNA. Find Your Roots" (African Ancestry), "Know Yourself" (Sure Genomics).

The widespread availability of genetic tests is changing the way we think about DNA: no longer a blueprint of an organism conceived as a machine, but the soul (in the Aristotelian sense) of a person. In a certain sense, we have come back to vitalism and see a new refusal of mechanicism, despite the fact that the "vital spark", now, is a macromolecule.

The problems of the blueprint metaphor for DNA are well understood (Pigliucci and Boudry 2010, Pigliucci 2010), and in recent years these metaphors have been used far less in scientific communication. Instead, the impact of the soul metaphor on the public understanding of science is not clear. Our suggestion is that this could be a good metaphor – for example appropriately accounting for the complex genotype-phenotype relation –, but there is a great weakness to face: the DNA mystique (Nelkin and Lindee 2004), the idea that genes are a sort of sacred and untouchable entity. This mystical conception of DNA is present in many campaigns against gene patents and genetic engineering.

What is symbiosis? A philosopher's answer

Javier Suárez (University of Exeter, United Kingdom)

Contact: jsuar3b@gmail.com

Keywords: symbiosis - emergence - ecology - evolution - evolutionary novelty

Symbiosis research is usually presented as a prominent field of research both in biology, where symbiosis is supposed to present a revolutionary challenge to Evolutionary Theory (Brucker & Bordenstein 2013; Rosenberg & Zilber-Rosenberg 2013; Kiers & West 2015), and in philosophy of biology, where it is assumed to question many of our traditional assumptions about topics like biological individuality (Dupré 2012; Pradeu 2012; Bouchard & Huneman 2013), fitness (Bouchard 2013, 2014), or natural selection (Booth 2014; Author). However, despite the general agreement on the importance of symbiosis both for biology and philosophy of biology, a satisfactory definition of symbiosis has not been provided yet, as biologists have frequently noted:

"Symbiosis has probably created the greatest quandary in the history of biological terminology. No other term has experienced as much confusion, variation in definition and controversy." (Martin & Schwab 2013: 32).

"This brings me to the most frustrating difficulty in the field of symbiosis –the lack of a single universally accepted definition. Disagreement over definitions has led to disputes about which relationships are symbioses and, consequently, a lack of consensus about the common features of symbiotic systems" (Douglas 2010: 4; emphasis added).

In order to mediate in such a dispute, in this paper I will discuss and argue against the two main definitions of symbiosis offered: (1) to equate symbiosis with any kind of biological association (mutualistic, commensalist or parasitic), defining it as "unlike organisms [organisms of different species] living together" (Margulis 1990: 673); (2) to equate symbiosis with mutualism or to understand it as a subclass of mutualistic associations (Douglas 2010; Leigh 2010: 2510). Against (1), I will say that it is too permissive, and allows for the inclusion of cases that we would not like to consider as symbiosis, such as the pathogenic association of HIV with humans, for instance. Against (2), I will argue that it is too restrictive, excluding cases such as Wolbachia-mediated isolations, which we normally consider as symbiotic (Werren et al. 2008).

Finally, I will offer an alternative definition of symbiosis according to which symbiosis is any biological process among two or more organisms of different species where: (1) there has been an acquisition (by engulfment, metabolic dependence, etc.) of one organism by another (intimacy) and, (2) as a consequence of a long-term evolutionary interaction between the organisms involved (constancy), (3) new structures and metabolic/reproductive routes that would have not appeared otherwise emerge (emergence of new traits), (4) making the association necessary for at least one of the organisms involved (obligate character).

I will argue that my definition of symbiosis fulfils the three main desiderata that a definition of symbiosis has to fulfil: First, it allows tending a bridge between ecology and evolution (Paracer & Ahmadjian 2000: 13); second, it is suitable to include cases of developmental symbiosis (Gilbert et al. 2015); finally, it avoids the accusations of being too restrictive or too permissive.

Pictorial Understanding

Jens Dam Ziska (University of the Faroe Islands)

Contact: jens.dam.ziska@gmail.com

Keywords: Depiction, epistemic value, understanding, scientific modelling

Many philosophers argue that when we appraise the epistemic value of images, we must accord a special status to photographs. According to Kendall Walton (1984), photographs are special, because they provide an indirect means of seeing the objects depicted. According to Robert Hopkins (2012), photographs are special, because they allow us to perceive that certain facts obtained at a certain point in time. According to Jonathan Cohen and Aaron Meskin (2004), photographs have special value as evidence (which paintings and drawings lack), since they bear an objective probabilistic relation to the visually accessible properties of the represented objects.

I shall not quarrel about the details of each these proposals. What I shall object to, however, is that none of these proposals account for the full extent to which images are epistemically valuable. Instead, Walton, Hopkins, Cohen and Meskin only manage to explain why pictures have epistemic value by explaining how pictures inherit this value from the deliverances of an external source of epistemic value – in this case, perception. According to Walton, images are valuable, because they extend our means of perception. According to Hopkins, Cohen and Meskin's approach, photographs are valuable, because they preserve some of the perceptible qualities of the pictured scene.

I shall argue that this does not do justice to all the ways in which pictorial representations can be epistemically valuable. Images do not only have derivative value as harbingers of perception. They can also have intrinsic value as an independent source of understanding. In so arguing, I follow a similar path to Gottfried Boehm (1994) and Horst Bredekamp (2005, 2015) both of whom try to explain how images can facilitate a distinct kind of understanding which cannot be expressed in non-pictorial form. My path is a little different, however. Whereas Boehm and Bredekamp use case studies from the history of science to make their point, I shall rely on tools and concepts from the philosophy of science. In particular, I shall argue that images can be an important source of understanding by providing insightful ways of modelling the world and the relations we bear to it. This way, we may not only rehabilitate the epistemic value of pictures. We may also discover one way of bridging the gulf between art and science.

References

- Boehm, G. (ed.) (1994) *Was ist ein Bild?*, Munich: Vilhelm Fink Verlag.
- Bredekamp, H. (2005) *Darwins Korallen: Die frühen Evolutionsdiagramme und die Tradition der Naturgeschichte*, Berlin: Wagenbach.
- Bredekamp, H., Dünkel, V., & Schneider, B. (eds.) (2015) *The Technical Image: A History of Styles in Scientific Imagery*, Chicago: Chicago University Press.
- Cohen, J. & Meskin, A. (2004) "On the Epistemic Value of Photographs", *The Journal of Aesthetics and Art Criticism*, Vol. 62, No. 2, pp. 197-210.
- Hopkins, R. (2012) "Factive Pictorial Experience: What's Special about Photographs?", *Noûs*, Vol. 46, No. 4, pp. 709-731.
- Walton, K. (1984) "Transparent Pictures: On the Nature of Photographs", *Critical Inquiry*, Vol. 11, No. 2, pp. 246-276.

Introspective reports as data: can we use subjective experience as evidence in science?

Joana Rigato (Champalimaud Research/ CFCUL, Portugal)

Contact: joana.rigato@neuro.fchampalimaud.org

Keywords: Introspection, conscious experience, neuroscience, first-person methods, reliability, heterophenomenology, neurophenomenology

After almost a century in which most of the studies of the mind and brain strived to do away with subjectivity, for the past two decades many cognitive scientists regained interest in the introduction of first-person methods as a fundamental component of their empirical research. This was motivated by the realization that a subject's personal experience is a precious source of information about her mind and cannot be accessed directly by any method other than introspection. Such contention is at the basis of the recent field of Neurophenomenology*, whose research is guided by the belief in the advantages of enriching scientific research programs with the triangulation of subjective reports, behavioral observations and neuro-imaging (or other neurophysiological) data.

In my presentation, I will go through some of the neurophenomenological studies done so far, and focus on the ongoing debate about the risks and merits of "Trusting the Subject"**, namely in what concerns the private status of introspective reports and their unreliability. The main questions are: How can a public and replicable method provide intersubjective access to private data? How can one avoid confabulation when using introspection? I will assess several techniques that have been proposed, tested and discussed in the literature recently, as a way to tackle these problems: Vermersch and Petitmengin's Elicitation Interview Method, Lutz and Thompson's use of meditators or trained subjects and Hurlburt's Descriptive Experience Sampling (DES). Finally, I will relate DES with Dennett's heterophenomenology and show that the former manages to address most of Dennett's criticisms regarding the risks of introspection, without having to embrace the most polemical aspects of his proposal.

* Varela, F. (1996), "Neurophenomenology: A methodological remedy to the hard problem", *Journal of Consciousness Studies* 3: pp.330-350.

** After the title of the two interesting volumes edited by Jack and Roepstorff.

References

- Dennett, D.C. (1991), *Consciousness Explained*, Boston: Little Brown.
- Dennett, D.C. (2007), "Heterophenomenology reconsidered", *Phenomenology and the Cognitive Sciences* 6: pp.247-270.
- Goldman, A.I. (2004), "Epistemology and the Evidential Status of Introspective Reports", *Journal of Consciousness Studies* 11: pp.1-16.
- Hurlburt, R.T., Heavey, C.L. (2006), *Exploring Inner Experience. The descriptive experience sampling method*, Amsterdam and Philadelphia: John Benjamins Publishing Company.
- Jack, A., Roepstorff, A., eds. (2003), *Trusting the Subject? Volumes 1 and 2*, Exeter: Imprint Academic.
- Lutz, A., Greischar, L.L., Rawlings, N.B., Ricard, M., Davidson, R.J. (2004), "Long-term meditators self-induce high-amplitude gamma synchrony during mental practice", *PNAS* 101 (46): pp. 16369-16373.
- Lutz, A., Thompson, E. (2003), "Neurophenomenology. Integrating Subjective Experience and Brain Dynamics in the Neuroscience of Consciousness", *Journal of Consciousness Studies* 10: pp.31-52.
- Petitmengin, C., Navarro, V, Le Van Quyen, M. (2007), "Anticipating seizure: Pre-reflective experience at the center of neuro-phenomenology", *Consciousness and Cognition* 16: pp.746-764.
- Piccinini, G. (2011), "Scientific Methods Ought to Be Public, and Descriptive Experience Sampling Qualifies", *Journal of Consciousness Studies* 18: pp. 102-117.

Opposing models of engagement in scientific research: lessons of an ignorant schoolmaster

João Duarte (CFCUL, Portugal)

Contact: cao.joao@gmail.com

Keywords: intellectual emancipation, engagement in scientific research, Jacques Rancière, implicated science, models of engagement, education

Currently there are many reports of conflicts between sciences and societies that fuel emergent approaches to scientific research. From the fields of Philosophy of Science and Science and Technology Studies (STS) there's several impetus to re-invent how sciences are related to expertise and democracy. Such is the case of Isabelle Stengers arguments in her seminal work *L'invention des sciences modernes* (Stengers 1993) or the claim of an implicated science having as central epistemological value the engagement of citizens (Coutellec 2015). In this regard, models have been created, as the one of a post-normal science by Funtowicz and Ravetz or the emergence of a 'mode 2' of knowledge production by Nowotny, Gibbons and colleagues (Funtowicz Ravetz 2000; Gibbons, Limoges, Nowotny et. Al. 1994). Still, opposing viewpoints accuse the theoretical fragility of multiple extensions and unhappy generalisations that these models produce (Marec 2009), or the need for distance, that the special social position of science demands (Collins 2014). These opposing viewpoints are concerned to what does this inclusion of laymen mean for scientific research. To further elaborate on this conflict, the lessons of an ignorant schoolmaster are taken into regard. Jacques Rancière's *Le Maître Ignorant: cinq leçons sur l'émancipation intellectuelle* (Rancière 1987) presents a merge between the author, Rancière, and this exotic schoolmaster from the turn of the nineteenth century, Jean-Joseph Jacotot. This book shows with clarity how from the pedagogical relation of science to ignorance, another sprouts, that relates stultification with intellectual emmanicipation.

Evaluating the impact of 4E Cognition on philosophy of science

João Fonseca (IFILNOVA Universidade Nova de Lisboa, Portugal)

Contact: manatim.detective@gmail.com

Keywords: 4E Cognition, representations, reference failure, scientific realism

Recent developments in the philosophy of cognitive sciences stress radically the role of the environment and the body in cognition itself. This new paradigm of has been dubbed '4E Cognition' (Embodied, Embedded, Enacted, and Extended) and questions some of the most central dogmas of the classical view such as the representational status of mental and linguistic items.

Strangely enough, few have been the philosophers of science considering the impact of the adoption of such paradigm for their discipline. An exception to this can be find in Paul Churchland's early work where he even anticipates some of the views and stances adopted by this new brand of cognitive scientists. Therefore Churchland's perspectives constitutes a possible path to be explored in the demand for an evaluation of the impact of 4E Cognition in philosophy of science.

I will first present some of those Churchland's early views and compare them to the more contemporary advocates of the new paradigm in cognitive science. Then I will rephrase some of those views in order to present an argument in favor of the adoption of the 4E Cognition paradigm in the context of philosophy of science. In short, I intend to use some of Churchland's early comments to show how the adoption of an embodied and enactive perspective can solve the apparent 'puzzle' in philosophy of science concerning the existence of empirically well succeeded scientific theories but whose theoretical terms fail to have any relation of reference to the world (eg, 'luminiferous

aether' and 'phlogiston' theories). Following some of Paul Churchland's suggestions we can conceive of an embodied/enactive solution to this problem. The central assumption is that, according to 4E Cognition, there are always sensorimotor relations to the world in any significant 'scientific' endeavor even if those scientific theories fail the relation of reference between their theoretical terms and an a mind-independent external reality (i.e., even if they are false). The supposedly primitive relation of linguistic reference is only derivative in relation with a much more fundamental sensorimotor involvement. In an enactive view, competing scientific theories correspond just to different sensorimotor engagements with the environment.

However, since institutional science still uses representational apparatus such as language, I will argue that the main consequence of adopting a 4E Cognition view for philosophy of science should not be a radical departure from such classical representational devices but rather a reevaluation of the metaphysical assumptions underlying many of those procedures, namely a commitment to scientific realism. What is needed is a dismissal of those metaphysical realist assumptions and an adoption of stances consistent with the more pluralist and perspectivist consequences of the 4E Cognition approach. I end the talk precisely by exploring these consequences and briefly presenting a philosophical proposal concerning the nature of natural kinds and scientific taxonomy compatible with the pluralist and perspectivist consequences of the 4E Cognition paradigm.

Interactivist Biosemantics: Ramsey's Principle Naturalized

João Pinheiro (CFCUL, Portugal)

Contact: joaopinheiro@hotmail.com

Keywords: Interactivism; autonomy & anticipation; internal relations; true contents & dynamic presuppositions; success conditions & truth conditions; Success Semantics; Ramsey's Principle; Biosemantics.

Interactivism [e.g. Bickhard 2009; Hooker 2009 & 2011; Bickhard & Christensen 2002; and Christensen & Hooker 2000] is a theory-model of autonomy from which a definition of biological functions can be derived. Namely, biofunctions are those causal powers of mechanisms or systems that are viably preserving organisms' autonomy, i.e., those that actually serve the continued flow of organisms' recursive self-maintenance powers qua nonstationary and stable far from thermodynamic equilibrium dynamics.

At the heart of this theory-model is the recognition that, because they are not isolated systems, there is an internal relation between the biosystems' recursive self-maintenance powers and the powers of the environment in which they are embedded and under which these powers are rendered viable preservers of their bearer's autonomy. More formally, if a recursive self-maintenance power x_1 exists, then it necessarily exists a power x_2 , a structure, or set of environmental powers x_n that sustain that power x_1 as recursive self-maintaining.

This ought to be in principle applicable to any biofunction. If representations have biofunctions, then, according to Interactivism, it is expected that whatever powers content-bearers (such as beliefs and desires) have in enabling autonomy preserving actions, will be as such and at least partially in virtue of their internal relation with those specific environmental conditions that render them successful enactors of their bearers recursive self-maintenance. Trivially, if contents are true whenever the state of the World of which they are about verifies, it will follow that, as a theory-model of Representation, Interactivism entails the existence of an internal relation between true contents and their evolutionary success conditions (being viability a necessary qualification of evolutionary success).

There is another pragmatist theory of content named Success Semantics (SS) [e.g. Whyte 1990; Papineau 1987 & 1993; and Dokic & Engel 2001 & 2005] that has for a founding principle an internal

relation closely resembling this one. SS holds that there is an internal relation between beliefs whose contents are true and the success of actions guided by these beliefs in such a way that we can equate their truth conditions with the success conditions of actions guided by them. This internal relation has been formally stated as the Ramsey's Principle: «a belief's truth conditions are those that guarantee the success of an action based on that belief whatever the underlying motivating desires» [Dokic & Engels 2001:46].

In this talk we will present the main tenets of these two theory-models and argue for their complementarity. The defence of their complementarity entailing that Interactivism is apt for the naturalization of SS. The result will be an Interactivist Biosemantics that can be presented as a tripartite theory-model of Representation according to which there is: (a) an internal relation between anticipated interactions (or representation(s)) and their dynamic presuppositions about the environment (or content(s)); and (b) an internal relation between true contents and their truth conditions qua pragmatic-evolutionary success conditions, the latter being the power(s) of the environment the dynamic presuppositions anticipate and are about, independently of their bearers' motives for action.

Epistemic vs. Dialectic: on the Function of Thought Experiments

Jorge Ornelas (Universidad Autónoma de San Luis Potosí, Mexico)

Contact: jornelass@gmail.com

Keywords: Thought Experiments, Counterfactuals, Williamson, Imagination

Contemporary literature on the epistemology of thought experiments can be divided as follows. On the one hand, we have the orthodox position (Brown: 2004, Norton: 2004, Nerssesian: 2012, Sörensen: 2003, Williamson: 2005 y 2015, among others): Thought experiments are genuine epistemological devices since through them it is possible to justify (or refute) a philosophical or scientific thesis. On the other hand, we have skeptical positions regarding the putative epistemic power of thought experiments (Kuhn: 1979, Buzzoni: 2012, Gooding: 1994, Einstein: 1917, 1918 y 1920). According to this position, thought experiments only have some kind of dialectic utility: to illustrate a philosophical or scientific thesis, to shape our conceptual scheme, to get an understanding of and acquaintance with some theory, etc.

In this paper, I try to show two things: (1) that an epistemological (or cognitive) question lies behind this debate, namely, which are the cognitive mechanisms involved when we reason through a thought experiment? Without a satisfactory answer to this question, it is not possible to establish any epistemic function for thought experiments. (2) I analyze Williamson's (2007 and 2016) answer to the aforementioned question — which argues that imagination is the reliable cognitive capacity behind thought experiments — and raise three objections to it.

1) Imagination: factual vs. offline

Here I try to show that Williamson's treatment of imagination exhibits an essential tension: In order to assure the sui generis character of imagination (relative to perception), Williamson (2007: 187) affirms that imagination has an offline application when verifying the premises of a thought experiment, which — from my perspective — undermines its factual character, essential to its putative epistemic function.

2) The temporal directionality of counterfactuals

For Williamson (2007 and 2016), all thought experiments are counterfactuals and they are temporarily directed to the future; that is why they allow us to express predictions and expectations from a cluster of theoretical assumptions. I give some grammatical and logical reasons to refute this claim, in particular — and following Iatridou (2000) — I try to show that not a single counterfactual is directed to the future.

3) Imagination, adaptation, and a priori biology

Williamson (2016) tried to establish that the factual character of imagination is a result of its evolutionary origin: Imagination is the result of an adaptive process oriented to truth. Against this claim I try to show two things: First, that Williamson does not have any empirical evidence to sustain this claim, and second, that even if his hypothesis could be defended as the best explanation, we have at hand another explanation as plausible as Williamson's: Imagination is the result of an "exaptative" process (Gould & Vrba: 1982).

In light of these objections, I conclude that Williamson's defense of the epistemic power of thought experiments fails, and this outcome could be read as an indirect defense of the skepticism regarding thought experiments.

Epistemological Issues on Machine Learning and Artificial Intelligence

Jose F. Quesada (University of Seville, Spain) / Angel Nepomuceno (University of Seville, Spain)

Contact: jquesada@us.es

Contact: nepomuce@us.es

Keywords: Epistemology, Artificial Intelligence, Machine Learning, Abduction

Since its very beginning, Artificial Intelligence has been an inspiring and thought-provoking field for different philosophical studies. Many parallel problems, structures, and strategies can be drawn between Artificial Intelligence and Philosophy. In particular, between Epistemology and Artificial Intelligence, and between Machine Learning and Philosophy of Science.

Applying a diachronic approach, it is worth mentioning the connection between the "production system" approach and a normative model of knowledge and deduction. A production system consists of four main elements: A set of conditional rules. A knowledge database containing the relevant information for the problem under consideration. A control strategy that selects and prioritize the rules to be applied. And a rule applier: a computational module that implements the control strategy and executes the corresponding action. This approach highlights many parallel features with a normative and deductive vision of epistemology. The work by Hayes, McCarthy and Sloman in the 70s emphasizes these connections. "It is at first sight curious that the philosophical activity of trying to understand aspects of human thought and language should have so much in common with the activity of designing intelligent machines" (Sloman 1979).

Similarly, many parallelisms can be established between Machine Learning and Philosophy of Science. Machine Learning has recently captured the attention of the media and general public. However, the idea of a machine that can learn already appears on the 1950 paper "Computing Machinery and Intelligence" by A. Turing, in his answer to Lady Lovelace's objection about the creativity on a programmed system. According to Tom M. Mitchell (1997) "a computer program is said to learn from experience E with respect to some class of tasks T and performance measure P if its performance at tasks T, as measured by P, improves with experience E".

Williamson (2010) suggests a "clear analogy between hypothesis choice in science and model selection in machine learning." Although science is commonly more interested on explanation, while machine learning is focused on prediction, for Williamson both scientific theorising and computational modeling are but two applications of a more general form of reasoning. Quite interesting, this general form of reasoning is "abductive inference or abduction". Therefore, Machine Learning-based trends on Artificial Intelligence correlate with an abductive approach to Science. This connection has created, among others, the idea of "automated scientific discovery" or "scientific machine learning".

Globally speaking, Machine Learning algorithms try to capture models and regularities from data found on the training set, so these models can be applied to new, out-of-data sample. But, is learning a feasible process? In "Learning from data", Abu-Mostafa et al (2012) critically discuss the mathematical feasibility of learning, concluding with a probabilistic approach to this problem. Additionally, two key concepts play a crucial role in Machine Learning: memorization and generalization. Curiously enough, these ideas appear on Philosophy of Science.

This work explores the aforementioned parallelisms between Artificial Intelligence and Machine Learning on one side, and Epistemology and Philosophy of Science on the other. We present some questions that arise from the most recent developments in both fields.

Biology and dialectics in the light of a revolution in evolutionary theory

Julio Muñoz –Rubio (Centro de Investigaciones Interdisciplinarias en Ciencias y Humanidades, Universidad Nacional Autónoma de México, Mexico)

Contact: juliomunozr2000@yahoo.es

Keywords: Evolution, dialectics, Karel Kosik, Neo-Darwinism, scientific revolution

In this paper, a scientific revolution is dialectically characterized as a transition from a state of false consciousness towards a state of true one. In biology, Neodarwinism has based its conception of living world in reductionist-individualist principles, identified with a competitive-commodified perspective. This means: elements of false consciousness. For that reason, it is limited to understand the evolutionary dynamics from the outlook of relations and totalities. In order to supersede this situation, it is considered necessary to build a biology able to transit beyond fetishisms, ideological appearances and notions taken from the so called "common sense". A biology able to extract and reveal the real internal movement of living systems, instead of maintain the attention on superficial expressions of biological elements. A biology that maintains a relational perspective instead of an essentialist one; that leads to fully understand the concrete totalities, moments and determinations instead of the decontextualized, non-historical abstractions. All this means a biology able to reveal also the real dynamics between essence and appearance, hidden behind the veil of the Neo-Darwinist essentialism.

The movement from false to true consciousness can operate in this way. Expressing this problem in terms of the Marxist philosopher Karel Kosik, it is possible to state that dominant pseudo concretions present in Neo Darwinism, can be eliminated using a Dialectical method, and leading to a revolution in Biology.

The basis of the Dialectical method was initially provided by Richard Levins' and Richard Lewontin's propositions. Their points of view have recently projected towards critics of the "genocentric" and Neo-Darwinist vision of evolution, such as Susan Oyama, Eva Jablonka, James A. Shapiro, and Karol Stotz, among others. In the present paper I also analyze the Dialectical and revolutionary elements contained in the contributions of these last authors in the light of the essence-appearance relation in Evolutionary Biology.

The Only (X) In The Lab: Improvisation and Epistemic Non-compliance

Katherine Jane Cecil (University College London, United Kingdom)

Contact: katherine.cecil.15@ucl.ac.uk

Keywords: virtue epistemology, social epistemology, feminist epistemology, injustice and ethics

"As a female [ecology] student, I feel like the type of sexism that we're warned about is mostly the blatant stereotypical kind that is actually the easiest to handle, like being accused of being on your period. That hardly ever happens, and if it does, it's corrected immediately. But I feel like it's the more subtle forms that are the real danger we tackle." (Abby Lawson 2016)

This paper will explore the epistemic processes that enable members of marginalised groups, such as Lawson, to navigate through the subtle forms of stereotype threat that dominate the scientific field. I will address how complex social and epistemic histories of stereotypes manifest implicitly and explicitly within the belief system of agents active in the academy. I will press the significance of how an agent's social capital (Bourdieu 1986) and credibility excess (Fricker 2007) effect the degree to which access to epistemic authority and the production of scientific knowledge can be gained via normative means.

Throughout the paper, I will emphasise the unique epistemic privilege marginalised groups exercise as a result of having to improvise through frameworks of oppression and epistemic injustice (Fricker 2007). Epistemic privileges of this kind often go un-noticed or ignored by those with greater social capital/ credibility excess as a result of epistemic ignorance. The inability of the dominant group to consider the production of knowledge from the standpoint of others can and does act as a barrier against exploring new avenues of knowledge (Harding 2004, Hill Collins 2000). This creates an epistemic feedback loop, in which the dominant groups active within science become products of their own knowledge as opposed to their knowledge being products of them.

I will argue that the key component of epistemic privilege is the agency it provides for groups to navigate around the problems of epistemic injustice and stereotype threat embedded within the feedback loop. Epistemic privilege provides an opportunity for groups to create back door entrances or epistemic cracks into the authoritarian field of science, thereby effecting the production of scientific knowledge by way of epistemic non-compliance and deviancy.

Using empirical cases studies I will stress that epistemic non-compliance and deviancy act in symbiosis when an agent utilises their epistemic privilege to challenge implicit biases. Non-compliance is the rejection (which can occur as a speech act, physical act, or silently), deviancy is the improvised route taken to circumvent the biases that have been imposed. These are not easy routes, and I will emphasize the struggle that marginalised groups endure when exercising their epistemic privilege within science -- a field that markets itself as 'objective'.

Crucially, throughout the paper I draw attention to agency over emancipation in regards to how groups that lack social capital interact with both the epistemic authority of science and in society more generally.

The Multiple Dimensions of Multiple Determination

Klodian Coko (Indiana University, United States)

Contact: kchoko@indiana.edu

Keywords: multiple determination, scientific methodology, experimental robustness

Multiple Determination is the epistemic strategy of establishing the same result by means of

multiple (usually independent) procedures. It is considered to be a very important strategy and it is praised by both philosophers of science and practicing scientists. (Wimsatt1981; Hacking1981, 1983; Cartwright1983, 1991; Franklin1986, 1994; Jardine1986, 1991; Bechtel1990, 2002, 2006; Culp1994, 1995; Burian1997; Chalmers2003; Nederbragt2003; Weber2005). Despite the heavy appeal to the multiple determination strategy, however, not much analysis has been provided regarding the specific grounds on which its epistemic desirability rest, besides a very blunt rationale, namely, that it would be an improbable coincidence for independent procedures to establish the same result and yet for the result to be incorrect.

Although intuitive, the blunt rationale does not provide much information regarding the structure and the epistemic import of the multiple determination strategy. For instance, the blunt rationale does not explain why a result that is determined by several independent procedures should be regarded as more credible than a result that is determined by a single (very reliable) procedure (Hudson1999, 2013; Stegenga2009, 2012). Furthermore, relatively recently, there have emerged many studies that investigate the employment of the multiple determination strategy in actual scientific practice (Soler et al.eds.2012). The general conclusion from these studies is that the blunt rationale is inadequate, to say the least, as a description of what really goes on in actual scientific practice. The latter is far more complex and messy (Hudson1999, 2003; Stegenga2009, 2012; Soler2012; Boon2012).

My presentation addresses the issues related to the conceptual structure and epistemic import of the multiple determination strategy. I argue that, despite the difference between the situation portrayed by the blunt rationale (which depicts what we may call the ideal epistemic situation) and the instantiation of the multiple determination strategy in actual scientific practice, it is still possible to develop a general unified conceptual framework for dealing with the structure and epistemic import of multiple determination. I develop such a framework by looking at the philosophical discussions on multiple determination and at concrete cases of multiple determination from scientific practice. I argue, first, that multiple determination is not a philosophers' invention but an epistemic strategy used and praised by the scientific researchers themselves. Second, that the ideal epistemic situation, although is almost never achieved in actual scientific practice it, nevertheless, plays a very important role in it. It plays the role of a methodological attractor: an ideal goal that is not achievable in actual scientific practice, but which is crucial for organizing and directing the researchers' work (Trizio2012). I further claim that the ideal epistemic situation can be used as an evaluative criterion. It can help in assessing the (structural and epistemic) divergence of concrete cases of multiple determination from the ideal. In order to conduct such an assessment I distinguish between the various dimensions of multiple determination. These are structural elements of the multiple determination strategy that give rise to the argument from coincidence as expressed in the blunt rationale. Assessing how much these structural elements, as exemplified in a concrete case, differ from the ideal epistemic situation helps in evaluating the force of the argument from coincidence in each case.

Evidential Reasoning in Archaeological Interpretation

Kristin Kokkov (University of Tartu, Estonia)

Contact: kristin.kokkov@ut.ee

Keywords: Evidential reasoning, middle range theories, archaeology, interdisciplinarity, scientific methodology

The purpose of this paper is to analyse the structure of evidential reasoning in the process of archaeological interpretation. Archaeology is a scientific domain that tries to reconstruct past events and their cultural context on the basis of material remains. Archaeology is often classified under the humanities, but archaeologists constantly use different methods and theories from other branches of science (physics, biology, geology, etc.) to study different kinds of empirical data and turn these into scientific evidence. Accordingly, archaeology includes various kinds of evidence (physical, textual, numerical, biological, etc.) that constitute the basis for different kinds of reasoning.

Therefore, it is essential to study how those different scientific methods, theories and evidence function together in the process of forming coherent scientific knowledge about the past events and culture. Thereby we also learn how empirical research methods in the natural sciences and various techniques used in social-scientific research relate to the interpretive methods of the humanities.

Alison Wylie (2011) points out that evidential reasoning in archaeological interpretation involves at least three functional components: 1) various kinds of empirical data; 2) theory that mediates the interpretation of data as evidence; and 3) the claims on which this empirical data bear as evidence. Lewis Binford (1977) has described evidential reasoning in archaeology in a similar way already earlier. He called this way of reasoning "the middle range theories method". Middle range theories are the background knowledge which is used to interpret empirical data as evidence about past events. Thus, the middle range theories are a component of evidential reasoning and they work as a connecting link between the present data and past events.

Relying on Wylie's scheme, I aim to analyse the structure of archaeological reasoning in reference to different kinds of evidence and show where exactly in the structure of argumentation "the middle range" is situated. I demonstrate schematically that the archaeological interpretation of past events is formed on the basis of different observational theories, scientific data and theories, historical facts, sociological theories, and claims about the past. These elements together constitute a web of reasoning where "the middle range" may lie between any two components of inference.

References

- Binford, Lewis R. 1977. *For Theory Building in Archaeology: Essays on Faunal Remains, Aquatic Resources, Spatial Analysis, and Systemic Modeling*. New York: Academic Press.
- Wylie, Alison 2011. *Critical Distance: Stabilising Evidential Claims in Archaeology*, in Philip Dawid, William Twining, Mimi Vasilaki (Eds.) *Evidence, Inference and Enquiry*. Oxford, New York: Oxford University Press, pp 371–394.

Biological Regulation: an organisational account

Leonardo Bich (Universidad de Chile, Chile)

Contact: leonardo.bich@ehu.es

Keywords: regulation; control; biological organization; dynamic stability; robustness

The appeal to the notion of regulation is widespread in biology. This property is usually ascribed to a variety of mechanisms and behaviours involved in living systems' responses to perturbations. Yet, the meaning of this notion is left somehow vague, very dissimilar types of phenomena are gathered under this label, and its relationship with akin concepts, such as control, homeostasis, robustness, and feedback is hardly stated in clear terms

To contribute to a deeper understanding of this notion, I will propose an organisational account of regulation by focusing on the mechanisms underlying compensations for perturbations in minimal living systems. In the first place, I will analyse different forms of control in the cell, and how they contribute to the self-maintenance of a biological organisation by constraining thermodynamic processes. These basic forms of controls involved in the constitutive dynamics of a living system include kinetic (enzyme), spatial (compartments) and template (genes) control.

In the second place I will analyse how a basic biological organisation can recruit forms of control to viably compensate for internal or external perturbations. It does so in two main ways: through network responses by means of basic controls alone, or by relying on the action of specific subsystems dedicated to handle perturbations by functionally modulating the constitutive dynamics of the system.

On this basis I will distinguish between two different classes of responses, respectively: dynamical stability and regulation. I will describe the limits of stability as an adaptive response, and I will provide a definition and a minimal set of organizational requirement for regulation, by pointing out the differences with similar concepts such as feedback, robustness and homeostasis.

Biological regulation, I will argue, is a specific form of second-order control, exerted over the core (constitutive) regime of production and maintenance of the components that put together a living system. It consists in the capability to selectively shift between different available regimes of self-production and self-maintenance in response to specific signals and perturbation, due to the action of a dedicated subsystem which is operationally distinct from the regulated ones.

The influence of animism on atomistic conceptions

Lidia Queiroz (CFCUL/IF-FLUP, Portugal)

Contact: lmqueiroz@fc.ul.pt

Keywords: atomism; animism; Bachelard

The paper aims to present an examination of animist convictions as a tendency that has greatly influenced atomistic conceptions. The presence of animism is striking in the course of the history of atomism and, according to Bachelard's reflections, is one of several epistemological obstacles that hindered the development of a scientific perspective of the structure of matter. In "La formation de l'esprit scientifique. Contribution à une psychanalyse de la connaissance objective", Gaston Bachelard explains that an epistemological obstacle is any element or extra-scientific process that, influencing the scientific theory and practice, provokes «stagnation and even regression» in the production of scientific knowledge. Animism is one of those epistemological obstacles and, as all the others, it presents itself in various ways within the pre-scientific spirit. In this paper, we intend to explore a selection of several animist intuitions, trying to expose how they have influenced atomistic conceptions.

The epistemology of logic and logical pluralism

Luis Rosa (Munich Center for Mathematical Philosophy, Germany)

Contact: fsopho@gmail.com

Keywords: Logical knowledge, disagreement, Logical Pluralism

An acceptable epistemology of logic is supposed to account for how we know logical truths such as "It is (logically) necessary that P or not-P" and "From P and If P then Q it logically follows that Q". Accounting for how we know those truths involves explaining what makes us warranted in believing them. Given that much, here is a challenge for any epistemology of logic: either (a) it has to explain how it is possible for rational people to have conflicting logical beliefs in an epistemically warranted way, or (b) it has to explain why is it that only one such logical belief can be held in an epistemically warranted way (e.g. no one can be warranted in believing that excluded-middle is not logically necessary).

In this talk, I am going to argue, first, that no epistemology of logic should be committed to (b). The problem is that such an option creates a discontinuity with our best general principles of epistemic warrant (not only for logical beliefs, but for beliefs in general). Second, I will argue that the two most popular epistemologies of logic--the one that says that intuition is the source of warrant for logical beliefs and the one that says that sheer understanding is the source of warrant for logical beliefs--are in direct conflict with (a). If that is true, then an alternative epistemology of logic should be fleshed out. The relevant account that would make it possible for both subjects to be warranted in their beliefs: the one who believes that a given claim is a logical truth and the one who believes

that it is not. My proposal will be that if suppositional reasoning is a source of warrant for logical beliefs, then we have a solution to that problem. The result will be an account of logical knowledge according to which the source of warrant for logical beliefs is just good-old reasoning.

On the nature of belief in pluralistic ignorance

Marco Antonio Joven-Romero (UNED - Universidad Nacional de Educación a Distancia, Spain)

Contact: majovenromero@bec.uned.es

Keywords: Truth, pragmatism, belief, pluralistic ignorance, normativity

Pluralistic ignorance is a recurrent topic in Sociology, and it is also treated in Cognitive Sciences and Philosophy of Social Sciences. Firstly mentioned by Katz and Allport (1931), it refers to the establishment of a social norm or behavior when every agent privately refuses that norm or behavior but believes that most other agents assume and follow it. Since then, many studies about this phenomenon have been developed, most of them practical applications to different attitudes and behaviors: teenagers drinking alcohol, classroom habits, top managements attitudes, racist attitudes, revenge and infidelity behaviors, etc.

In this paper I use the accurate definition of pluralistic ignorance given by Bjerring, Hansen and Pedersen (2014):

"Pluralistic ignorance" refers to a situation in where the individual members of a group

- (i) all privately believe some proposition P;
- (ii) all believe that everyone else believes $\neg P$;
- (iii) all act contrary to their private belief that P (i.e. act as if they believe $\neg P$); and where
- (iv) all take the actions of the others as strong evidence for their private beliefs about P (2458)

I analyze this definition, considering it as a very accurate one, although (i) and specially (iv) may need some clarification. Interestingly, (ii), (iii) and (iv) are connected. We may consider that (ii) is caused by (iv): we all believe that everyone else believe $\neg P$ because we take the concepts and actions of the others as strong evidence for their private beliefs about P. The action (iii) is caused by the belief about the rest (ii), and that action works as a reason for acting as if $\neg P$ (iv). This action helps everybody to believe that the rest believe $\neg P$ (ii). But for development of pluralistic ignorance an initial social evidence -the action of the rest- is needed, so (iv) goes first. And the concept of evidence needs to be broader, not just empirical evidence (maybe social evidence in some cases, like in the teenagers' drinking alcohol case). The concept of believe used in (i) also needs to be broad, in order to accommodate this definition of pluralistic ignorance to some specific cases.

I defend that this theoretical study of pluralistic ignorance is useful to model it. Also pluralistic ignorance phenomena can offer some clues and arguments in the debate between pragmatism and realism. I defend that pluralistic ignorance can be better understood if we take a pure epistemic position about beliefs -beliefs aim at truth-, accepting that final behaviors and actions depend not only on beliefs but on other elements and attitudes, like the pragmatic ones. Nevertheless, the pragmatic position may offer a coherent complex analysis that does not need of the concept of truth. Although I consider a theoretical approach, I also work with the three main examples found in the literature: the classroom case, the college drinking case and the Emperor's case.

Behavioral epigenetics: new insights into the nature/nurture debate

Marco Pina (CFCUL, Portugal)

Contact: marco.pina32@gmail.com

Keywords: Epigenetics; Behavior; Psychology; Nature/Nurture debate

After the 20th century genetic revolution, the 21st century rise of epigenetics is shedding new light on an old problem in philosophy and philosophy of science, the nature/nurture debate. Epigenetics studies the cellular mechanisms that regulate gene expression (resulting in gene silence or activation). These mechanisms do not act in isolation, they participate in a complex web of interactions where the genome and environmental factors also step in. Specifically in the behavioral phenotype field, the novel discipline of behavioral epigenetics (BE) aims at elucidating to what extent epigenetic mechanisms influence behavior in animals and humans.

In a landmark paper in BE (Weaver et al, 2004) the authors showed "that an epigenomic state of a gene can be established through behavioral programming, and is potentially reversible". Franklin et al (2010) concluded that maternal separation in mice is associated via epigenetic mechanisms with emotional distress that can last through adulthood. Murgatroyd and Spengler (2011) claimed that "understanding how early life experiences can give rise to lasting epigenetic marks conferring increased risk for mental disorders (...) is increasingly becoming a focus of modern psychiatry."

However, before we can fully grasp the real impact of epigenetic processes in the phenotypical and pathophenotypical variation displayed later in life, enormous challenges do persist. From an epistemological position this presentation will firstly present a critical analysis of the latest developments in BE; and secondly outline its main challenges, specially focusing on methodological limitations (from the relevance of molecular changes to specific pathophysiology to the translation of findings in animal models to human psychology), in order to ultimately help understanding the nature of its inescapable although yet fairly undetermined relevance to the nature/nurture debate.

References (selection)

- Fraga M. et al "Epigenetic differences arise during the lifetime of monozygotic twins". *Proceedings of the National Academy of Sciences*. 102: 10604-10609 (2005)
- Franklin T. et al "Epigenetic transmission of the impact of early stress across generations". *Biological Psychiatry*. 68(5):408-15 (2010)
- Han J. et al "Functional Implications of miR-19 in the Migration of Newborn Neurons in the Adult Brain", *Neuron* 91(1):79–89 (2016)
- Jorge M, "Inato versus Adquirido / Natura versus Cultura". In Levy A et al (eds) *Homem: Origem e Evolução*, Lisboa: Glaciar (2015)
- Kubota T. et al "Epigenetic understanding of gene–environment interactions in psychiatric disorders: a new concept of clinical genetics". *Clinical Epigenetics*, 4:1. (2012)
- Murgatroyd C. et al "Epigenetics of early child development". *Frontiers in Child and Developmental Psychiatry*. 2:16 (2011)
- Petronis A. et al (eds) *Brain, Behavior and Epigenetics*, Springer (2011)
- Roth T. et al "Epigenetic marking of the BDNF gene by early-life adverse experiences". *Hormones and Behavior*. 59(3): 315–320 (2011)
- Roth T., "Epigenetic mechanisms in the development of behavior: advances, challenges, and future promises of a new field" *Dev Psychopathology* 25: 1279–1291 (2013)
- Szyf M., et al "The Social Environment and the Epigenome". *Environmental and Molecular Mutagenesis*. 49:46–60. (2008)
- Weaver I. et al, "Epigenetic programming by maternal behavior". *Nature Neuroscience*. 7: 847 - 854 (2004)

The animal roots of the self

Margarida Hermida (CIIMAR-Madeira, Portugal)

Contact: margarida.hermida@ciimarmadeira.org

Keywords: animalism, organisms, persistence conditions, personal identity, proto-self

From a biological perspective, the answer to the question “what are we?” is quite obviously, animals. Surprisingly, animalism has only recently gained prominence in the philosophical debate, due to its conflict with deep-seated intuitions regarding certain thought experiments, such as brain transplant scenarios. In order to assess whether our intuitions can be reconciled with animalism, it is necessary to take a closer look at the persistence conditions of animals and what neuroscience has to say about the self. Like other organisms, animals are essentially alive. Yet they have different persistence conditions from other organisms. In plants, for example, no particular part of the organism is essential for its continued existence; it is only a matter of whether the remaining living cells can carry on respiration, photosynthesis, etc. Animals, on the other hand, are characterized by the presence of a “core” which is needed for their continued existence. Thus, an animal can die even if some of its cells are still alive, provided that the “core” is no longer functioning. This core is composed of nerve cells, which not only maintain the animal's vital processes, but also coordinate the animal's parts, permitting the production of coherent behaviour. In order to fulfil this task, at least in animals with brains, the nervous system generates a proto-self that consists of sensations or feelings of the internal state of the animal (Damasio 2010). This proto-self does not imply conscious awareness of the self, but only a bare sensation of own body vs. world. It is a minimal subjectivity, an organism perspective, shared by all vertebrates, and possibly some invertebrates. In humans, the proto-self is generated in the brain stem in close connection with the body proper, with core self and full-on personal consciousness arising in the cortex, and the thalamus acting as a bridge between these structures (Damasio 2010). Without the proto-self, the locus of minimal subjectivity, it is not possible to generate the higher levels of consciousness. With this in mind, our intuition regarding brain transplants needs to be revised. Thus, in Olson's (1999) hypothetical scenario we would in fact remain behind as the animal after having our cerebrum removed (with the brain stem and rest of the body left intact). Moreover, a full brain transplant, including the brain stem, might fail to preserve the person, since the feedback between brain stem regions and the visceral organs would be broken, and these form the basis of the proto-self. At this point, it is unclear exactly how much of the body would be required for persistence. What is clear, though, is that the existence of a psychological continuant, or the preservation of thoughts and memories, is neither necessary nor sufficient for our survival, since the feeling of the living body that is the animal proto-self is essential for the “me” quality of first-person perspective.

Damasio, A. (2010). *Self Comes to Mind: Constructing the Conscious Brain*. Vintage.

Olson, E. T. (1999). *The Human Animal: Personal Identity without Psychology*. Oxford University Press.

Epistemology of Research on Radiation and Matter: a Structural View

Maria Elisa Maia (CFCUL and IIBRC, Portugal) / Isabel Serra (CFCUL, Portugal)

Contact: elisamaia@gmail.com

contact: isabelserra@netcabo.pt

Keywords: Radiation; patterns of research; interaction theory experiment

The modern understanding of radiation got its start in 1895 with X-rays discovered by Wilhelm Roentgen followed in 1896 by Henri Becquerel's discovery of radioactivity. The development of the study of radiation opened a vast field of research concerning various disciplines: chemistry, physics,

biology, geology, sociology, ethics, etc. Additionally new branches of knowledge were created, such as atomic and nuclear physics that enabled an in-depth knowledge of the matter. Moreover, during the historical evolution of this body knowledge a wide variety of new technologies was emerging.

The theoretical, experimental and technological diversity of the evolution in research on radiation and matter allows an epistemological analysis around structural features. Some of the features are very general, such as the type of discovery and innovation from the beginning in the late nineteenth century to the present day. But it is possible in addition to a temporal epistemological structure find other patterns of research and knowledge into this case, such as the sharing of results between the various disciplines involved.

This communication is intended to be a structural epistemological analysis of the development of knowledge in order to detect patterns in the theory-experience interaction. This analysis will also focus on other aspects, such as the exchange of knowledge between disciplines that share the field of radioactivity and the progress that resulted from these exchanges.

A case study will be presented: the radioactivity in Portugal. Despite the small size of the scientific activity in Portugal in the first half of the twentieth century, radioactivity and nuclear physics assume a certain importance and have structural characteristics similar to those of research in other European countries.

Science, Art and Photography: the study of Clouds from nineteenth to early twentieth century

Maria Estela Jardim (CFCUL; CQE, Portugal)

Contact: mejardim@fc.ul.pt

Keywords: Scientific photography, clouds, Art, nineteenth century, twentieth century

In nineteenth century culture, dramatic scenes representing atmospheric phenomena were quite common as visual objects. Some of the most accomplished artist-photographers of early nineteenth century, Gustave Le Gray (1820-1884) and Roger Fenton (1819-1869) obtained photographs of clouds in the period 1850-1860. The two photographers met in Paris: Fenton went there to learn Le Gray's negative wax paper technique which he used later in his photographic account of the Crimean War. In 1802 the English meteorologist Luke Howard (1772-1864) published the first scientific classification of the clouds. This scientific paper inspired the English painter John Constable (1776-1837) to make some painting studies of clouds during the years 1821-1822, annotating in the back of his paintings the weather conditions and the scientific names of the clouds according to Howard's nomenclature. In the 1st International Meteorological Congress in Vienna (1873), delegates decided to encourage institutes and observatories to publish through photography or painting, pictures of the different types of clouds. Following this decision Swedish meteorologist Hugo Hildebrandsson (1838-1925), director of the observatory of Uppsala in Sweden, published in 1879, with the collaboration of photographer Henri Osti, an edition containing 16 photographs of clouds, using the wet collodion photographic technique. Again the idea of iconography associated with the classification of clouds, was discussed during the 2nd International Meteorological Congress in Rome in 1879, which was also attended by the Portuguese meteorologist João de Brito Capelo (1831-1901) from the Observatory D. Luiz and it was then determined that an exclusive use of photography should be used in order to prepare an International Atlas. In 1896 the Atlas was published in three languages, French, English and German, illustrated with black and white photographs and colour paintings of clouds reproduced by photochromotypography, a colour reproduction relief photomechanical technique carried out by Brunner & Hauser from Zurich. It was also acknowledged that measurements of speed and height of clouds were important for scientific purposes. The Cloud Atlas, a different version, is still in use today to help meteorologists predict the weather.

Clouds continued to fascinate photographers and other artists well into the next century. Between 1925 and 1931, the American photographer Alfred Stieglitz (1864-1946) made a series of photographs of clouds which he named "Equivalents". Stieglitz wrote in 1923: "Clouds and their relationship to the rest of the world, and clouds for themselves, interested me, and clouds which were difficult to photograph-nearly impossible".

In this work we will discuss how photography played an important role in the scientific and artistic study of clouds and the technical challenges it presented to its early practitioners, photographers and scientists.

References

- AUBENAS,S.(Org.)(2002).Gustave Le Gray(1820-1880).Paris: Gallimard
 ANDERSEN,K.,(2005).Predicting the weather. Chicago: The University of Chicago Press, p.219-22
 DANIEL, M. and BALDWIN, G. (2004). All the Mighty World: The Photographs of Roger Fenton. Museum of Modern Art and Yale University Press.
 HILDEBRANDSSON, H., Riggerbach, L. e BORT, T. (1896).Atlas International des nuages. Paris: Gauthiers-Villars.
 STIEGLITZ, A. (1923). How I came to Photograph Clouds. The Amateur Photographer, Vol 56, p.255

Confirmation and the Generalized Nagel-Schaffner Model of Reduction: A Bayesian Analysis

Marko Tešić (Munich Center for Mathematical Philosophy, Ludwig Maximilians University, Munich, Germany)

Contact: marko.tesic375@gmail.com

Keywords: Confirmation, Nagelian reduction, Thermodynamics and Statistical mechanics, Bayesian network models

Recently, Dizadji-Bahmani et al. (2010) argued that the generalized version of the Nagel-Schaffner model that they have developed (henceforth the GNS) is the right one for intertheoretic reduction, i.e. the kind of reduction that involves theories with largely overlapping domains of application. Drawing on the GNS, Dizadji-Bahmani et al. (2011) presented a Bayesian analysis of confirmatory relation between the reducing theory and the reduced theory and argued that post-reduction, evidence confirming the reducing theory also confirms the reduced theory and evidence confirming the reduced theory also confirms the reducing theory, which meets the expectations one has about theories with largely overlapping domains.

In this paper, I argue that Bayesian analysis presented by Dizadji-Bahmani et al. (2011) is not without difficulties. I raise several issues regarding this analysis that call to one's attention. In particular, I argue that the modifications of the Bayesian network representing the situation after the reduction that Dizadji-Bahmani et al. allow for lead to unacceptable consequences from the perspective of the GNS. Furthermore, I argue that even if one does not allow for these modifications, difficulties still emerge. Nevertheless, I also argue that given slight changes to the Dizadji-Bahmani et al.'s analysis that are in agreement with the GNS, one is able to account for these difficulties and, moreover, one is able to more rigorously analyze the confirmatory relation between the reducing and the reduced theory.

Naturalized philosophy of science: Two accounts of the method of conceptual analysis

Martin Zach (Charles University in Prague, Czech Republic)

Contact: m_zach@seznam.cz

Keywords: naturalized philosophy of science, conceptual analysis, model-based approach

There will be two aims of this talk: i) to argue against philosophy of science in its traditional form (i.e. non-naturalized) and ii) to sketch how a naturalized philosophy of science should look like. As for the first critical part, I will turn my focus on the main problematic areas which can be found in the positivistic, post-positivistic and the historical ("kuhnian") school as well. The problem lies in the method of conceptual analysis. I will distinguish between two possible construals of this method. One way to construe it is to view the conceptual analysis as a method which starts with concepts and proceeds to search for necessary and sufficient conditions. This has usually been done in a following way: 'What is X' is to be investigated through the means of concepts and intuitions without any regard to serious empirical work. The other way is to view conceptual analysis in a naturalized way, i.e. the bulk of the work lies in an empirical investigation. I will argue that the non-naturalized way of using conceptual analysis in philosophy of science is a mistake and I will do so by showing it on concrete examples (e.g., theories of reference, approximative truth). I will also defend the prospects of the naturalized way, since it is the only way to make sense of scientific practice.

The second part of my talk will be aimed at sketching a positive image of how the naturalized philosophy of science (the naturalized conceptual analysis) can make sense of several aspects of scientific practice. Here, I will base my argument on the model-based approach towards scientific theories and reasoning. Models are at the center of the scientific theorizing and it is vital to study them within the context of their actual usage if one is to give a proper account of how science works – and this is indeed the main preoccupation of the philosophy of science. Thus the underling argument lies in the following: Non-naturalized philosophy of science starts with its own concepts and then goes to crudely fit science into them. This is why most of traditional philosophy of science has failed both in illuminating the scientific endeavor and in being relevant to science. Naturalized philosophy of science, on the other hand, seems to be well equipped to shed some light on science since it starts with science itself, not with philosophical presuppositions about science.

Carruthers, P.; Stich, S.; Siegal, M. (2004): *The cognitive basis of science*. Cambridge: Cambridge University Press.

Giere, R. N. (ed.) (1992): *Cognitive models of science*. Minneapolis: University of Minnesota Press.

Giere, R. N. (1999): *Science without laws*. Chicago and London: The University of Chicago Press.

Magnani, L.; Nersessian, N. J.; Thagard, P. (eds.) (1999): *Model-based reasoning in scientific discovery*. New York: Springer.

Nersessian, N. J. (2008): *Creating scientific concepts*. Cambridge (Mass.) and London: MIT Press.

Wagenknecht, S.; Nersessian, N. J.; Andersen, H. (eds.) (2015): *Empirical Philosophy of Science: Introducing Qualitative Methods into Philosophy of Science*. New York, Dordrecht and London: Springer.

Extrapolation and the Russo-Williamson thesis

Michael Wilde (University of Kent, United Kingdom)

Contact: m.e.wilde@kent.ac.uk

Keywords: Mechanisms, extrapolation, the Russo-Williamson thesis.

Federica Russo and Jon Williamson have put forward the following epistemological thesis: In order

to establish a causal claim in medicine, it is typically necessary to establish both that the putative cause and effect are appropriately correlated, and that they are linked by an appropriate mechanism (Russo and Williamson 2007). They claim that the thesis is supported by the practice of the International Agency for Research on Cancer (2007: 161). This practice aims to identify exposures that cause cancer in humans by evaluating a range of evidence, including evidence from observational studies of cancer in humans, studies of cancer in experimental animals, and mechanistic and other relevant data. However, I point out some problems in appealing to this practice to support the Russo-Williamson thesis. In particular, there is a case in which an exposure is classified as carcinogenic to humans, even though the studies of cancer in humans fall short of establishing a correlation in humans, viz., the benzo[a]pyrene case. The proponent of the thesis may respond that the mechanistic and other relevant data are strong enough in this case that they may establish not only the existence of a mechanism in humans, but also the existence of the appropriate correlation. However, it has been argued that biomedical mechanisms are often so complex that it is rarely possible to establish the existence of a correlation between a putative cause and effect solely on the basis of the existence of a mechanism linking them together (Howick 2011: 140-146). It is unlikely that the mechanistic and other relevant data may alone establish that an exposure causes cancer to humans, because it alone cannot establish an appropriate correlation between the exposure and cancer in humans. Therefore, the benzo[a]pyrene case looks like a real counterexample to the Russo-Williamson thesis. Against this, I argue that the benzo[a]pyrene case is not in fact a counterexample. In this case, although a correlation is not established by the studies in humans, there is still more than just the mechanistic data available. In particular, there are the studies of cancer in experimental animals which establish that there is a correlation between benzo[a]pyrene and cancer in the animals. Although the studies of cancer in humans do not establish a correlation in humans, the established correlation between benzo[a]pyrene and cancer in experimental animals may be carried over to humans by means of extrapolation, at least with the help of the mechanistic and other relevant data. If this extrapolation proposal is correct, there should be comparisons between mechanisms going on in the practice of the International Agency for Research on Cancer (Steel 2008). I argue that this is exactly what is going on in their practice. I conclude that the benzo[a]pyrene case is not a counterexample to the Russo-Williamson thesis. In this case, there is an established correlation in humans, it is just established indirectly by extrapolation from studies of cancer in experimental animals rather than directly by the observational studies of cancer in humans.

Time and Causality in Natural History Research

Nathalie Gontier (CFCUL, Portugal)

Contact: nlgontier@fc.ul.pt

Keywords: evolutionary epistemology, philosophy of evolutionary sciences

Different notions of time bring forth diverging notions of causality and generate distinct means to model and calculate the evolutionary distance between natural kinds. Both time and causality have for the most part of history been considered unidirectional and unilineal, and both concepts enable for uniformitarian and mechanical explanations on how species evolve, as well as linear timelines and phylogenetic tree models that demonstrate vertical patterns of evolution. The different ideas associated with an extended synthesis underlie different notions of time in comparison to the time notion endorsed by early natural history scholars. Fields such as ecology, symbiology and evo-devo investigate processes such as emergence, reversed directionality, up- and downward causation, and such horizontal interactions induce perturbations in otherwise unilineal systems and are modelled by making use of networks and non-linear dynamic system theories. These approaches also mark shifts from mechanical to statistical thinking, because the number of parameters that are taken into account to calculate change become so numerous that straightforward predictions for future change are near to impossible. Tree to network modelling, mechanical to statistical thinking, and genealogy to economy thinking is underlain by different notions of time; and these transitions in epistemological approaches associate with the introduction of new parameters that are used

to time evolutionary events (the earth's strata, molecular clocks, the organisms themselves and the interactions they entertain). Today, the very existence of time is questioned by physicists, while there exists a somewhat consensus view that time serves as a cognitive medium that enables us to act in the world. Time enables us to perceive change in the natural world and I argue, from an evolutionary epistemological point of view, that it is no coincidence that straight line, unilineal and mechanical thinking has had the upper hand for most of scientific history. The latter follows the way time, as a cognitive medium, patterns our everyday lives while no concept let alone unifying theories and models exist to differentiate, conceptualize and explain the different trajectories life has taken in space-time.

Does Mathematical Epistemic Explanatoriness Entail Platonism?

Navia Rivas de Castro (Universidade de Santiago de Compostela, Spain)

Contact: naviarivas@hotmail.com

Keywords: mathematical entities, explanation, platonism, fictionalism, deflationism

Mathematics has a central role in our scientific image of the world, and that is why explaining the connection between mathematics and the world is such an interesting and complicated issue. In particular, there are multiple examples of physical and biological phenomena that seem to depend on mathematical facts alone (see Hales 2000 and 2001, or the already well-known 'cicada' example in Baker 2005). When we address this problem, we commonly face the question whether mathematics is explanatory or not.

This question is relevant because it deals with issues related to the ontological status of abstract objects, central in debates around the role mathematical entities play in formal and empirical sciences. In this context, there are several views that should be taken into account.

Mathematical Platonism is commonly linked to ontological realism and it can be roughly defined as the acceptance of the existence of mathematical entities as abstract and independent from our cognitive activities. Platonists usually argue that we can intuit mathematical entities and grasp mathematical concepts, a sort of "seeing with the mind's eye".

One of the main arguments in favour of Platonism is the explanatory indispensability argument. It attempts to establish that there are mathematical entities in virtue of their explanatory indispensability in science. The notion of explanation used here is a strong concept of explanation, so that this kind of indispensability has ontological consequences.

James R. Brown (2013), among other authors, rejects that mathematics is explanatory in this strong sense. By contrast, he argues that mathematics is explanatory and indispensable if we take 'explanatory' in a weaker epistemic sense, that is, mathematics is indispensable to our understanding of the world. For Brown, this carries an ontological commitment to mathematical Platonism in a strong sense, because there are cases where the only explanation we could have is mathematical. He also appeals to mathematical intuitions, arguing that they are necessary in order to acquire mathematical knowledge, so there must be some mathematical reality beyond the spatiotemporal world.

There are several alternatives to mathematical Platonism. Due to their current relevance in philosophy of mathematics, this paper will focus on fictionalism and deflationism, which entail the rejection of the existence of abstract objects.

The main aim is to show that accepting mathematics is explanatory in his sense is compatible with a fictionalist or deflationist view. Therefore, we can be fictionalists or deflationists and still argue that mathematics has a central role in the explanation of facts of the world. It can be coherent not to believe in the existence of mathematical objects and at the same time believe that they have explanatory power.

The strategy will be a thorough analysis of Brown's concepts of mathematical explanation and intuition, followed by the rejection of mathematical intuitions as Brown puts them, in order to show that mathematical knowledge and its explanatory power can be understood without appealing to anything beyond the empirical realm.

A conceptual model of human life extension

Pablo García-Barranquero (University of Málaga, Spain)

Contact: pablogarcia@uma.es

Keywords: Life extension/ Cluster properties/ Moderate life extension/ Radical life extension/ Other ways to extend the life

"Life extension" refers to the idea that humans could live longer and live better. However, the concept of "life extension" has been used unequivocally over the history of science, philosophy and literature. Thus, it is usual to confuse the concept of "life extension" with some others concepts related with it such as "extending life", "seeking the source of eternal youth", hope for "eternal life", discovering what the "elixir of life" might be, or the desire for "immortality", among others, have created this confusion. To do this I will discuss a fragment of Nick Bostrom article A history of transhumanist thought in "Journal of evolution and technology" (2005) in which the error is observed.

I intend to shed some light on the debate about the concept "life extension" as applied to humans. This is because the concept can be understood as natural kind (in Griffith's or Kitcher's sense): I will argue that this concept would be natural kind understood as cluster properties homeostatically maintained. What this means is that this concept has properties that tend to occur together because there are underlying causal mechanisms that reinforcing each other, although they are subject to exceptions.

I will offer a tight definition of what can be considered generally as a "life extension" in humans and then I will discuss how a conceptual model can be created such that encompasses three different levels of life extension in humans which can be conceived.

The structure will be as follows:

In the first section, I argue that there are a cluster properties on the concept "life extension" in humans shared in two points, namely: the extension of the years of life (and the quality) and delay (in some cases removal is attempted) of death.

Thereafter, in the second section, I create three interconnected levels with their own characteristics and limits from each other:

- i) Moderate life extension.
- ii) Radical life extension.
- iii) Other ways to extend the life.

The connection, distinction and nature of each of the levels will be clarified.

Finally, in the third section, I will try to justify my conceptual model and go deeper in the level of detail. In order to develop this task, I will compare my model with partial approaches that have been made on this subject, and I will also discuss the influence I have had from authors such as Aubrey de Grey, David Callahan or Walter Glannon among others.

Walter Benjamin between science and art

Pedro Caldas (CFCUL, Portugal)

Contact: pedrovcaldas@mail.telepac.pt

Keywords: Science; art; film; Walter Benjamin

Walter Benjamin says that "to demonstrate the identity of the artistic and scientific uses of photography which heretofore usually were separated will be one of the revolutionary functions of the film" and also that "Renaissance painting offers a revealing analogy to this situation." I will explore an interpretation of the relationship between science and art in the light of the Benjamin's proposal in "The Work of Art in the Age of Mechanical Reproduction".

Bonjour and the Irrationality accusation directed to Qualified Externalism: a critical review

Pedro Dinis (Center of Philosophy - University of Lisbon, Portugal)

Contact: pedrodinis@campus.ul.pt

Keywords: Epistemic Externalism; Epistemic Internalism; Epistemic Justification; Reliabilism; Reasons

Laurence Bonjour accuses Epistemic Externalism (EE) to treat epistemic justification in an irrational and irresponsible way. My purpose here is to make a critical review of one of the ways Bonjour adopts to attack EE. I propose myself to analyze the objections Bonjour made to the version of EE that he himself considers to be the most suitable, and which he named of Qualified Externalism (QE). Accordingly to Bonjour S is being epistemic rational and responsible about p if and only if S is aware of some (good) reason to believe p. Given that QE doesn't commit S with that requirement, Bonjour tries to prove that QE is an irrational and irresponsible position about epistemic justification. In order to obtain this result, Bonjour compares QE with Epistemic Internalism (EI).

According to Bonjour QE accepts one of the internalist requirements – the Internal Negative Requirement (INR) which can be expressed as follows: S is not aware of any reasons (strongly enough) to believe not-p – and rejects the other. Based on this idea, Bonjour presents two main objections against QE. The first says that QE in adopting an INR is accepting an internal part, and in doing so, is granting to EI. The second objection says that the reason that supports the INR is the same that supports the Internal Positive Requirement (IPR), which says that S is aware of reasons (strongly enough) to believe p. But that same reasoning cannot be applied to QE. As a result of the two objections Bonjour concludes that QE is an incoherent and untenable perspective about epistemic justification.

I will critically examine each of these two objections made by Bonjour and try to show that the objections are not good. As a result, I conclude, against Bonjour, that we cannot say that QE is an "untenable middle way" perspective about epistemic justification, irrational and irresponsible.

A philosophical approach of the mathematical representation of the visible reality in the technologies of 3D imaging and virtual reality: René Descartes and David Hume

Pedro Gomes (Science Art Philosophy Laboratory, CFCUL; Portugal)

Contact: pedromfarinhagomes@gmail.com

Keywords: 3D imaging, virtual reality, mathematics, analytical geometry, substance, Descartes, Hume

This talk has as its subject the photorealistic computational modeling and simulation of the visible reality. The analysis will be established in two moments of the history of modern philosophy, namely the revision of the classical concept of substance made by Descartes, and its rejection by Hume.

Specifically, 3D and virtual reality software will be considered as a tool for the computational modeling and simulation of the visible reality, namely of objects in space (the term 'object' here refers to concrete particulars, that is, singular entities individuated in space and time), of the physical phenomenon of light, of movement, etc. If one of the key-concepts of modern philosophy was the concept of representation, we can consider that the technologies of computer simulation are, by their turn, a way of re-represent the visible reality that we can empirically access.

The digital modeling ('modeling' here is considered as digital sculpting) of three-dimensional virtual objects in virtual space is based in a mathematics' area called analytical geometry, created by René Descartes. When computationally implemented, it also needs linear algebra, another mathematics' area.

Analytical geometry results of a junction between geometry and algebra, and it allows the three-dimensional representation of objects in space, based in a three coordinate axis, x-axis (length), y-axis (height) and z-axis (depth). A virtual object is made of a very large quantity of points, and its position in the three-dimensional space is determined by those three coordinates, in that three-dimensional referential. The object's figure is obtained by the connection of the different points, made by segments, and so, it is then obtained the object's polygonal configuration and, by its turn, its figure and its different surfaces. In these surfaces will be applied the object's textural properties, which, in interaction with the virtual light (obtained through the use of computer algorithms that result from the physics-mathematical modeling of light), determine the object's colour and texture. To Descartes, the essence of extramental reality, matter, is reduced to the concept of extension, in length, height and depth, and matter is ontological conceptualizes as *res extensa*. It is sufficient to have knowledge of those geometrical properties of an object, considered in its length, height and depth, so that that object can have an ontological status. All its other properties, like colour, texture, etc., are considered secondary properties. With this mathematical understanding of reality, Descartes revises the classical notion of substance with this notion of extended substance, and in analytical geometry can be found its mathematical representation.

On the contrary, to Hume the concept of substance does not have ontological status. He considers an object as a bundle of properties, and from the conjunction of those properties it comes the notion and knowledge of an object, in which those same properties coalesce.

With the analysis of the constitution of the visual experience of objects in Hume's understanding, and with the analysis of the concept of extended substance in Descartes, it will be shown how the photorealistic computational modeling and simulation exemplifies both those ontological understandings.

The non-reductionist methodology: a contribution of Herman Dooyeweerd to the philosophy of science

Pedro Lucas Dulci (Universidade Federal de Goiás, Brazil)

Contact: pedro-lucas.dulci@gmail.com

Keywords: ontology; methodology; sphere of reality; law; multidisciplinary

In an effort to articulate the modern knowledge in the scientific research with the practice in multidisciplinary field, a question of first magnitude arises: the ontology that supports this research methodology. For scientific researchers have adequate rigorous, it is important to ask: What is the

understanding of wholeness that is behind our analysis? What are the limits of such anti-reductionist approach? These questions are part of the ontology of intervention. In this branch of philosophy, we believe that the contributions of the Dutch philosopher Herman Dooyeweerd – and its current successors in Netherlands, Canada, EUA and Brazil – are unique to promote interdisciplinary discussion of scientific issues. Although it is a thinker with a vast work, and with multiple entrance gates, there is a central point. This is a modal ontology which resulted in a description of the structure of each sphere of reality. Through a hierarchically organized and interdependent scale, Dooyeweerd provided the widest possible analytical diversity. This communication will rebuild the argument of Dooyeweerd with the objective to trace the minimum outlines of a philosophical methodology not reductionist to contemporary scientific activity.

Towards Spacetime Structuralism

Philipp Berghofer (University of Graz, Austria)

Contact: philipp.berghofer@uni-graz.at

The question of whether the world we live in is adequately described by our most successful scientific theories is a central topic in the philosophy of science. There is a special focus on the ontological status of unobservable entities. Scientific realism is the view that we should have a positive attitude towards the existence of the entities posed by science: We are not only justified but are obliged to believe in the existence of the entities posed by science, whether they are observable or not. The main motivation for this view is the miracle argument that holds that scientific realism is the best explanation for the obvious success of our scientific theories. This success would be miraculous if our successful theories were misleading. Despite its initial plausibility, scientific realism and its miracle argument have been attacked on many fronts. A specific version of scientific realism, however, namely structural realism has been widely discussed and remains popular. Structural realism is the view that science primarily tells us something about the structure of or the relations within the physical world. One has to distinguish between epistemic and ontic structural realism. Epistemic structural realism is the view that all we can know about the world are these relations, whereas ontological structural realism holds that these relations are all there is. Originally, structural realism was introduced by John Worrall as it seemed to unite the most plausible aspects of substantialism and relationalism (cf. Worrall 1989). This, however, was only the beginning. Meanwhile there have been several excellent attempts to demonstrate the advantages of structural realism by discussing concrete problems in theoretical physics. Most notably, proponents of ontic structural realism have tried to apply this position to the interpretation of quantum field theory. My focus, however, is on the physics of spacetime. My aim is to defend spacetime structuralism, which is the view that "spacetime is a real structure that is embodied in the world." (Bain 2006, 64) In the past, the main motivation for such an undertaking was the alleged analogy between spacetime points and quantum particles (cf., e.g., French & Rickles 2003). Against this analogy has been forcefully argued by Pooley 2006 and since then establishing spacetime structuralism seems to have lost much of its former appeal. The aim of my contribution is to evaluate Pooley's criticism and show how an ontological structural realism can be applied to the physics of spacetime.

References

Bain, J. (2006): "Spacetime Structuralism," in D. Dieks (ed.), *The Ontology of Spacetime*, Amsterdam: Elsevier.

French, S. & Rickles, D. (2003): "Understanding Permutation Symmetry," in K. Brading and E. Castellani (eds.), *Symmetries in Physics: Philosophical Reflections*, Cambridge: Cambridge University Press.

Pooley, O. (2006): "Points, particles and structural realism," in D. Rickles, S. French and J. Saatsi (eds.), *Structural Foundations of Quantum Gravity*, Oxford: Oxford University.

Worrall, J. (1989): "Structural realism: The best of both worlds?" *Dialectica* 43: 99-124.

The dam project. Who are the experts?

Pierluigi Barrotta (University of Pisa, Italy) / Eleonora Montuschi (Ca' Foscari University – Venice, Italy)

Contact: pierluigi.barrotta@unipi.it

Contact: eleonora.montuschi@unive.it

Keywords: scientific knowledge, local knowledge, experts

There is a demarcation problem in public debates involving technical matters: expert vs. non-expert knowledge. There is a view that citizens have the right to participate in these debates in the 'political' stages of their development. However, it is much more controversial whether participation should be allowed in the more 'technical' stages of problem solving. How effective is non-expert knowledge vis a vis expert knowledge? We do live in an 'expert culture', after all. For most decisions we know that we can rely on an 'expert' (often more than one) in the relevant field. And so we happily delegate to experts the burden of decisions concerning what to do and how to do it. But how happily so? Paradoxical as it might sound, we also live in an 'expert-wearied culture'. Experts often betray our trust. There is an argument that non-expert knowledge not only has a specific contribution to offer, but also that such contribution is a necessary condition for the success of problem-solving outputs. Sometimes it just squares better than expert knowledge (eg Wynne 1996).

So, do we need experts? Should they be trusted? Should they be consulted, and for what reasons? In this paper we would like first to assess the difference between two types of knowledge that can be classified as expert and non-expert, namely 'scientific' knowledge and 'local' knowledge, and clarify in what sense they both qualify as types of 'knowledge'. Secondly, we will discuss whether these two types of knowledge are disjunctive or complementary. Thirdly, we will argue that if we believe that they can be complementary, a theoretical framework of conditions and practical requirements should be articulated to allow technical information and informal experience suitably to combine. To illustrate the need for this interactive framework we analyse a case study that displays many of the contentious features mentioned above.

In 1963 a huge landslide covered the Vajont valley (north--east of Italy), where one of the tallest arch dams in the world had been put in place. The dam itself did not suffer damage but massive flooding spread over the valley with catastrophic consequences for the villages there situated. The locals had repeatedly warned the scientists that the sides of the valley were too fragile to hold significant impact.

With the help of this case study we analyse how two types of knowledge (official science and local experience) may confront each other and why they fail to interact. We then draw some lessons concerning how the use of expert knowledge becomes effective and valuable in the context of non--expert knowledge. In particular:

- 1) Scientific claims normally take a general form, but their application requires a whole host of 'supporting factors' drawn from local awareness of the specific circumstances of application. Science can learn from local knowledge.
- 2) At least in some situations (as the Vajont case points out) expert and non--expert knowledge should be complementary. It is an epistemological mistake to oppose scientific and local knowledge (as for example suggested by some radical constructivists).

Manipulating Causes in Medicine

Renata Arruda (Universidade Federal de Goiás, Brasil/ Universidad de Salamanca, Spain)

Contact: renataearruda@gmail.com

Keywords: Medicine, multicausality, manipulability.

Multicausality, a conception that consists in an effect being considered resulting from a set of causes, may seem to us, in a sense, a redundancy and a triviality. After all, no event can occur in an absolutely isolated manner, without interference from other events or without being part of a causal chain. Nevertheless, multicausality should not be understood as devoid of any meaning.

J. Mackie and K. Rothman worked on an elucidation of this concept in order to address the issue of multicausality in philosophy and also in medicine. In the specific context of medicine, multicausality is opposed to the idea of monocausality, which attributes the causes of illnesses to specific factors, in isolation. We can find a paradigmatic illustration of this idea in "Koch's postulates" of 1880, which describe criteria that aim to establish a causal relationship between a specific microorganism and a specific disease, from an exclusive association of both. Many counterexamples weakened the criteria defined by Koch, and, contemporaneously, Rothman have influenced the adoption of the concept of multicausality as a more satisfying approach to the analysis of cause and effect in the study of diseases.

Considering the view that medicine works with the assumption of a set of specific facts, anterior and concurrent to the occurrence of diseases (or physiological conditions), there is a problem in the lack of limits on the number of the co-incident events when we think from a multicausal point of view. If, on one hand, monocausality restricted too much, on the other, multicausality can be very permissive. The number of factors present in a combination of causes tends potentially to a quantity whose measurement is not feasible. How many they would be? How relevant is to medicine list them and identify them?

The application of the notion of manipulability offers a possibility of going beyond the triviality of multicausality. Our goal is to present how the notion of multicausality acquires validity on medicine when combined with manipulability, which, in turn, reaches the status of test of the causal set. The determination of manipulable factors allows breaking the prospect of infinite regress, for it delimits, by virtue of what is manipulable, which is effective for obtaining or preventing certain events, two of the main purposes of medicine.

From Effect to Cause: Deductive Reasoning?

Ricardo Tavares da Silva (University of Lisbon, Portugal)

Contact: ricardo.silva@campus.ul.pt

Keywords: Criminal Procedure; Causal Reasoning; Deductive Reasoning; Warranty; Novelty

In the criminal systems that incorporate the inquisitorial model causal reasoning is of greatest importance in criminal procedure. This procedure consists in gathering evidence which supports (gives epistemic reasons for) the accusation of someone for committing a crime. To put it in other words: it consists in inferring causes from effects.

Throughout the history of Logic and Philosophy causal reasoning has been understood as a case of inductive reasoning. Like Copi, Cohen e McMahon say in their 2011's paper Causal Reasoning, "induction goes far beyond analogical arguments", since "when we know, or think we know, that one

thing is the cause of another, or the effect of another, we can reason from cause to effect, or from effect to cause". And more: "if the supposed relations between cause and effect have been correctly established, the reasoning based on those relations is very powerful".

Stuart Mill, in *A System of Logic*, talks about causal reasoning in the context of Book III, dedicated to inductive reasoning. Here he asserts: "the notion of Cause being the root of the whole theory of Induction, it is indispensable that this idea should, at the very outset of our inquiry, be, with the utmost practicable degree of precision, fixed and determined".

I will argue that causal reasoning can be, like reasoning in general, both deductive and inductive. In deductive causal reasoning, the set of premises, propositions about effects, is sufficient for or warrants the conclusion, proposition about the cause. In inductive causal reasoning, that certainty is replaced by probability: the premises are insufficient and the more premises about effects we add, the stronger the reasoning will be.

The traditional view supports itself in a dilemma: in reasoning, either there is warranty or there is novelty. If there is warranty, there is not novelty; that would be the case of deductive reasoning. If there is novelty, there is not warranty; that would be the case of inductive reasoning. Causal reasoning would belong to the second group because there is novelty and, therefore, there is not warranty in it.

But this a false dilemma. Reasoning may lack novelty and, nevertheless, be an inductive one: that's what happens, for instance, in simple generalization. And reasoning may have novelty and, nevertheless, be a deductive one: that's what happens in some causal reasoning.

Against the traditional view I will develop the following line of argumentation: one thing is to warrant that some state of affairs exists and other thing is to warrant that warranty. For instance: the application of a force in a ball may serve as warranty that the ball will move; but we may also ask what warrants that, if we apply a force in a ball, then that ball will move – here the warranty is about the truth of the conditional, not about the truth that the ball will move.

So we may have correct deductive reasoning without having warranty of that correction, like in some cases of causal reasoning.

Mechanisms and natural laws: Why mechanisms need of natural laws in order to be explanatory?

Roger Deulofeu (University of Barcelona, Spain) / Javier Suárez (University of Exeter, United Kingdom)

Contact: roger.deulofeu@gmail.com

Contact: jsuar3b@gmail.com

Keywords: scientific explanation - mechanisms - scientific laws

Mechanistic talk has become very popular in recent philosophy of science, and it's claimed to have provided a new framework for addressing traditional questions. One of these questions concerns the nature of scientific explanation. Defenders of the mechanistic view of explanation argue that to explain a phenomenon consists in giving the mechanisms that are responsible for the phenomenon to come about (Machamer, Darden & Craver 2000; Craver 2007). In this paper we will argue that, in proper scientific explanations, the recurrence to natural laws is prior to the recurrence to mechanisms, whose explanatory character lies ultimately in the laws that unify the mechanistic discourse. For that reason, following the account of scientific explanation developed by Díez (2014), we will defend that the explanatory character of science does not lie in mechanisms, but in the appearance of an "ampliative specialized scientific law" in the explanans which provides the explanation with its usual

unifying character.

We will argue in favour of our view by presenting a biological example, namely: the persistence of symbiotic associations. As it is well known nowadays, symbiosis is a pervasive phenomenon in nature and its existence posits certain challenges to traditional biological thought. The main problem with symbiosis consists in explaining how and why symbiotic alliances are maintained through time (Douglas 2010). To explain this means that we need to explain, in the first place, how it is possible that the existence of cheaters –organisms that only benefit from the association without giving anything in return– is prevented and avoided. In the biological world, different organisms have evolved a wide variety of mechanisms to prevent their existence, and thus to allow the maintenance of the symbiotic association: genetic assimilation (“kidnapping” certain genes from the symbiont in order to control its reproductive rates), vertical transmission (guaranteeing that the “good symbionts” are exclusively passed from parents to offspring), molecular recognition, etc. The origin and maintenance of these different mechanisms, we will argue, depends on the existence of a biological regularity according to which all associations that confer fitness advantages to the partners involved will tend to be preserved. Our argument will be that such a regularity: (1) has the status of a scientific law –in Mitchell’s sense of laws as “pragmatic laws” (Mitchell 2003); (2) is necessary in order for biologist to explain the maintenance of symbiotic associations; and (3) is explanatory prior to the mechanisms involved, and gives biological explanation its unifying status: without mentioning this law, the reference to the mechanisms lacks explanatory character.

In conclusion, we will argue that laws are priors to mechanisms in scientific explanation and are a necessary element for every scientific explanation, thus justifying Díez’s account of scientific explanation vis à vis mechanistic accounts.

Laws and Mechanisms in the Human Sciences

Rui Silva (University of the Azores, Portugal)

Contact: rui.js.silva@uac.pt

Keywords: Laws; Mechanisms; Causal Inference; Underdetermination.

According to an influential epistemological tradition, science explains phenomena on the basis of laws, but the last fifteen years have witnessed a “mechanism movement” that emphasizes the fundamental role of mechanism-based explanations in science, which have the virtue of opening the “black box” of correlations and of providing a genuine understanding of the phenomena; the investigation of mechanisms enriches the empirical content of a theory by introducing a new set of variables, helping us to make causal inferences that are not possible on the basis of macro-level correlations (due to well-known problems regarding the underdetermination of causation by correlation).

Given the complexity of human behavior, it is reasonable to claim that, if there are laws in this domain, they should be *ceteris paribus* (cp) laws, which admit exceptions because of the interference of causal factors that cannot be specified in advance. Critics complain that cp laws are vague, vacuous and untestable, whereas their supporters argue that they describe real tendencies (in a necessarily idealized way), that they can be tested in idealized settings, and that exceptions to nomological generalizations are acceptable provided that they have independent explanations. The appeal to powers and capacities can also help to legitimize cp laws. Nancy Cartwright, for instance, claims that a sentence like “smoking has the capacity to cause lung cancer” (intended as a reformulation of a cp law) has predictive value and entails regularities.

In this context, the use of mechanisms might be tempting; besides providing more fine-grained explanations than nomological ones, the study of causal mechanisms can explain away exceptions to cp laws. However, the appeal to mechanisms has also a methodological price. First, the interference

effects that seem to legitimize cp clauses reappear at the level of mechanisms; same-level and lower-level mechanisms may inhibit, or strengthen, the operation of a particular mechanism. Sometimes, opposing mechanisms may be both in action and have a zero net effect (as shown, e.g., by Elster). Second, their individuation as causal patterns can be controversial. Third, they are strongly context-dependent; in certain contexts, a particular arrangement of entities and interactions may generate regularities, but not in other ones. Fourth, mechanism-based explanations face also underdetermination problems, because the available evidence allows often different interpretations of the underlying structure of a correlation. Finally, mechanisms present testability problems, to the extent that it is often not possible (against the so-called modularity assumption implicit, e.g., in interventionist accounts of causation) to test, or intervene on, their components without affecting other causal factors.

At any rate, the study of mechanisms is an indispensable part of the human sciences, and the significant epistemological challenges that they raise do not lead to a defeatist, but only to a satisficing (to use Herbert Simon's term) account of the human sciences, according to which their complexity can be at least satisfactorily managed with the help of detailed empirical research (including statistic methods, quasi-experimentation, randomized control trials or case studies) and by developing critical thinking skills at the level of scientific inference.

The ontological concept of Disease and the Clinical Empiricism of Thomas Sydenham

Ruy Jose Henriquez Garrido (Universidad Complutense de Madrid, Spain)

Contact: ruyjose@ucm.es

Keywords: Sydenham, Locke, empiricism, ontological concept, illness, disease

The clinical empiricism of Thomas Sydenham and his definition of "morbid species" (species morbosae) in the XVIIth century, involves an important transition in the history of medicine. The medical research tradition fundamentally physiological becomes an ontological tradition. This transition also marked the passage of a qualitative notion to a quantitative understanding of diseases. Leading to a medical nosographic revolution.

Influenced by the botanical conception of John Ray, Sydenham takes the first steps defining the disease as "scientific fact" (in terms of Larry Laudan), thereby initiating a Copernican turn in the history of medicine.

This paper shows that just like the nascent Greek philosophy sought support in Hippocratic medicine for its development, the empirical philosophy of John Locke found a source of inspiration in the medical conception of Sydenham. Facilitating the definition of epistemological method of empiricism and the rethinking of philosophical thought in general.

Additionally, this paper will support that when there is a qualitative understanding of a certain aspect of reality is largely due to ignorance of the laws involved in it, or to the lack of definition of the object of knowledge. The basis of every revolution in science is the change towards a quantitative understanding of the facts. The clinical empiricism of Sydenham is a clear example.

What We (Should) Talk About When We Talk About Fruitfulness

Silvia Ivani (Tilburg University, Netherlands)

Contact: silvia.ivani@gmail.com

Keywords: Fruitfulness, Values, Evolutionary Psychology

What are the relevant values to assess a scientific theory? This question remains hotly debated. Thomas Kuhn (1977) suggested a list of five desirable values that scientists should consider when assessing scientific theories. That list included accuracy, consistency, scope, simplicity, and fruitfulness. Since then, several philosophers have proposed many lists and analysed these values. Surprisingly, despite being included in several lists, little attention has been paid to fruitfulness. To date, philosophers have not exhaustively explained and justified its inclusion in the lists of values. Granted, it is taken as a fundamental desideratum and, intuitively, it seems one of the crucial features of scientific theories. However, in order to avoid 'empty shells' among cognitive values, philosophers should provide a clear definition of fruitfulness by answering two key questions: what is fruitfulness? What is its role in the assessment of scientific theories?

In this paper, I try to fill these gaps by suggesting an analysis of the meaning and roles of this value. To do so, I propose a specific case study, i.e., I analyse Evolutionary Psychology (Buller 2005) by using a new interpretation of fruitfulness. This case study shows how this approach improves the understanding and assessment of fruitfulness of research programs and theories. I argue that the traditional accounts of fruitfulness are vague and unsuitable. Despite offering interesting insights, they mistakenly characterize fruitfulness by focusing on the quantity of hypotheses and predictions produced by a theory. These accounts fail to distinguish between fruitful and 'creative' theories. That is, they characterize a creative theory producing many ad hoc hypotheses and unreliable explanations as fruitful. Although it satisfies fruitfulness, such a theory does not seem valuable. I argue that a suitable account of fruitfulness should focus on the quality of predictions and hypotheses. In other words, fruitful theories should provide a satisfactory amount of reliable explanations.

In this paper, I use Evolutionary Psychology to show the benefits of this account of fruitfulness. For this analysis, two aspects are especially important. First, we have to analyse the methods and approaches used to formulate new predictions and hypotheses. I focus on reverse engineering and adaptive thinking. Second, we have to evaluate the tests employed to validate predictions and hypotheses. Here, I consider some of the tests used by evolutionary psychologists, such as the tests employed in cross-cultural studies. The account of fruitfulness defended in this paper permit us to pinpoint many interesting and relevant aspects of Evolutionary Psychology that are not detectable with a traditional interpretation of fruitfulness. Hence, I argue that this new characterization both improves the philosophical analysis of fruitfulness and the scientific evaluation of the merits of research programs and scientific theories.

References

- Buller, David 2005. *Adapting Minds: Evolutionary Psychology and the Persistent Quest for Human Nature*. Cambridge, MA: MIT Press.
- Kuhn, Thomas S. 1977. "Objectivity, Value Judgment and Theory Choice". *The Essential Tension*, 320-339. Chicago: Chicago University Press.

Knowledge in Context: The Factivity Principle and Its Epistemological Consequences

Stefano Leardi (FINO Consortium (University of Torino, University of Genova, University of Pavia, University of Piemonte Orientale, Italy) / **Nicla Vassallo** (University of Genova, Italy)

Contact: stefano.leardi.g1@gmail.com

Contact: nicla.vassallo@unige.it

Keywords: Epistemology - Contextualism - Knowledge - Knowledge ascriptions

Epistemic contextualism is the view according to which the truth conditions of the expressions that ascribe or deny knowledge depend upon certain features of the knowledge attributor's context. This novel approach to knowledge-attributions surely represents one of the more interesting developments in the current epistemological debate; indeed, it provides an original account for our ordinary epistemic behaviour, proposes an attractive solution to the sceptical puzzle and appears to be a serious competitor to the traditional view about knowledge-attributions labelled as invariantism. However, contextualism faces a severe objection - known in literature as the "factivity problem", - that seriously menaces its own survival; this quite recent objection claims that the contextualist who endorses two well-known epistemological principles that he should not desire to give up - i.e. the factivity principle (according to which knowledge implies truth) and the principle that maintains that knowledge is closed under known logical implication, - cannot coherently state his own theory. The argument of the objection runs as follow: consider (1) a subject S_1 who is in a context C_1 characterised by a particularly strict epistemic standard such that he cannot count as knowing that q in C_1 and (2) another subject S_2 who is in a less demanding context C_2 such that S_2 counts as knowing that q in C_2 . Now, according to the premises of contextualism, we should acknowledge that (3) S_1 , as a contextualist, knows in his own context C_1 that " S_2 knows that q in C_2 " is a true proposition; however, applying the factivity and the closure principles to the proposition mentioned before we will end up with a contradiction, i.e. that S_1 counts as knowing that q in C_1 ; apparently then, contextualism cannot be coherently stated.

Here we propose a critical scrutiny of the main solutions presented until now to solve the factivity problem. A first way to unravel the puzzle could be, as Wolfgang Freitag and Alexander Dinges have suggested, to deny the first step of the argument maintaining that the contextualist should not committed himself to the truth of any particular empirical proposition. A second approach to the problem, developed by Anthony Brueckner and Christopher Buford, claims that the advocates of the factivity problem misunderstood the contextualist view: the third step of the argument would then not be valid because the contextualist shouldn't recognize as true in his more demanding context the knowledge-attributions considered true in others less demanding contexts. A third attempt of solution proposes instead to reconsider in a contextualistic friendly way the epistemological principles involved in the argument of the factivity problem; doing so, maintains Peter Baumann, the proponent of this approach, would be enough in order to avoid the contradiction.

We will show that the above methods make some interesting moves forward, but that all three achieve a solution to the factivity problem only at high prices for contextualism; the consistency of this theory with the closure principle and especially with the factivity principle seems then to be still very dubious.

Performance art: a rhizomatic almost continuously tending to liquid approach

Telma João Santos (Universidade de Évora, CFCUL, Portugal)

Contact: tjfs@uevora.pt

Keywords: Performance Art, Almost Convergence, Rhizome, Liquidity

Concepts as set, sequence, function, continuity, limit, convergence, are just some examples of mathematical notions that are also part of the vocabulary used in artistic production. These notions are not yet settled formally in performance studies in general, since it is still an open road to be travelled. I propose here to use some of these concepts in several layers within a case study, discussing their generality and their contextualization regarding different fields of study.

I propose a relational model within artistic creation where the use of mathematics helps mapping artistic creation. Also, widely known concepts as rhizome, liquidity and presence/absence perception states are used to convey, together with mathematical concepts, new possible ways of perceiving and understanding a performance art piece. Also, a transdisciplinary way of constructing thought is presented through the way several concepts from several fields can be used to generate new materials and new environments.

I also present a case study: *In Between Selves*. This project, which covers a performance, some academic papers, and an experimental documentary, started with some video recordings of improvised movement, as well as some improvised speech moments around movement and questions associated to the construction of the performance. At the same time, I dedicated myself to several attempts to prove the validity of the Harnack Inequality in the context of my research in mathematics. Harnack Inequality is a qualitative property of partial differential equations, which gives us an estimate around the variation of any solution inside the domain. This property was proved for some classic equations, and also proved for more general equations, and I wanted to prove its validity in variational context, where, instead of solutions to partial differential equations, we are dealing with minimization problems in more general sets and spaces of functions. The motivation to construct this project aroused on an axiomatic will to share an autoethnographic research, creating an environment from which I could generate new places from improvisation, composition and perception techniques, edited and in real time. The papers and the experimental documentary came later, when I tried to understand the whole process of connecting research, practice, multimedia and movement improvisation.

So, *In Between Selves* is presented here as a project where several directions are considered:

- (a) As an example of the proposed model;
- (b) As an example where, not only the interdisciplinarity between mathematics and performance art is present within the model, but also the transdisciplinarity between mathematics, movement improvisation, performance and multimedia, since I do not only use these tools to convey each others, but also as tools to generate new environments and new ways of doing, through their intersubjectivities;
- (c) As an example of what I call an "actual body", where new technologies are used as self (re) presentations in everyday life, as well as tools within artistic creation;
- (d) As an example of an autoethnographic performance, where a body of work, made of academic papers, an experimental documentary and a performance, is constructed.

Varieties of Strong Emergence

Umut Baysan (University of Glasgow, United Kingdom)

Contact: emin.baysan@glasgow.ac.uk

Keywords: strong emergence, causal powers, supervenience

Some philosophers of science have found it useful to apply the notion of "emergence" to explain the occurrence of certain complex phenomena and some higher-level goings-on. In metaphysics of science, the main focus has been on the distinction between "weak" emergence and "strong" emergence. Whereas the existence of weakly emergent entities are typically taken to be compatible with broadly physicalist and mechanistic world views, the alleged existence of strongly emergent entities is thought to challenge these world views.

Strong emergence is often understood in terms of novelty of causal powers: strongly emergent properties are supposed to have causal powers beyond the causal powers of the properties that they depend on. In this sense, strong emergence is typically associated with the doctrine of "downward causation" and also the failure of the causal closure of the physical. But it is also often suggested that strongly emergent properties nomologically, but not metaphysically, supervene on the structural properties that they emerge from. An arising consensus is that strong emergence can then be understood as the combination of these two features: (i) causal novelty and (ii) nomological (but not metaphysical) dependence.

In this talk, I argue that, given some plausible views about how properties are related to the causal powers that are associated with them, these two constraints on emergence, namely causal novelty and nomological dependence, cannot be satisfied at the same time. One of these "plausible views" is motivated by the acknowledgment of the role of laws of nature in governing the causal relations that properties enter into. I then explore two ways in which strong emergentists about special science properties can defend their views. I argue that each option is loyal to the typical anti-physicalist and anti-mechanistic commitments. Accepting this consequence requires a revisionary approach to theorising about emergence.

Genetic causation in developmental and population behavioural genetics

Veli-Pekka Parkkinen (University of Kent, United Kingdom)

Contact: v.k.parkkinen@kent.ac.uk

Keywords: genetic causation, development, behavioural genetics

This talk considers the concept of genetic causation in developmental and population behavioural genetics. The bulk of behavioural genetics research focuses on tracing individual differences in psychological and behavioural phenotypes to genetic differences between individuals, providing clues of genetic origins of population wide variation in behavioural and psychological traits. By contrast, developmental behavioural genetics studies how genes dispose individuals to particular psychological phenotypes; the focus is on understanding causes of phenotypes, not phenotypic differences. In this talk it is argued that the population-level and developmental behavioural genetics – the latter understood as the study of determinants of individual phenotypes – employ different concepts of genetic causation, and that confusion may arise when inferences and evidence pertinent to applying one concept are used in a context where the other concept is more appropriate. In the population perspective, genes are conceptualized as candidate actual difference-makers for phenotypes in a given environment: a gene may be said to cause a phenotype in the sense that allelic differences map to phenotypic differences, and – per hypothesis – intervening to change

the distribution of actually observed alleles in a population would change the distribution of the phenotypes. In the developmental perspective, genes cause phenotypes by determining the shape of the developmental landscape, making some phenotypes more easily accessible than others. The population perspective highlights genetic causes as a source of differences in a given environment, while the developmental perspective highlights causation by canalization, where genes have their influence through biasing development towards particular phenotypes against (hypothetically) varying environments. There seems to be a simple way of reconciling these perspectives – just think of the influence of genes on development as a mechanistically mediated effect, where genetic differences cause differences in developmentally intermediate physiological and psychological phenotypes that map to differences in adult phenotypes that emerge later. However, this interpretation would ignore a potentially important role of genes in determining the sensitivity of development to environmental variation. Sometimes genetic differences result in phenotypic differences because an allele makes its bearer susceptible to particular environmental effects that, when the environment is present, pushes development to a path that is not as easily accessible for individuals not carrying the susceptibility allele. It is argued that in order to reconcile the individual and population perspectives, we should conceptualize development as a series of changes in the causal capacities of an organism over time, partly determined by its genetic makeup. Studies on the interaction between rearing environment and serotonin transporter gene promoter polymorphism in the etiology of depression are used as an example to illustrate these arguments.

The international diffusion of economic ideas: a search for connecting principles

Vitor Neves (Universidade de Coimbra, Portugal)

Contact: vneves@fe.uc.pt

Keywords: Economics; internationalisation; complexity

Economics is a plural and complex science, subject to different methodological approaches and constructions not independent from the historical, social and cultural circumstances conditioning them. The processes of internationalisation of economic ideas, in particular those associated with the transmission, assimilation and adaptation in scientific (semi)peripheral countries of ideas originally produced in other spaces, are an important aspect of how economics as a science develops at a global scale.

However, in spite of its relevance, knowledge of these processes is still incipient. Histories of economics are in general histories of the contributions considered to have been decisive in the formation of economics as a scientific discipline, i.e. largely histories of the scientific contributions to knowledge at the core of the economics profession. The processes of international diffusion of economic ideas are usually neglected.

When these processes are taken into consideration they tend to be analysed under three dominant frameworks: (i) the infectious disease model; (ii) the model of the marketplace for ideas; and (iii) the information theory model.

Although the complexity approach has already been applied to a variety of fields in economics – for example, to issues in the history of economic thought (e.g. Colander 2000) and in the economics of public policy (e.g. Colander and Kupers 2014) – no attempt, to my knowledge, has been made so far to apply complexity theory to the analysis of the processes of the international diffusion of economic ideas.

My aim in this paper is thus twofold: first, I will provide a critical review of the three models mentioned above; second, I intend to consider what, hopefully, can be the contribution of the complexity approach to the analysis of the processes of international circulation of economic ideas. Of course, this is no more than a tentative endeavour.

Symposia

Symposia

Symposium 1

Interdisciplinarity today: Scope and Applications

Coordinators: Prof. Olga Pombo, Klaus Gärtner.
Contact: klga@gmx.de

This symposium is put forward by the CFCUL thematic line "Unity of Science and Interdisciplinarity". It continues a research being done with several colleagues, both from Portugal and in Brazil. The aim is to discuss several case studies in areas where ID plays an essential role. In this context, one panel (dedicated to ID approaches in education) and three round tables (discussing different interdisciplinary research areas) will be put forward.

The morning panel will discuss three ID case studies in the context of educational initiatives. Presentations will consider an experimental ID post graduation program, the relation between existing ID practices and formal/informal education, and an ID initiative for teachers of secondary schools. The former two case studies are about currently running programs in Brazil, while the third case study analyzes an already completed Portuguese initiative.

In the afternoon, the first round table is dedicated to case studies about urban studies, water research and the broad role played by emergence and relational ontology in several disciplines. The first case study will investigate the nexus between sustainability, ID and urban studies. This is followed by an assessment of ID in the context of Portuguese water research. The round table will close with a conceptual discussion of emergence and relational ontology within biology and the social sciences.

The second round table will deal with case studies discussing ID in the context of neurosciences, cognitive sciences and language studies. The first case study will discuss how the neurosciences and first-person methods go together. This is followed by the second case study which will have a close look at how ID approaches within the cognitive sciences have changed over time. The final case study will shed light on ID in the origin and evolution of language studies.

Finally, the third round table considers case studies about ID within transcontinental relations, social sciences and interdisciplinary applications in science. The first case study will consider how ID enters in transcontinental knowledge exchange in Lusophone countries. After, a discussion about ID discourses in the Social Sciences will be offered. The round table closes with an examination of the role of ID in the context of pressing questions or problems that go beyond the scope of one scientific discipline.

Case Study: Programa de Pós-Graduação Interdisciplinar

Helena Esser dos Reis / Cerise de Castro Campos / Rosani Moreira Leitão (Universidade Federal de Goiás)

Neste estudo de caso é analisado a prática interdisciplinar em curso no Programa de Pós-Graduação Interdisciplinar em Direitos Humanos da Universidade Federal de Goiás. O Programa é baseado na integração interdisciplinar do trabalho de discentes, docentes e técnico-administrativos visando articular as atividades desenvolvidas no campo dos Direitos Humanos.

Case Study: Relações existentes entre práticas interdisciplinares e a formação formal e não formal

Giselle Faur de Castro Catarino (Universidade do Estado do Rio de Janeiro & Universidade do Grande Rio), **Glória Regina Pessoa Campello Queiroz** (Universidade do Estado do Rio de Janeiro)

O estudo de caso consistirá na análise de uma prática interdisciplinar peculiar resultante de uma formação inicial muito diferenciada que combina o formal e o não formal, a partir de uma parceria entre um Museu e instituições formadoras de professores.

Case Study: Acção de formação de professores do ensino secundário – trabalho experimental e Interdisciplinaridade

Elisa Maia (Center for Philosophy of Sciences of the University of Lisbon)

Neste estudo de caso é analisada uma acção de formação realizada pelo Departamento do Ensino Secundário (DES) em 1999-2000, no âmbito da Reforma Curricular então em curso, relativa ao ensino experimental das ciências. Entre os objectivos da acção estabelecia-se "desenvolver competências científicas disciplinares e interdisciplinares e competências didácticas necessárias à implementação de trabalho prático numa perspectiva investigativa e interdisciplinar" A análise baseia-se na documentação produzida ao longo da acção. Através de entrevistas a alguns dos professores pretende-se ainda avaliar o impacte desta formação na sua prática lectiva subsequente.

Case Study: The sustainability, interdisciplinarity and urban studies nexus

Olivia Bina (Institute for Social Sciences of the University of Lisbon)

21st century challenges are characterized by high potential impact, complexity, and uncertainty. Understanding and addressing these types of challenges is an essential pre-requisite for meeting sustainability objectives and policies, and yet disciplinary boundaries and related institutions, cultures, and power structures continue to stand in the way of insight. Education and research are all too often called upon to create the conditions for sustainable futures, but are confronted with formidable internal barriers.

There is a pressing need for contextual and relational perspectives, and for the enabling of "integrative" mindsets through the pursuit of interdisciplinary inquiries. The United Nations declaration of the Decade of Education for Sustainable Development advocates the need for universities to embed sustainability in all learning areas. We explore the specific link between Education for Sustainable Development and interdisciplinary practices, focusing on the specific case of post-graduate top-level programmes in urban studies. We start by reviewing an extensive literature to identify the principles and practices characterising the UN DESD, and to identify the topics and themes considered essential for teaching aimed at the promotion of sustainable urban development. Based on the extensive literature review we define an analytical framework in five parts, related to various aspects of curricular content and teaching and learning approaches: programme orientation, skills, ethics and critical reasoning, interdisciplinarity and content related to sustainable urban development issues. We then conduct an empirical study of 25 among the best post-graduate level (MA and MSc) programmes in urban studies from Europe, China, the USA and the Global South, to see how they are adapting their curricula to the requirements of sustainable urban development captured in the analytical framework. While acknowledging the significant context specificities that must

be respected, and the multiple challenges that must be reconciled when defining urban studies curricula - we find both strengths and weaknesses in these top programmes, including important differences among the programmes from the four regions. Our data suggests that important steps are being taken towards 'whole-system' transformation envisaged by the UN Decade of Education for Sustainable Development, but also that trans-formative factors depending on cultural and institutional values and practices remain relatively weak.

Case Study: Assessing interdisciplinarity in water research in Portugal. Where to find the Social Sciences and Humanities?

Marta Varanda (Lisbon School of Economics & Management)

Our departing assumption is that water issues are complex and require an integrative, ID and holistic approach (Braithwaite & Craswell 2008 p. 474). This is increasingly true as water problems, that had a more benign character in the 18th and 19th century, have taken a wicked character as the 20th century unfolded (Freeman 2000, p. 484).

In this study we set out to inquire whether Portuguese research centres approach water in an interdisciplinary and holistic manner.

Water research was traditionally a "monopoly" of natural sciences: engineering, chemistry biology, ecology, climatic sciences But persistent difficulties in the management of water have made clear that "technical fixes", which do not take into account the social, political, economic and cultural context, fail to address the root of the problems and endanger the sustainability of the resource. Hence the social sciences have been called into the water research field. At this point it is not yet clear what is the weight of their presence, what exactly is expected and demanded of them, in short, how are they contributing to water research aiming the sustainability of the resource.

This research, still in its initial phase, aims to clarify some of those issues, which are at the centre of the debate of the collaboration between the social and natural sciences. Based on a web search (complemented by the authors and colleagues' previous knowledge of the field) we identified all the research centres studying water in Portugal. The prevalence and nature of interdisciplinarity is identified through the integration of disciplines (codified according to OECD's 2007 revised field of science and technology) of co-authors of randomly selected papers.

Preliminary findings show that research in water in Portugal is characterised mostly by collaboration within natural sciences (mainly earth and environmental sciences and biological sciences and engineering) with some interdisciplinary collaboration of the natural sciences with social sciences, represented almost exclusively by business and economics. This is consistent with a recent report on the role of Social Sciences and Humanities in the Horizon 2020, which shows the dominance of business and economics in interdisciplinary collaboration. The network pattern identified clearly reveals a core-periphery structure, with natural sciences at the core and the social sciences at the periphery, meaning that there is a hierarchical division of work within water research.

Many questions remain open: What is preventing social sciences from entering the study of water to side to natural sciences? What maybe the consequences of this lack of dialogue and open and frank cooperation? Are funding schemes, university structures, disciplinary "arrogance" or simply researchers lack of competences, time, knowledge blocking interdisciplinary collaboration? These questions will shape this research next steps because "It is essential to seek comprehensive solutions which consider the interactions within natural systems themselves and with social systems. We are faced not with two separate crises, one environmental and the other social, but rather with one complex crisis, which is both social and environmental. Strategies for a solution demand an integrated approach to combating poverty, restoring dignity to the excluded, and at the same time protecting nature" (Pope Francis 2015, p.104).

Case Study: Emergence and Relational Ontology: Biology and Sociology

Gil C. Santos (Center for Philosophy of Sciences of the University of Lisbon)

The 'emergence'/'reductionism' issue was born at the end of the 19th century. It was re-visited and was further developed at the end of the last century. The main subject of this issue lies in the relationships between the different levels of organization of reality and the relations between the different sciences such as physics, chemistry, biology, psychology, sociology etc. The basic problem concerns ontological and epistemological questions and applies to all sciences. From an ontological point of view the notion of 'emergence' can only be understood in the context of the opposition between 'atomistic essentialism' and a particular version of 'relational ontology'. In this paper, I will analyze this opposition in biological and sociological ideas.

Case Study: Interdisciplinarity in neuroscience

Joana Rigato (Champalimaud/Center for Philosophy of Sciences of the University of Lisbon), **Rita Venturini** (Champalimaud)

After almost a century in which most of the studies of the mind and brain strived to do away with subjectivity, for the past two decades many cognitive scientists regained interest in the introduction of first-person methods as a fundamental component of their empirical research. This was motivated by the realization that the personal experience a subject has at any given time is a precious source of information about her mind and cannot be accessed directly in any other way rather than by introspection.

There are many methods to access and communicate introspective experience. In this talk, Joana Rigato (philosopher of science) and Rita Venturini (neurologist, group facilitator and improviser) will present briefly their interdisciplinary experience at Champalimaud Research, where more than 200 neuroscientists do fundamental research on the brain.

Rita Venturini embraced the challenge of weaving together neuroscience and improvisation, which has been a source of recursive inspiration. Improvisation asks the neuroscientist to consider constructs that are not intrinsically emerging from the field, like the concept of presence and its relationship with awareness, actions and identity. Neuroscience provides improvisation with a grounded framework for its experiences, its theoretical claims and predictions.

Joana Rigato has dedicated herself to exploring the field of neurophenomenology, as well as mapping the various methods that have been proposed as ways to obtain accurate introspective reports from subjects. With a restricted group of neuroscientists, Joana and Rita implemented one of the methods, Descriptive Experience Sampling.

Case Study: The Cognitive Sciences

Klaus Gärtner (Center for Philosophy of Sciences of the University of Lisbon)

Since the Cognitive Sciences are considered a paradigmatic example of interdisciplinarity, this case study analyzes what this means in practice. Consequently, interviews with actual scientists who work in the area on a daily basis were conducted and put in scientific context. The results of this case study stem from a reflection about what these respective scientists state, recent developments in the Cognitive Sciences and what this may imply for interdisciplinarity. The main conclusion is two folded. On the one hand, it confirms that the Cognitive Sciences are interdisciplinary in nature, on the

other hand, it shows that this is highly context dependent.

Case Study: Inter- and Trans-Disciplinarity in Origin and Evolution of Language Studies

Nathalie Gontier (Center for Philosophy of Sciences of the University of Lisbon)

By exemplifying how the new linguistic and sociocultural sciences make use of various evolutionary paradigms, we will detail the nature of the inter- and transdisciplinarity that currently characterizes origin and evolution of language research.

Case Study: Transcontinental Interdisciplinarity

José Carlos Tiago de Oliveira (CFCUL, University of Lisbon) / **Viviana Yaccuzzi Polisena** (Universidad Nacional de Tucumán, Argentina) / **Bhargav Srinivasa Desikan** (Institut National de Recherche Agronomique; Lille, France)

This case study is designed to analyze Interdisciplinarity in the context of transcontinental relations. In the XX century and in cooperation with Lusophone countries - from Angola to Asia and mainly Cape Verde - the project under scrutiny sought an exchange of knowledge between colleagues from Philosophy and Science and a contribution to the creation of new teaching methods, as well as libraries.

Case Study: Interdisciplinary discourses of social scientists

Jorge Jesuíno (Center for Philosophy of Sciences of the University of Lisbon) / **Lígia Amâncio** (University Institute of Lisbon), João Manuel de Oliveira (University Institute of Lisbon)

Illustrative interviews with social scientists were conducted. The aim was to identify what the prevalent discursive repertoires about both the concept and practices of interdisciplinarity, grounded in their own experience, are. A first attempt to categorize the data leads to the following three types of discourse: (1) additive, (2) instrumental, and (3) strategic. This suggests an underlying polysemic nature of how the concept of interdisciplinarity is represented in the social sciences.

Case Study: Needs and Desires of Interdisciplinary Science

Helder Coelho (University of Lisbon)

Intractable issues motivate today scientists to break the borders of several disciplines, trying to work across bridges, by combination (binary or more), integration or juxtaposition, building a common ground. Meshing of different disciplines, for example technology and humanities, can yield good results, namely when we aim answers to pressing questions or problems that cannot be adequately addressed by people from just one discipline. Therefore, when we desire a collection of people tackling a big problem, using more than their specific skills, we try a synthesis of different approaches into something unique. And, we adopt general principles, such as collective and cooperative effort, collaborative communication, discipline and no hierarchy.

Symposium 2

Simplicity of Proofs. The philosophical challenges of Hilbert's 24th Problem

Reinhard Kahle (CMA & DM, FCT, Universidade Nova de Lisboa, Portugal) / **Alan J. Cain** (CMA, FCT, Universidade Nova de Lisboa, Portugal) / **Augusto J. Franco de Oliveira** (Universidade de Évora & CFCUL, Portugal)

Contact: kahle@mat.uc.pt

Contact: a.cain@fct.unl.pt

Contact: francoli@kqnet.pt

Keywords: Philosophy of Mathematics, Hilbert's 24th Problem

Symposium Description: In 2000 a draft note was found in David Hilbert's Nachlass containing the idea for a 24th problem of his famous list of Mathematical Problems presented at the International Congress of Mathematicians in 1900 in Paris. This 24th problem is concerned with "criteria of simplicity, or proof of the greatest simplicity of certain proofs" in a mathematical context.

After the scholarly discovery of the previously unknown 24th problem, the question of simplicity of proofs was addressed by several authors, but mainly in the context of formal proof calculi.

It is our aim, however, to reassess Hilbert's 24th problem as a philosophical challenge (rather than a purely formal exercise), putting special emphasis on the potential impact of Hilbert's 24th problem on contemporary philosophy of mathematics.

At the proposed symposium Hilbert's 24th Problem will be discussed from different perspectives.

Next to a general presentation of the Problem in connection with Hilbert's Proof Theory, its relation to Aesthetics of Proofs, as well as a general outline of Hilbert's Philosophy of Mathematics will be given. In accordance with the time constraints of the organization of the main conference, the symposium can be opened to contributions, in particular by young researchers which may bring in new ideas and perspectives.

The symposium will be organized within the recently launched FCT-funded project "Hilbert's 24th problem", PTDC/MHC-FIL/2583/2014.

1st Author's Abstract: Hilbert's 24th Problem.

Reinhard Kahle (CMA & DM, FCT, Universidade Nova de Lisboa, Portugal)

We present Hilbert's 24th Problem as found in the Nachlass of David Hilbert, and discuss the current state-of-affair concerning existing attempts to answer it in the literature. We also address the place of Hilbert's 24th Problem in the further development of Hilbert's Proof Theory.

2nd Author's Abstract: Simplicity and the aesthetics of mathematics

Alan J. Cain (CMA, FCT, Universidade Nova de Lisboa, Portugal)

Professional mathematicians often evaluate proofs in aesthetic terms ('elegant', 'neat', 'beautiful'). Notably, Gauss wrote that after establishing the correctness of a result through a proof by any possible means, one should continue to seek 'the most beautiful and simplest proof' [Werke II, 159-160]. Like Gauss, modern writers, reflecting on how they evaluate proofs, often connect beauty and simplicity. For instance, McAllister writes that a beautiful proof possesses 'brevity and simplicity', and that a proof's beauty is thus dependent on how well it can be grasped as a whole [The Visual Mind

II, ed. Emmer, (MIT Press, 2005), ch. 2, pp. 22ff.]. Hardy's "A Mathematician's Apology" [Cambridge University Press, 1940] (probably the canonical modern defence of mathematics as an aesthetic pursuit) says that one of the properties of beautiful proofs is that the tools used are simple, though he prefers the term 'economy'.

Yet a recent study that considers the language mathematicians actually use when they evaluate proofs (as opposed to when they reflect on evaluating proofs) has shown that there is essentially no correlation between a proof being described as 'beautiful' and as 'simple' [Inglis & Aberdein, *Phil. Math.* 23 (2015), no. 1, pp. 87-109].

This talk will discuss to what extent some historical and contemporary perspectives on the aesthetics of proof are compatible with the notion of simplicity (as used by mathematicians when evaluating proofs). Particular emphasis will be placed on how simplicity relates to other notions that have been identified as facets of the aesthetics of proof, like unexpectedness, inevitability [Hardy, *op. cit.*], surveyability [Tymoczko, *J. Phil.* 76 (1979), no. 2, pp. 57-83.], and enlightenment [Rota, *Synthese* 111 (1997), no. 2, pp. 171-182]. The aim will be to discuss whether it is possible to clarify 'simplicity' in proofs, with the goal of resolving (or at least ameliorating) the apparent disagreement between mathematicians' aesthetic evaluations of proofs and what they say when they reflect on these evaluations.

3rd Author's Abstract: On Hilbert's Works in Foundations and Philosophy of Mathematics (1900-1931)

Augusto J. Franco de Oliveira (Universidade de Évora & CFCUL, Portugal)

This is a brief survey of David Hilbert's works, namely in the form of conferences delivered and papers published during the first three decades of the 20th century, dedicated to Foundations and Philosophy of Mathematics. We illustrate the steps from the early conceptions and attempts at the problem of non contradiction of the axioms of arithmetic to the full conservation and consistency program and the genesis of his method (proof theory or metamathematics) to tackle this question and its accompanying philosophy (formalism).

Symposium 3

Science and Eurhythmy – Foundations

José Croca (CFCUL, Portugal) / **Gildo Santos** (USP, Brazil) / **Andrea Mazzola** (CFCUL, Portugal) / **Paulo Castro** (CFCUL, Portugal)

Contact: jncroca@fc.ul.pt

Contact: jncroca@fc.ul.pt

Contact: mazzpazz@gmail.com

Contact: jpcastro@fc.ul.pt

1st Author's Abstract:

José Croca (CFCUL, Portugal)

Since its early beginnings one of the main objectives of Physics has always been the Unity. Still,

due to the huge development of this science there was a strong specialization followed by large diversification of fields. Some of these fields of Physics, such as relativity and quantum mechanics are conceptually incompatible. Relativity is a causal theory while quantum mechanics is indeterministic theory. Many efforts without success have been made to try to unify physics. Nevertheless, all these efforts lack an ontological perspective. Now, thanks to the genetic organizing principle of eurhythmy the unity of physics seems possible.

Keywords: Eurhythmy, complexity, nonlinearity, linearity, unity of science, nonlinear quantum physics, reciprocal interactions, complex systems, chaotic processes, cooperative processes.
References

- Niels Bohr, Nature, 14, (1928)580; (1928) - Como Lectures, Collected Works, Vol. 6, North-Holland, Amsterdam, 1985.
- Albert Einstein, On the electrodynamics of moving bodies, translation from Zur Elektrodynamik bewegter Körper, in Annalen der Physik. 17:891, 1905), in The Principle of Relativity, published in 1923 by Methuen and Company, Ltd. of London.
- J. R. Croca, Towards a nonlinear quantum physics, World Scientific, London, 2003;
- J.R. Croca, Eurhythmic Physics, or Hyperphysics, The Unification of Physics, Lambert Academic Publishing, Berlin,

2nd Author's Abstract:

Gildo Santos (USP, Brazil)

The Darwinian theory of evolution is based on randomness, and was strongly influenced by a pessimistic view on the scarcity and finitude of resources for the species' survival. The assumption of linear growth of resources became an absolute dogma, determining crises due to the exponential population growth, thus increasing competition among individuals. The concept of eurhythmy developed for physics of the non-linear complex has supported the overcoming of paradoxes brought about by the non-causal and merely probabilistic formulation of quantum phenomena. A natural extension of this concept to the biological domain, where complexity and nonlinearity are considerably enhanced, is presented, thereby challenging the Darwinian vision, substituting it by a theory of evolution where cooperation is the main characteristic of survival. Under this approach, cooperation among individuals evidences a trend of continually creating the exponential growth of new resources, transforming evolution from random processes towards a directed process of problem solving, ever more encompassing in relation to the environment. The progressive increase and complexity of mammalian encephalization in the particular case of human species points to the capacity for evolution to be eurhythmic, as evidenced by creativity.

3rd Author's Abstract:

Andrea Mazzola (CFCUL, Portugal)

In the controversy on the philosophical foundations of quantum mechanics, Whitehead's philosophy of the organism has an essential place. Its realistic position, however, invalidates any attempt to relate it to the School of Copenhagen's "orthodox interpretation". On the contrary, the Eurhythmic Physics developed by the School of Lisbon has notable theoretical similarities with Whitehead's philosophy. In both cases, the notion of passive matter disappears, entities are understood as arising from a continuum of potentialities, and they achieve physical persistence thanks to a set of synergistic interactions. The principle of Eurhythmy proposed by Prof. Croca appears then as the hypothesis, in theoretical physics, corresponding to the organicist vision of a developing universe through the actualization of the abstract potentialities of all possible worlds: a universe that, as an organism, should be described as guided by an immanent teleological principle.

Keywords: Whitehead, Principle of Eurhythmy, Organic Universe, Immanent Teleology, Intensity of Experience.

References

- Croca, J., Alves, P., Gatta, M., (eds.), 2013, Space, time, and Becoming, Lisbon, Cátedra A Razão.
 Croca, J.R. and Araújo, J.E.F., (eds.), 2010, A New Vision on PHYSIS. Eurhythmy, Emergence and Nonlinearity, Lisbon, Center for Philosophy of Science (CFCUL).
 Moreira, R.N., 2012, Psicologia, Filosofia, e física quântica. O Princípio de Complementaridade no século de Bohr, Lisbon, CFCUL.
 Whitehead, A.N., 1925, Science and Modern World, New York, The Free Press, (Reed. 1967).
 Whitehead, A.N., 1929, Process and Reality. An Essay in Cosmology, New York, The Free Press, (Reed. 1978).

4th Author's Abstract:

Paulo Castro (CFCUL, Portugal)

It has been a constant source of interest and even fascination, as with the Pythagoreans, the acknowledgment of simple numerical relations between observable quantities in natural phenomena. In some occasions such relations led to important scientific insights. Among many possible examples, one may recall de Broglie's fundamental intuition that the occurrence of integer numbers in Bohr's model for the hydrogen atom should have something to do with wave phenomena, for which that occurrence was well established and easily understood. This was undoubtedly one of the major impulses leading to the birth of present-day quantum mechanics. Another example is the so called Titius-Bode empirical law, initially proposed in 1776, and predicting the average distances from the Planets to the Sun, according to a function that depends on a sequence of integer numbers. Using a framework analogous to de Broglie's pilot wave theory and the self-organizing Principle of Eurhythmy, it can be shown that some of the physical quantities describing the Solar System are quantified. Titius-Bode Law with its numerical quantization can thus be interpreted as a direct manifestation of a gravitational wave-like phenomena underlying the Solar System overall stability. This initial eurhythmic modelization of Solar System can be used as a paradigm for further thought about the concepts of rhythm, cooperative interaction, emergence of order and overall system stability in relation with the stability of its parts.

Symposium 4

Vitalism and the scientific image in the 21st century

Charles Wolfe (Ghent University, Belgium) / **Bohang Chen** (Ghent University, Belgium) / **Cecilia Bognon-Küss** (IHPST, France)

Contact: ctwolfe1@gmail.com
 Contact: chenbh07@gmail.com
 Contact: cecilia.bognon@gmail.com

Keywords: vitalism, organicism

Symposium Description: Vitalism was long considered to be the most grotesque view in the spectrum of biological theories: appeals to a mysterious life-force, Romantic insistence on the autonomy of the living, or worse, a metaphysics of an entirely living universe. In the early twentieth century, attempts were made to present a revised, lighter version that was not weighted down by revisionary metaphysics: 'organicism', popular in the emerging theoretical biology of the time (Peterson 2010).

Now, philosophers since the Vienna Circle (particularly Schlick, Frank and later Nagel), but also, Mikhail Bakhtin have justifiably criticized the 'neovitalism' of Driesch and Bergson as a too-strong ontological commitment to the existence of certain entities or 'forces', over and above the system of causal relations studied and modeled by mechanistic science, which itself seeks to express these entities or the relations between them in mathematical terms – and they tend to reject the weaker form, organicism, as well.

But there has been some significant scholarly 'push back' against this orthodox attitude, notably pointing to the Montpellier vitalists of the 18th century, and emphasizing that there are different historical forms of vitalism, including in their relation to the mainstream practice of science (the topic of Wolfe and Normandin, eds. 2013). Additionally, some trends in recent biology that run counter to genetic reductionism and the informational model of the gene, place themselves under the heading of this concept of organicism (Gilbert and Sarkar 2000, Moreno and Mossio 2015).

What happens if we return to the challenge of the anti-vitalist arguments formulated by the Vienna Circle and its successors, and look at vitalism in the twentieth century and today, not just as a historical form but as a significant metaphysical and/or scientific model? Is it possible to grasp some of the conceptual originality of vitalism without either (a) reducing it to mainstream mathematicocentric models of science (in a kind of "victors' narrative") or (b) just presenting it as an alternate model of science? In other words, without either normalizing it or projecting a kind of 'weak messianic power' onto its supposed abnormality? (Wolfe 2014, 2015). In this panel we address these issues with a focus on (i) historical forms of vitalism (Wolfe), logical empiricist critiques of vitalism (Chen) and the impact of synthetic biology on current (re-)theorizing of vitalism.

1st Author's Abstract:

Charles Wolfe (Ghent University, Belgium)

In what follows I examine a series of conceptual constructs of Life, some of which we might call or do call "vitalist", in the period roughly going from Descartes, Leibniz and Stahl (the mid to late seventeenth century) to La Mettrie, Diderot and the Montpellier vitalists in the 1740s-1770s. I shall argue for a conceptual reconstruction of this variety of medico-theoretical and philosophico-medical views in terms of a broad distinction between substance and function claims in vitalism. In other words, I distinguish between substantival and functional vitalism: the former articulates claims about life as a substance (soul, vital force, etc.) while the latter, in different strengths and varieties, presents claims about life as a function of organized beings. In addition, I reflect on how these varieties of vitalism intersect with what some commentators call 'vital materialism' in the period, since one of my observations based upon consideration of the textual corpus is that the two genuinely overlap, sometimes deliberately so (contrary to the rather tired opposition between 'vital forces' and 'mechanistic materialism'). I conclude with some considerations on how a typology of forms of vitalism might impact our understanding of the emergence of biology as a science.

2nd Author's Abstract:

Bohang Chen (Ghent University, Belgium)

Unlike the current dismissal of vitalism on the basis of the belief in metaphysical materialism, logical empiricists rejected both vitalism and materialism if their arguments were merely conducted at the metaphysical level. Further, logical empiricists accepted the materialistic concept of the atom since it was capable of being associated with physical laws and experimental results in modern physics. In contrast, they rejected the vitalistic concept of the entelechy because vitalistic biologists like Hans Driesch were unable to develop vital laws confirmed by biological phenomena. It is also claimed that the logical empiricist refutation of vitalism is widely misunderstood, partly as a consequence of the misinterpretations of the logical empiricist positions on realism and physicalism.

3rd Author's Abstract:

Cecilia Bognon-Küss (IHPST, France)

Vitalism understood as the commitment to the fact/existence of irreducibly vital properties or dispositions seems to have constantly been challenged by chemistry. In the 19th century, the achievement of the synthesis of urea by the German chemist Friedrich Wöhler seemed to put an end to vitalist speculations by showing that nothing in vital matter needed more than ordinary synthetic chemistry to be assembled (Ramberg 2000). However, many vitalist views have still been defended afterwards, no more emphasizing the irreducible nature of living matter, but the complexities of living processes, their subtle organization or self-organization (Varela 1979, Normandin and Wolfe 2013). In the last decade, a novel, powerful take on the nature of life emerged, at the interplay of molecular biology and computer science, namely "synthetic biology". The general avowed goal of this program, whose name was coined as an analogue to "synthetic chemistry", consists in producing from scratch a living system, endowed with basic living processes. The field itself inherited from artificial life (Langton 1989) as well as from bioinformatics and was developed by scientists trained in engineering science such as Drew Endy (Endy 2005).

It seems that, at first stake, successes of synthetic biology would mean the defeat of any vitalist view. However, by considering varieties of projects within synthetic biology, as well as the various possible philosophical meanings of "vitalism," the present talk will deflate such initial intuition. First, I distinguish within the field of "synthetic biology" between genome engineering (programs that introduce synthetic genomes within bacteria, see Gibson et al. 2010), DNA-based device construction (Smolke 2009), and bottom up programs such as the quest for realizing protocells (Rasmussen et al. 2009). I then show that the former merely displaces the vitalist challenge to biochemistry, by locating it within the cellular machinery, which is still assumed by bioengineers in order to realize their synthetic bacteria. Second, I address the protocell program, which intends to construct not only the genome, but also the whole cellular system within which a genome becomes functional. The challenges, as acknowledged by the participants of the program, are no more the constitution of a functional genome, which mostly relies on computing, but also the construction of a lipid membrane, likely to display all properties required for maintaining cellular homeostasis, thermodynamics stability, etc. (Ruiz-Mirazo and Moreno 2013). I'll show that the experimental procedures and ontological assumptions greatly differ from the former synthetic biology programs. Then, I'll argue that in this framework the question of the meaning of vitalism may remain open, depending upon the kind of commitment "vitalism" denotes. To this end I contrast several senses of vitalism, depending upon whether the locus of vitality relates to properties, processes, laws, structures, etc. and finally argue that if the protocell program succeeds only a specific subset of those meanings will be affected.

Symposium 5

Multiple Realization, Reduction, and Explanatory Autonomy

Ken Aizawa (Rutgers University – Newark, United States) / **Cédric Brun** (University of Bordeaux-Montaigne, France) / **Marie Kaiser** (Bielefeld University, Germany) / **Thomas Polger** (University of Cincinnati, United States) / **Lawrence Shapiro** (University of Wisconsin, United States)

Contact: ken.aizawa@gmail.com

Contact: cedric.brun@u-bordeaux3.fr

Contact: kaiser.m@uni-koeln.de

Contact: thomas.polger@uc.edu

Contact: lshapiro@wisc.edu

Keywords: explanation, reduction, multiple realization, autonomy, special sciences, Fodor, Esfeld and Sachse,

Symposium Description: Non-fundamental things (e.g., macroscopic things) depend on their parts or constituents for their existence, and the properties of macroscopic things depend on the properties of their parts or constituents. It is plausible that any or all macroscopic things could be made up of different constituents than the particular ones of which they are in fact constituted, and that many properties of macroscopic things could be grounded in different properties than those that in fact ground them. Similar observations apply to non-fundamental powers, processes, and events. According to advocates of multiple realization, phenomena such as those mentioned above have important implications for philosophy of science: They are said to, variously, falsify mind-brain identity claims, undermine scientific reductions, justify the autonomy of non-fundamental sciences, require a special kind of explanation for non-fundamental entities or for the dependence between non-fundamental entities and those that depend upon them. The talks in the session examine these consequences in light of recent advances in the understanding of the phenomenon of multiple realization.

Unfortunately the canonical disputes over multiple realization have made somewhat antiquated assumptions about explanation, reduction, autonomy, and identity. In this session we aim to remedy this problem by connecting the debate over multiple realization in the special sciences to currently salient debates in philosophy of science, particular regarding the nature of explanation and explanatory reduction.

Kenneth Aizawa (Rutgers University, Newark, USA) argues that there are several distinct sources of multiple realization, that examples are abundant, and that explanation of multiply realized properties should be understood on the model of mechanistic explanation more generally, per the "New Mechanist" approach to explanation, viz., Bechtel and Richardson; Machamer, Darden, and Craver; and many subsequently.

Cédric Brun (University of Bordeaux-Montaigne, France) examines one specific proposal for how to achieve "reduction with autonomy," or at least "reduction with realism" for the special sciences, namely, the "conservative reductionism" advanced by Michael Esfeld and Christian Sachse. Brun argues that, contrary to their intentions, the Esfeld and Sachse model has eliminativist consequences because the key distinction between "pertinent" and "perfect" similarity has not been adequately explained.

Marie Kaiser argues that there are three central features of reductive explanations in contemporary science, and that reductive explanations that have these features are compatible with a kind variation in nature that is sometimes thought to be exemplary of multiple realization. She further argues that this variation is no obstacle to reductive explanation because sciences often engage in what Polger and Shapiro (2016) call "kind-splitting."

Finally, Thomas Polger and Lawrence Shapiro argue that the very notion of explanatory "autonomy" has been neglected in recent discussions and requires further examination. There can be "reduction with autonomy," they claim, provided that we separate the explanatory ambitions of advocates of the special sciences from faulty assumptions about multiple realization and irreducibility.

1st Author's Abstract: Multiple Realization as Convergence of Properties? Ken Aizawa (Rutgers University – Newark, United States)

Near the end of "Special Sciences" 1974, Fodor comments, "Any pair of entities, however different their physical structure, must nevertheless converge in indefinitely many of their properties." Fodor is apparently thinking of multiple realization as a matter of different entities with different physical structure, somehow converging in (many of) the same properties. Near the end of "Special Sciences" 1997, Fodor again alludes to the idea of a convergence of properties: "Damn near everything we know about the world suggests that unimaginably complicated to-ings and fro-ings of bits and

pieces at the extreme microlevel manage somehow to converge on stable macrolevel properties" (Fodor, 1997, pp. 160-1). But, what exactly is this "convergence of properties"? How does that work? In 1974, Fodor does not say. By 1997, however, seems to despair of such an account, saying "the 'somehow' really is entirely mysterious." This paper will describe three ways in which one might have multiple realization through "property convergence." The first might be called "multiple realization with individual variation," the second, "multiple realization by compensatory differences," and the third, "multiple realization by orthogonal realizers." In all these ways, there are scientific explanations of how an individual can possess a given property in virtue of its parts having qualitatively distinct properties. These explanations are in many respects analogous to the explanations of processes often discussed in the New Mechanism literature.

2nd Author's Abstract: How conservative is 'Conservative Reductionism'?

Cédric Brun (University of Bordeaux-Montaigne, France)

In *Conservative Reductionism*, Michael Esfeld and Christian Sachse (2011) propose an account of the properties and laws of the special sciences (sociology, psychology, biology, etc.) vindicating (1) their reducibility to physics (despite the multiple realizability of their instances), (2) their genuine scientific status, and (3) their explanatory value as such.

The strategy they adopt leads them to develop a specific 'causal theory of properties' intended to allow "in any case of multiple reference, to conceive more fine-grained functional concepts and laws of the special sciences—so-called sub-type laws—that are coextensive with those of physics that seize the complex, local physical structures that are identical with property tokens of a special science" (Esfeld & Sachse, 2011, p. 160). Thus, multiple realization "no longer constitutes an anti-reductionist argument" (Ibid. p. 161). Yet, Esfeld and Sachse claim that this reduction to physics does not entail any eliminativist consequence given that the functional concepts and laws of the special sciences "seize pertinent objective similarities that there are in the world and that physics cannot express within its conceptual means" (Ibid. p. 166). After a short overview of the main aspects of their *Conservative Reductionism*, this paper examines the core argument presented by Esfeld and Sachse in favor of the ineliminability of the laws and concepts of special science and of their explanatory value and discuss its crucial distinction between 'pertinent similarities' (typical of the natural kinds in the special sciences) and 'perfect similarity' (distinctive of the physical kinds). The main thesis of this paper is that this distinction—key to the conservation of the special sciences despite their possible reduction to physics—needs to be more precisely defined if conservative reductionism is to be distinguished from classical functionalism.

3rd Author's Abstract: Explanatory Reduction and Multiple Realization in Biology

Marie Kaiser (Bielefeld University, Germany)

The multiple realization of biological types provides a serious challenge to Nagel's (1961) classical model of theory reduction because it questions that the required bridge principles can be formulated which connect terms of the reduced theory with those of the reducing theory. Multiple realization was thus a major motivation for philosophers of biology to abandon Nagel's model and to start looking for an alternative understanding of epistemic reduction that accounts for the reductive explanatory strategies that characterize actual biological practice. In this paper, I present such a novel account of explanatory reduction in biology, I examine whether multiple realization continues to present an obstacle to (explanatory) reduction, and I reveal different strategies of how biologists can handle multiple realization.

My account of explanatory reduction addresses the question of what makes a biological explanation

reductive. I argue that reductive explanations possess three main characteristics. They explain the behavior of a biological object or system S, first, exclusively in terms of factors that are located on a lower level of organization than S, second, by focusing on factors that are internal to S (i.e., that are parts of S) and simplifying external factors, and third, by describing the parts of S only as "parts in isolation". Multiple realization poses a problem primarily to type identity multiply realized types cannot be said to be identical to their realizing types. Hence, the central question is whether reductive explanations, understood in this way, require ontological reduction in the form of type identity. I claim that they do not. Biologists can avoid the problem of multiple realization by targeting individual instances instead of types, by choosing narrower types as the behaviors of systems to be explained (this is related to the strategy known as "kind-splitting", Polger and Shapiro 2016), or by regarding reduction not as a relation of identity, but of constitution or localization.

4th Author's Abstract: The Autonomy of Sciences as a Working Hypothesis

Lawrence Shapiro (University of Wisconsin, United States)

In this paper we sketch an account of explanatory autonomy that is responsive to the explanatory ambitions of Fodorians but that does not tie the legitimacy of the special sciences to their irreducibility, severing Fodor's quasi-analytical connection between the two. The result is an account of explanatory autonomy that is compatible with at least certain kinds of ontological reduction. [Full abstract could not be submitted due to there being no 4th field and the word limit on the field for Abstract 3--please contact authors for full abstract, if needed.]

Symposium 6

Is an Extended Synthesis required to properly account for biological diversity?

Silvia di Marco (CFCUL, Portugal.) / **Jorge Marques da Silva** (University of Lisbon - Faculty of Science Department of Plant Biology / BioISI - Biosystems and Integrative Sciences Institute, Portugal) / **Elena Casetta** (Train2Move Fellow - Marie Curie Actions, Department of Philosophy and Educational Sciences, University of Turin & CFCUL, Portugal) / **Susana A. M. Varela** (cE3c - Centre for Ecology, Evolution and Environmental Changes, Faculdade de Ciências, Universidade de Lisboa, Portugal) / **Davide Vecchi** (CFCUL, Portugal)

Contact: elenattesac@gmail.com

Contact: davide.s.vecchi@gmail.com

The Modern Evolutionary Synthesis was undoubtedly a fundamental achievement in the history of biology: by fusing Mendelian genetics and the Darwinian theory of evolution by natural selection, it promoted the development of evolutionary sciences. Nonetheless, the Modern Synthesis, focusing almost exclusively on genetic inheritance and on changes in gene frequencies, rules out the possibility of extra-genetic inheritance, and puts on the backburner processes that are nevertheless increasingly recognized as playing an important role in evolution, such as niche construction, phenotypic plasticity and symbiogenesis. It is for these reasons that, most recently, a growing number of scholars have called for an extension - or even an overcoming - of the Modern Synthesis

(Koonin 2012, Pigliucci & Muller 2010, Laland et al. 2015). In this respect, consider that Mayr – despite defending the view that the Modern Synthesis does not require a revision as a consequence of the spectacular discoveries of molecular biology – conceded that it had limited explanatory resources to fully account for the phenomenon of generation of biodiversity:

Most of the enormous variation of kinds of organisms has so far been totally ignored by the students of speciation. We have studied the origin of new species in birds, mammals, and certain genera of fishes, lepidopterans, and molluscs, and speciation has been observed to be allopatric (geographical) in most of the studied groups ... However, numerous other modes of speciation have also been discovered that are unorthodox in that they differ from allopatric speciation in various ways. Among these other modes are sympatric speciation, speciation by hybridization, by polyploidy and other chromosome rearrangements, by lateral gene transfer, and by symbiogenesis. (Mayr 2004, p. 47).

In this symposium we would like to provide an interdisciplinary context in which to discuss, from a philosophical and biological perspective, the putative limits of the Modern Synthesis approach as well as the putative benefits of an Extended Synthesis approach to the phenomenon of generation of biodiversity.

Bibliography

Koonin, E. V. (2012). *The Logic of Chance*. Upper Saddle River, NJ: FT Press.

Laland, K. et al. (2015). The extended evolutionary synthesis: its structure, assumptions and predictions. *Proceedings of the Royal Society B*.

Mayr E. 2004. Happy birthday: 80 years of watching the evolutionary scenery. *Science*, 305(5680): 46-7.

Pigliucci, M. & Müller, G. B. (2010). *Evolution – The Extended Synthesis*. Cambridge, MA: MIT Press.

1st Author's Abstract: Could an Extended Synthesis help Biodiversity Conservation?

Silvia Di Marco (Centre for Philosophy of Sciences, University of Lisbon, Portugal/BIODECON R&D Project. Ref. PTDC/IVC-HFC/1817/2014)

The importance of biodiversity for ecosystem services is recognized both in biodiversity and ecosystem science. However, while conservation biologists struggle to develop an evidence base that supports the protection of biodiversity as a good endowed with direct value, community ecologists focus on the contribution provided by biodiversity to the ecosystem processes. For conservationists, such a utilitarian view of biodiversity is a cause of concern (Mace et al. 2012).

This preoccupation, however, might be misplaced. Although ecologists have traditionally considered biodiversity a mere epiphenomenon of extant ecological conditions, they are gradually changing their approach. In fact, since the introduction of the concept of ecological service in conservation policies, community and ecosystem ecologists have paid more and more attention to biodiversity as a driver, not a product, of ecosystem functioning, and in order to study the reverse effect of biodiversity on ecosystem functioning, they are searching new ways to connect the dots that link the evolution of species traits at the individual level, the dynamics of species interactions and the overall functioning of ecosystems (Loreau 2010).

The goal of this presentation is to spell out the interaction and reciprocal influence between biodiversity conservation, community/ecosystem ecology and evolutionary theory. To this aim we focus on eco-evolutionary feedback theory (Post & Polkovacs 2009), as an example of evolutionary model directly informed by conservation concerns. The theory of Post & Polkovacs—based on a revision of the concept of niche construction proposed by Laland et al. 1999 and Odling-Smee et al. 2003—attempts to link community and ecosystem ecology with so called contemporary evolution (heritable trait evolution observed over the human time-scale), thus making a strong case for the conservation of both ecological and evolutionary diversity.

The presentation is divided in three moments: first, we analyze the eco-evolutionary feedback theory as an example of evolutionary theory that falls within the Extended Synthesis approach; second, we discuss how this evolutionary model is supportive of conservationists' idea that biodiversity can be considered a good per se, even in a policy framework dominated by the ecological services approach; finally, we explore the question whether a new understanding of the biodiversity-ecosystem function in the light of eco-evolutionary feedback theory could reshape the debate over the intrinsic/utilitarian value of biodiversity.

Bibliography

- Laland, K.N., Odling-Smee, F.J. and Feldman, M.W. (1999), Evolutionary consequences of niche construction and their implications for ecology. *Proceedings of the National Academy of Sciences*, 96(18):10242-10247
- Loreau, M. (2010), Linking biodiversity and ecosystems: towards a unifying ecological theory. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 365(1537):49-60
- Mace, G.M., Norris, K. and Fitter, A.H. (2012), Biodiversity and ecosystem services: a multilayered relationship. *Trends in ecology & evolution*, 27(1):19-26
- Odling-Smee, F.J., Laland, K.N. and Feldman, M.W. (2003), *Niche construction: the neglected process in evolution*. Monographs in Population Biology, Princeton University Press.
- Post, D.M. and Palkovacs, E.P. (2009), Eco-evolutionary feedbacks in community and ecosystem ecology: interactions between the ecological theatre and the evolutionary play. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 364(1523):1629-1640

2nd Author's Abstract: The diversity of life in a reticulate perspective. The case of multispecies biofilms

J. Marques da Silva (Department of Plant Biology / BioISI - Biosystems and Integrative Sciences Institute, Faculty of Sciences, University of Lisbon, Portugal. BIODECON R&D Project. Ref. PTDC/IVC-HFC/1817/2014) / **E. Casetta** (Train2Move Fellow - Marie Curie Actions, Department of Philosophy and Educational Sciences, University of Turin, Italy / CFCUL, University of Lisbon, Portugal / BIODECON R&D Project. Ref. PTDC/IVC-HFC/1817/2014)

Since Darwin and then the Modern Synthesis, evolutionary biologists privileged vertical descent, i.e. when the genetic material of an evolutionary individual is replicated within its own lineage. But there is growing evidence that vertical descent is not the only process through which evolutionary diversity is produced. In addition to vertical descent, recombination, lateral gene transfer, and symbiosis—i.e. processes that use, horizontally, genetic material coming from multiple sources—produces evolutionary outcomes at different hierarchical level (Baptiste et al. 2012). Two different representations of the diversity of life are at play: on the one hand, the representation of the tree of life, well-fitted to the Modern Synthesis' framework; on the other hand, the representation of the reticulum of life, more in tune with the Extended Synthesis' framework (Pigliucci and Müller 2010; Gonthier 2015).

In this contribution we explore how evolutionary novelties can emerge in a peculiar type of multispecies entities, i.e., multispecies bacterial biofilms. First, we show that phenotypic and molecular change can arise in response to selection in multispecies entities. Second, we evaluate the possibility of multispecies biofilms being evolutionary individuals. In the conclusion we shall make some reflections on the apparently paradoxical relation between evolution and bioconservation, arguing for the inclusion of multispecies evolutionary individuals among the targets of conservation actions.

Bibliography

- Baptiste E, O'Malley MA, Beiko RG, Ereshefsky M, Gogarten JP, Franklin-Hall L, Lapointe F-J, Dupré J, Dagan T, Boucher Y, Martin W (2009) Prokaryotic evolution and the tree of life are two different things. *Biol Direct* 4:34. doi:10.1186/1745-6150-4-34
- Ereshefsky M and Pedroso M (2015) Rethinking evolutionary individuality. *PNAS* 112/33: 10126–10132.
- Gonthier N.(2015) Reticulate Evolution Everywhere. In: Gontier, N. (ed.), *Reticulate Evolution*. Dordrecht, Springer: 1–38.
- Pigliucci, M. and Müller, G.B. (2010) *Evolution. The Extended Synthesis*, Cambridge, MA: MIT Press.

3rd Author's Abstract: Mate-choice copying and the extended evolutionary synthesis

Susana A. M. Varela (cE3c – Centre for Ecology, Evolution and Environmental Changes, Faculty of Sciences, University of Lisbon, Portugal.)

A key question of sexual selection theory is how sexual organisms, mostly females, choose their mates. Researchers have been classically interested in understanding the genetic mechanisms of mate choice and how they impact species evolution (Anderson & Simmons 2006). However, it has also been acknowledged that Mate-Choice Copying (MCC), a non-genetic mechanisms of mate choice, can equally impact the evolutionary process (Santos et al. 2014). MCC occurs when an individual copies the mating choices of others by a process of social learning (Pruett-Jones 1992). Because it can cause or increase skews in male mating success, it seems to have the potential to induce a rapid change in the direction and rate of sexual selection, potentially leading to divergence and eventually speciation (Danchin et al. 2004; Mery & Varela et al. 2009; Leadbeater 2009). Therefore, under the framework of the extended evolutionary synthesis (Danchin 2013; Laland et al. 2015), MCC is a powerful example of a non-genetic mechanism of information inheritance (Danchin et al. 2004), and over the past 20 years, MCC has consistently been shown to affect mate choice in several species (Vakirtzis 2011).

However, what has been poorly understood, so far, is the exact ways by which MCC can indeed affect evolution. In other words, how can it affect the biological evolution of male traits and female preferences? The lack of a conceptual framework for the actual mechanisms by which MCC can consistently affect gene flow and reproductive isolation has made the role of MCC on speciation to be questioned, because linkage disequilibrium cannot be established between the copied preference and the male trait, given that females copy from unrelated individuals in the population (Verzijden et al. 2005).

Although linkage disequilibrium can indeed hamper MCC to cause speciation in sympatry, the potential role of MCC on fostering speciation in micro-allopatry, with some degree of habitat selection, has not been tackled. The latter scenario may, under specific conditions, overcome the problem of the lack of linkage disequilibrium. Hence, I propose a detailed analysis of the role of mate-choice copying in evolution, specifying – despite how stringent these conditions might be – how and when it can plastically change female behaviour to the point of disrupting and canalizing their preferences for certain male phenotypes, creating and potentiating divergence and speciation. Furthermore, MCC may actually play a key role in the opposite way, that is, by facilitating gene flow, thereby fostering hybridization. The role of MCC on hybridization has been so far overlooked, though the conditions under which it might occur are much more likely, or less stringent, than those favouring speciation.

Here, I will propose a conceptual framework to identify the exact conditions under which speciation or hybridization are expected under MCC, placing MCC in the core of the extended evolutionary synthesis debate.

Bibliography

- Andersson, M. & Simmons, L.W. 2006. Sexual selection and mate choice. *Trends in Ecology & Evolution* 21:296–302.
- Danchin E., Giraldeau L.A., Valone T.J. & Wagner R.H. 2004. Public information: from nosy neighbors to cultural evolution. *Science* 305:487-491.
- Danchin, E. 2013. Avatars of information: towards an inclusive evolutionary synthesis. *Trends in Ecology & Evolution* 28(6):351-358.
- Laland K.N., Uller T., Feldman M.W., Sterelny K., Müller G.B., Moczek A., Jablonka E., Odling-Smee J. 2015. The extended evolutionary synthesis: its structure, assumptions and predictions. *Proc. R. Soc. B* 282:20151019.
- Leadbeater, E. 2009. Social learning: what do *Drosophila* have to offer? *Current Biology* 19:R378–R380.
- Mery, F., Varela, S.A.M., Danchin, E., Blanchet, S., Parejo, D., Coolen, I., Wagner, R.H. 2009. Public Versus Personal Information for Mate Copying in an Invertebrate. *Current Biology* 19(9):730-734.
- Pruett-Jones, S. (1992) Independent versus nonindependent mate choice: do females copy each other? *American naturalist* 140: 1000–1009.
- Santos M, Matos M & Varela SAM. 2014. Negative public information in mate-choice copying helps the spread of a novel trait. *American Naturalist* 184(5):658-672.
- Vakirtzis, A. 2011. Mate choice copying and nonindependent mate choice: a critical review. *Annales Zoologici Fennici* 48, 91–107.
- Verzijden, M.N., Lachlan, R.F., and Servedio, M.R. 2005. Female mate-choice behavior and sympatric speciation. *Evolution* 59:2097–2108.

4th Author's Abstract: The instability of the homogeneous and the stability of the heterogeneous as causes of biodiversity

Daive Vecchi (Centre for Philosophy of Sciences, University of Lisbon, Portugal/ BIODECON R&D Project. Ref. PTDC/IVC-HFC/1817/2014)

Barring creationist myths, the only naturalistic explanation for the diversity of extant life is evolutionary. Darwin hypothesized that life originated from one or few original forms. He also proposed that biodiversity patterns are the result of the slow and gradual accumulation of heritable variations. The Modern Synthesis has refined Darwin's insight in many respects, for instance by proposing many theoretical models of speciation and by identifying genetic mutation as the ultimate source of heritable variation. But the Modern Synthesis has arguably neglected alternative non-selectionist explanations of biodiversity patterns. In order to characterize such explanations, let us consider the entirety of biotic evolutionary history: what can we infer about the pattern of evolution from what we know about LUCA (i.e., the last universal common ancestor) and fossils of primitive life forms? That it has exploded in diversity and complexity. The implicit Darwinian assumption is that selection essentially explains this intricate pattern. All the contributors in this symposium are unified by the stance that an explanation of biodiversity patterns should be complemented by evolutionary processes putatively neglected by the Modern Synthesis, such as niche construction (Di Marco), multispecies assemblage formation (Casetta & Marques da Silva) and non-genetic inheritance (Varela). Instead of focusing on particular processes, in this talk I would like to construct a general framework to categorize them. In order to do so, I shall focus on the significance of two general evolutionary principles proposed by past and recent evolutionary thinkers. The first – probably first noticed by Herbert Spencer (1862) but resurrected in a new form by McShea and Brandon (2010) – is the principle of the instability of the homogeneous, which is supposed to account for the tendency to diversify underlying life's evolution and account for the path from one single life form to extant biodiversity. The second – again probably first noticed by Herbert Spencer (1862) but later emphasized by many proponents of orthogenesis, including Teilhard de Chardin (1955), and resurrected in a scientifically respectable form by Margulis (1991) and Maynard-Smith & Szathmari (1995) – is what could be called the principle of the stability of the heterogeneous, which is supposed

to explain the tendency to complexify underlying life's evolution and account for the route from single cells to multi-cellularity and sociality through major evolutionary transitions. The question I would like to pose in this context is whether the allegedly emerging extended synthesis needs to take into account these two principles in order to explain biodiversity patterns.

Bibliography

de Chardin, T. *The Phenomenon of Man*. Harper. 1975
 Margulis, L. ed. *Symbiosis as a Source of Evolutionary Innovation: Speciation and Morphogenesis*. The MIT Press. 1991
 Maynard Smith, J. and Szathmáry, E. *The Major Transitions in Evolution*. Oxford University Press. 1995
 McShea, D.W. & Brandon, R.N. *Biology's first law*. University of Chicago Press. 2010
 Spencer, H. *First Principles*. Cambridge University Press. 2009

Symposium 7

From normative to descriptive: epistemic attitudes and epistemic dynamics of non-ideal agents

Alfredo Burrieza (University of Málaga, Spain) / Claudia Fernández-Fernández (University of Málaga, Spain) / Angel Nepomuceno (University of Seville, Spain) / José F. Quesada Moreno (University of Seville, Spain) / Francisco J. Salguero (University of Seville, Spain) / Fernando Soler (University of Seville, Spain) / Fernando R. Velázquez (University of Seville, Spain)

Contact: nepomuce@us.es

Contact: fernandorvelazquezq@gmail.com

Keywords: abduction, beliefs revision, non ideal agents, dialogue systems

Epistemology focusses on the study of concepts as knowledge, belief and reasoning, all of them fundamental for Philosophy of Science in its study of how scientific reasoning works. When studied formally, Epistemology has produced tools for studying many different epistemic concepts, ranging from formal models of epistemic states (possible worlds models, probabilistic models) to formal models of epistemic-changing processes (belief revision, communication, learning). However, most of the developed tools are normative in the sense that they not only represent the epistemic attitudes an ideal agent would have (e.g., the closed-under-logical-consequence property of knowledge in epistemic logic) but also describe epistemic changes as an ideal agent would perform them (e.g., the basic postulates of belief revision). This by itself is not a problem, as it is important to provide a normative account of how a rational agent should operate. However, it is equally important to provide descriptive accounts focussing on depicting and understanding the way non-ideal agents behave. The well-known and accepted justification for this is that we human beings do not always act 'rationally', and thus it is useful to understand how we still manage to achieve progress. A second justification that has arise in latter years is that such study and understanding is crucial in the development of (typically resource-limited) artificial agents/ systems whose task is to interact with fallible agents (humans, limited artificial agents) in real-time, as dialogue systems.

The symposium focuses, then, on formal treatments to study epistemic attitudes and epistemic dynamics of non-ideal agents, discussing formal frameworks that take into account not only the particular reasoning abilities of an agent but also her fallibility. The presented approaches follow

mostly the dynamic epistemic logic framework, but more general perspectives for representing non-ideal agents and epistemic actions that affect them are also discussed. Of course, we will take into consideration the epistemological theories that sustain this type of approaches.

1st Author's Abstract: Reasoning on Incomplete Information and Dialogue Systems Design

José F. Quesada Moreno (University of Seville, Spain) / **Francisco J. Salguero** (University of Seville, Spain)

The abduction constitutes one of the fundamental problems of the contemporary epistemology. The classic model has taken as the inferential parameter classical logic systems, while another approach with non classical logic is possible, as, for example, with dynamic epistemic logic. In this part the proposal is to analyze the role of abduction as the underlying logic in interpretation and contextualization processes in dialogue, to design formal models for representing meaning in natural language understanding and relating those formal models with cognitive representations of meaning and grammar

2nd Author's Abstract: The concept of epistemic awareness in awareness logic.

Alfredo Burrieza (University of Málaga, Spain) / **Claudia Fernández-Fernández** (University of Málaga, Spain)

Different applications of the same concepts in Epistemology and Epistemic Logic are shown. After showing the origin of Epistemic Logic, explicit and implicit knowledge is introduced and the relation between them is studied. Then a double interpretation of awareness is studied and it is proposed a combination of concepts: awareness of facts – implicit knowledge – propositional approach, and awareness of things – explicit knowledge – propositional-sentential approach.

3rd Author's Abstract: Belief revision

Angel Nepomuceno (University of Seville, Spain) / **Fernando Soler** (University of Seville, Spain) / **Fernando R. Velázquez** (University of Seville, Spain)

Belief revision proposals have typically followed the normative AGM postulates, properties that a revision operator should satisfy in order to be considered rational. Thus, most proposals for specific revision operators describe the way an ideal agent would assimilate new information, leaving outside the discussion the way a more 'real' agent would react in such situations (in particular, the way she would react if the new information contradicts her current beliefs).

This talk follows a rather descriptive approach to belief revision. First, it argues for a pluralistic view on revision operators by suggesting that not only different agents might use different belief revision policies (depending, e.g., on the reliability of the --source of the-- new information), but also that an agent might actually use different policies according to how much the incoming information contradicts her current beliefs. Then it presents revision operators that do not satisfy the crucial success postulate ("after a revision with P, the agent will believe P"), showing nevertheless how even though the immediate effect of these operators is almost negligible, their long-term consequences are stronger than those of traditional ones.

Symposium 8

Scientific realism and intertheory relations in physics: classical physics, quantum physics, and space time theories

Nahuel Sznajderhaus (University of Leeds, United Kingdom) / **Kian Salimkhani** (University of Bonn, Germany)

Contact: phns@leeds.ac.uk

Contact: ksalimkh@uni-bonn.de

Keywords: intertheory relations, scientific realism, physics

Symposium Description: The revolution in science during the C20th has radically challenged our views on the scope and limits of science, and how science relates to the world. The new theories of space-time and quantum physics have delivered astonishing progress in terms on technological developments. However, that cannot overshadow the relevance of the conceptual challenges. How should we conceive the relationship between different theories? Does quantum mechanics need to explain the appearance of classical results? Are physicists justified in searching for a theory which unifies the arguably most fundamental theories, namely quantum field theory and general relativity? Indeed, issues in the philosophy of science concerned with accounting for the way scientific disciplines and their theories relate with each other are of central importance. As Butterfield (2011, p. 930) indicates, there are two plausible broadly construed intuitions of reduction or pluralism, both as well capable of being developed in epistemic terms, namely, explanation, or in metaphysical terms – identity of entities or properties.

Recent and relevant research in the philosophy of physics strongly focuses around these issues, in the likes of Bokulich (2008), Landsman (2016), Huggett and Wüthrich (forthcoming), and others. In this symposium we present contribute to these articulating possible solutions to these questions by presenting two different analyses on the issue of how scientific realism in physics can reflect on questions about intertheory relationships. We will draw on questions from the point of view of scientific realism, focusing on two ends of the spectrum. One contribution will address general methodological issues in the considerations of intertheory relations between quantum mechanics and classical mechanics. In the second contribution, we will look at the complex relationship between space-time theories and quantum field theory: what grounds the search for a unifying theory? Does quantum gravity respond to requirements grounded on firm convictions, such as fundamentality, or is this, by contrast, a challenge to that very philosophical ambition?

Our aim is to engage in these fundamental questions for philosophy of science, upon which any both realist and anti-realists are concerned with. We will be addressing relevant consequences for those whose work focuses in other fields different to fundamental physics as well.

References

- A. Bokulich. Reexamining the Quantum-Classical Relation: Beyond Reductionism and Pluralism. Cambridge: Cambridge University Press, 2008.
- J. Butterfield. Emergence, reduction and supervenience: A varied landscape. *Foundations of Physics*, 41(6):920–959, 2011.
- N. Huggett & C. Wüthrich. *Out of Nowhere: The Emergence of Spacetime in Quantum Theories of Gravity*. Forthcoming: Oxford University Press.
- N. P. Landsman. Between classical and quantum. In Jeremy Butterfield and John Earman, editors, *Handbook of the Philosophy of Science: Philosophy of Physics*, pages 417–554. Elsevier, 2007.

1st Author's Abstract: On the Received Realist View of Quantum Mechanics and its relationship with Classical Physics.

Nahuel Sznajderhaus (University of Leeds, United Kingdom)

In this article I defend that an underlying framework exists among those interpretations of quantum mechanics which crucially consider the measurement problem as a central obstacle. I characterise that framework as the Received View on the realist interpretation of quantum mechanics. It is characterised by two central –somewhat underdetermined– statements: 1) a metaphysical consideration that quantum objects are in some way related to the 'everyday' ontology of tables and chairs. In particular, classical tables and chairs “emerge from”, “reduce to”, etc., quantum objects. And 2) an epistemic consideration that theories are ordered by hierarchy of fundamentality, whereby more fundamental theories are successors over less fundamental ones. Hence, equations of quantum mechanics must give rise to equations in classical mechanics under some appropriate limits.

In particular, I show that the measurement problem captures the concerns involved in the Received View. In addition, I analyse the extent to which two of the most relevant attempts at quantum mechanics belong within the Received View. Namely, many worlds interpretations –in the version defended by the school of Oxford, e.g. Wallace (2013) –, and Bohmian mechanics – in the variant favoured by D. Dürr, S. Goldstein, and N. Zanghi (2013).

However, I claim that scientific realism in itself does not entail commitment to such a view. Furthermore, that resolving the measurement problem so conceived within the Received View still does not necessarily respond to the realist question: “what does Psi represent in the world?” Hence, I propose to consider a form of realism that dissolves the measurement problem, and hence departs from the Received View. It is simply a stripped down version of scientific realism, and I dub it Core Realism. It involves three statements: 1) The world exists independently of humans. 2) Successful scientific theories represent approximately true features of the world, and 3) a methodological question that the realist ought to respond: given a theory, what does it say on how the world is really? I discuss that the measurement problem is dissolved here, and therefore that the challenges are different to those of the Received View. I conclude by speculating that within it a novel realist interpretation of quantum mechanics could be conceived.

References

D. Dürr, S. Goldstein, and N. Zanghi. *Quantum Physics Without Quantum Philosophy*. Springer-Verlag Berlin Heidelberg, 2013.

T. Nickles. Two concepts of intertheoretic reduction. *The Journal of Philosophy*, 70(7):181–201, 1973.

D. Papineau. *The philosophy of science. Oxford readings in philosophy*. Oxford University Press, 1996.

S. Psillos. *Scientific Realism: How Science Tracks Truth*. Routledge, 1999.

B. C. Van Fraassen. *Quantum Mechanics: an empiricist view*. Oxford: OUP, 1991.

D. Wallace. The everett interpretation. In R. Batterman, editor, *The Oxford Handbook of Philosophy of Physics*, pages 460–488. New York: OUP USA, 2013.

2nd Author's Abstract: On realism and intertheory relations within unification attempts in modern physics

Kian Salimkhani (University of Bonn, Germany)

In this presentation I will carve out the intertheoretic relations between two seemingly isolated theories of modern physics: General relativity and quantum field theory. While it is often argued that the quest for Quantum Gravity rests on a metaphysical (or at least somewhat metatheoretical) paradigm of unification (cf. Mattingly 2005, Wüthrich 2005), I claim that modern high energy physics does not need to rely that principle in addition – or even opposition – to empirical adequacy, but that in particular the quest for a theory of Quantum Gravity should be understood as the result of an immanent analysis of our best theoretical framework, namely quantum field theory.

To do so, I will consider Weinberg's attempt (cf. Weinberg 1964) to detach the core of the General

Theory of Relativity, Einstein's Principle of Equivalence, from its close connection to a geometrisation picture of gravity that is understood to be responsible for this wedge in physics and to prohibit unification. As a result, the rich and asymmetric relation between both frameworks becomes transparent: General Relativity should not be conceived as a fundamental theory on its own, but as an effective field theory just like the Standard Model of Particle Physics, derivable from Special relativity and Quantum mechanics (cf. Weinberg 1997).

Although the highly non-trivial relation between both theories has to be investigated carefully, this suggests that the received view – also among physicists – that finding a unified theory describing and explaining all physical phenomena is the ultimate aim of physics, should rather be understood as a *façon de parler* than an accurate description of physical practice. Unification in modern physics should be viewed as a by-product. This shall also be emphasised by briefly looking at other historical examples (cf. Maudlin 1993, Morrison 2000, Ducheyne 2004).

In addition, I provide an insight into how modern high energy physics addresses the notion of fundamentality, namely by re-interpreting established structures within a new theoretical context. This prompts the question which challenges scientific realism to meet in this particular case study. E.g., does the presented approach lead to changes in the assumed fundamentality of the structures involved?

References

- Ducheyne, S. (2004): Newton's Notion and Practice of Unification. *Studies in the History and Philosophy of Science* 36, 61-78.
- Mattingly, J. (2005), Is Quantum Gravity Necessary?, in A. Kox and J. Eisenstaedt (eds.), *The Universe of General Relativity*. Boston: Birkhäuser, 327-338.
- Maudlin, T. (1993): On the Unification of Physics. *The Journal of Philosophy* 93 (3), 129-144.
- Morrison, M. (2000): *Unifying Scientific Theories*. Cambridge: CUP.
- Weinberg, S. (1964), Derivation of Gauge Invariance and the Equivalence Principle from Lorentz Invariance of the S-Matrix, *Physics Letters* 9 (4).
- Weinberg, S. (1997), What is quantum Field Theory, and what did we think it is? *Proceedings of "Historical and Philosophical Reflections on the Foundations of Quantum Field Theory"*.
- Wüthrich, C. (2005), To Quantize or Not to Quantize: Fact and Folklore in Quantum Gravity, *Philosophy of Science*, 72, pp. 777-788.

Symposium 9

On the Uncanny: Interdisciplinary Perspectives between Art, Science and Human Technology

Pietro Conte (CFCUL, Portugal)/ **Alexander Gerner** (CFCUL, Philosophy of Human Technology, Portugal)/ **Graça Corrêa** (CFCUL & CIAC, Portugal)

Contact: pjconte@fc.ul.pt

Contact: alexandergerner@gmail.com

Contact: graca.p.correa@gmail.com

Keywords: Uncanny Valley, Doubles, Androids, Virtual Reality, Avatar Human Technology, Cognitive Mismatch, Gothic Theory & Aesthetics

Symposium Description: This symposium will critically investigate the concept/feeling/perception of the uncanny from different perspectives: ranging from Gothic literature and film of the nineteenth and twentieth-centuries, to the most recent phenomenological and cognitive approaches in the

notion of «cognitive mismatch» as elaborated in the field of robotics, digital animation, immersive reality and in Avatar Schizophrenia Therapy.

1st Author's Abstract: The uncanny revisited. Towards a phenomenology of «cognitive mismatch»

Pietro Conte (CFCUL, Portugal)

In his pioneering History of Portraiture in Wax Julius von Schlosser traced back the age-old history of wax as an artistic material which at that time seemed to be already antiquated, if not obsolete. Wax sculptures were rejected and ousted from art history because of their excessive similarity and adherence to models. One hundred years later, however, hyperrealism got its revenge with Maurizio Cattelan's celebrated life-like effigies of three children hanging from a tree in the city centre of Milan. Starting from this controversial artwork and focusing on the heated polemics over it, my paper will investigate the concept of the «uncanny» in a phenomenological perspective, showing how the Husserlian investigations on the creepy and unaesthetic effect elicited by hyper-realistic figures can be fruitfully compared to the notion of «cognitive mismatch» as elaborated in the field of robotics, digital animation and immersive reality in relation to the existence and nature of the so called «Uncanny Valley».

2nd Author's Abstract: On the virtual "uncanny". Cognitive enhancements of transformed self-self and self-other relations by Avatar/ Virtual Reality technology between Virtual double extensions and techno-human detachments

Alexander Gerner (CFCUL, Philosophy of Human Technology, Portugal)

The Virtual Uncanny is conceived in this paper in relation to immersive interfaces of VR/Avatar technology in which a double detachment strategy (cf. Neyrat 2011) inherent in the feeling of the uncanny is shown: in a first hyletic sense the (modern) techno-human condition can be seen as a material detachment confronted with des-coordinated doublings and uncanny feeling when confronted with material substitutions of human-like somatic bodies by Virtual bodies. A second sense of detachment as process of a techno-human subjectivation of enhanced experience can trigger freedom from somatic conditions and project a hyperphenomenal existential feeling of somatic independence leading even to more autonomous self-controlled action and self-governance via the use of Avatar doubles and enactive transformations of self-self and self-other relations, that can as well change our minds (Bailey, Bailenson & Casanto upcoming, critical Madary&Metzinger 2016).

Already in the classical rubber-hand-illusion (RHI) (Botvinick & Cohen 1998) the uncanny reintegration of external artifacts (a rubber hand on the table) as part of the body schema, while synchronically stimulating the hand and the visual rubber hand, has brought new insights in the plasticity of the body image, the embodiment of „the“ self by a strong episodic influence of exteroception and the transformed body-experience that we will follow in VR self-Avatar enhancements in schizophrenia therapy, triggering the uncanny feeling between (a) doubling, (b) self-substitution and (c) extension of self-experience and technically VR/Avatar mediated enhanced autonomy.

What is at stake, is the necessary multisensory synchronizations and de-synchronizations (Banakou & Slater 2014) and sensory-motor embodiment (Gerner & Guerra 2014; Gerner 2017 upcoming), that will introduce our topic of the virtual uncanny in virtual reality immersion, in which body-ownership attribution and its transformation as well as the coordination of vision, touch, and posture (proprioception) or the coordination/ synchronisation or discoordination of touch and proprioception (Ehrsson et al 2005; 2007) becomes key in Avatar studies (Slater et al 2010, Slater et al 2009).

Technologically mediated Full-body illusions (Blanke & Metzinger 2009) among other forms of illusion of embodiment- e.g. autoscopic experiences (Blanke, Slater & Serino 2015; Brugger 2002; 2006)- can have uncanny lasting effects- e.g. derealization (Madary & Metzinger 2016) or feeling of detachment/substitution.

By giving an example from Avatar schizophrenia therapy I will amplify (cf. Gerner upcoming; Gerner upcoming 2017) Leffs et al (2013; Leff et al 2014) and Craigs (Craig 2015) computerassisted 2D screen Avatar schizophrenia therapeutic doubling paradigm in providing different levels and methods of full body immersion with other factors that should be taken into account in clinical follow-up research in the Lab: a) human factors in Avatar studies in difference to b) autonomous computer-controlled agents (Fox et al 2015), Virtual humans- human intimate interaction (cf. Fox & Bailenson 2009; 2013; Bailey, Bailenson & Casanto upcoming). Of importance is the degree of visuo-spatial similitude, attractiveness or repulsivity of the Avatar and the patient's proteus effect (cf. Yee & Bailenson 2007; Yee 2014; Sabolius 2016) as for example researched in „uncanny valley“ effects (Mori 1970; MacDorman 2005; MacDorman et al 2009; MacDorman & Ishiguro 2006; Tinwell et al 2011; Slotovsky et al 2015) for a projective self by using virtual worlds as philosophical tools for polycentric positionalities (Gualeni 2015; Plessner 1975) for reducing among others as well cognitive, and even discriminatory bias (Banakou & Slater 2016), in enhanced VR self-Avatar experiences.

References

- Bailey, J.O., Bailenson, J.N., & Casasanto, D. (in press). When does virtual embodiment change our minds? Presence: Teleoperators and Virtual Environments.
- Blanke, O., Slater, M., Serino, A. (2015) Behavioral, Neural, and Computational Principles of Bodily Self-Consciousness. *Neuron* 88: 1. 145-166 Oct.
- BRUGGER, P. (2002). Reflective mirrors. Perspective-taking in autoscopic phenomena. *Cognitive Neuropsychiatry*, 7: 179–194.
- BRUGGER, P. et al (2006) "Polyopic heautoscopy: Case report and review of the literature "
- Banakou, H. Slater, M. (2016) Virtual Embodiment of White People in a Black Virtual Body Leads to a Sustained Reduction in their Implicit Racial Bias. *Front. Hum. Neurosci.* 10: 601.
- BOTVINICK, M., COHEN, J. (1998)." Rubber hand 'feel' touch that eyes can see". *Nature* 391, 756
- Craig, T et al (2015). „The effects of an Audio Visual Assisted Therapy Aid for Refractory auditory hallucinations (AVATAR therapy): study protocol for a randomized controlled trial," *Trials* 16:329, DOI 10.1186/s13063-015-0888-6
- EHRSSON, H. et al (2005). "Touching a Rubber Hand: feeling of body ownership is associated with activity in multisensory brain areas." *J Neurosci* 25 (45), 10564-73
- EHRSSON, H. (2007) "The experimental induction of out-of body experiences". *Science* 317, 1048
- FOX, J., AHN, S.J., JANSSON, J., YEYKELIS, L., SEGOVIA, K., & BAILENSON, J. N. (2015). Avatars versus agents: A meta-analysis quantifying the effect of agency. *Human-Computer Interaction*, 30 (5), 401-432.
- FOX, J. BAILENSON, N., TRICASE, L. (2013). The embodiment of sexualized virtual selves: The Proteus effect and experiences of self-objectification via avatars. *Computers in Human Behavior*. 29 (3): 930–938
- FOX, J and Jeremy N. BAILENSON, "Virtual Self-Modeling: The Effects of Vicarious Reinforcement and Identification on Exercise Behaviors," *Media Psychology* 12 (2009): 1–25
- GUALENI, S. (2015). *Virtual Worlds as philosophical Tools. How to philosophize with a digital hammer.* London: Palgrave
- GERNER, A. (upcoming). Proben zu einer semiotischen Körper rhetorik mit Avataren ausgehend von C.S Peirce
- GERNER, A. (2017 upcoming). Technologies of Encounters of Projective and Avatar Selves. Philosophical Outlook on Cognitive Enhancements in Avatar-based schizophrenia therapy. In: Pereira, J., Gonçalves, J., Hipólito, I. (eds). *Schizophrenia and Common sense. Studies in Mind and Brain*: Springer
- GERNER, A. (2016). Towards a philosophy of human technology: outlook on cognitive enhancements in Avatar/Virtual Reality schizophrenia therapy. *Complexitas - Rev. Fil. Tem.* 1(1), 118-138
- GERNER, A., GUERRA, M. (2014). "On the Cinematic Self. Cinematic Experience as "Out of body" experience? In: Alexander Gerner & Jorge Gonçalves (eds.). *Altered Self and Altered Self Experience.*

BoD: Norderstedt, p.85-106

LEFF, J., WILLIAMS, G., HUCKVALE, M.A., ARBUTHNOT M., LEFF, A.P.(2013). "Computer-assisted therapy for medication-resistant auditory hallucinations: proof-of-concept study," *Br J Psychiatry*, 202, 428–433

LEFF, J. et al (2014). "Avatar therapy for persecutory auditory hallucinations: what is it and how does it work," *Psychosis* 6(2), 166-176

MacDORMAN ,K.F. (2005) Androids as an experimental apparatus: why is there an uncanny valley and can we exploit it? In: *CogSci- 2005 workshop: toward social mechanisms of android science*. pp 106–118

MacDORMAN, K. F., Wairatpanij, S., Chen, Y., Du, Y., Anwar, S., Yu, C. (2009). Humanizing robots. IUPUI Research Day. April 24, 2009. Indianapolis, Indiana.

MacDORMAN, K. F., & ISHIGURU, H. (2006). The uncanny advantage of using androids in social and cognitive science research. *Interaction Studies*, 7(3), 297–337.

MADARY & METZINGER, *Real Virtuality: A Code of ethical Conduct. Recommendations for Good Scientific Practice and the Consumers of VR Technology*, *Frontiers in Robotics and AI*, Vol3, art.3,2016, p.1-21.

MORI, Masahiro. The uncanny valley. *Energy*, v.7, p. 33–35

NEYRAT, F. (2011). "Das technologische Unbewußte. Elemente einer Deprogrammierung, " trans. E.v.Osten & E.Hoerl in: Erich Hoerl (ed). *Die technologische Bedingung. Beiträge zur Beschreibung der technischen Welt.*(=swt 2003). Berlin: Suhrkamp, 147-148

PLESSNER, H. (1975[1928]). *Die Stufen des Organischen und der Mensch. Einleitung in die philosophische Anthropologie*. Walter de Gruyter: Berlin/New York Slater et al 2010

SABOLIUS, Kristupas (2016). *Proteus or radical imagery*. Vilnius: Contemporary Center Center, Kraków: Bunkier Sztuki Gallery for Contemporary Art

SLATER, M. et al (2009). "How we experience immersive virtual environments: the concept of presence and its measurement." *Anuario de Psicologia* 2009, 40/ 2, 193-210;

SLATER, M. et al (2010). "First person Experience of Body transfer in virtual reality" *PLoS ONE* 5/5, e10564. doi:10.1371/ journal.pone.0010564

SLOTOVSKY, J. et al. Persistence of the uncanny valley: the influence of repeated interactions and a robot's attitude on its perception *Front. Psychol.*, v.6, e. 883, 2015.

TINWELL, Angela et al. *The Uncanny Wall*. *Int.J. Arts and Technology*, v.4, n.3, p.326-341, 2011

YEE N, BAIENSON J (2007). "The Proteus Effect of Transformed Self-Presentation on Behavior," *Human Communication Research* 33: 271-290;

YEE, N. (2014). *The Proteus Paradox. How Online Games and Virtual Worlds change us- and how they don't*. Yale University Press

3rd Author's Abstract: The Gothic Uncanny: Selected Mind-Images in Literature and Film

Graça Corrêa (CFCUL & CIAC, Portugal)

In his often-cited essay "The Uncanny," written in 1919, Sigmund Freud defines it as something that is known to us, "secretly familiar," but which has undergone repression and then returned, thus becoming strange. In the field of Art Studies, several critics have pointed out how such "uncanny" intensities may be particularly suggested by Gothic aesthetics, a mode noted for its extended use of doubles, ghostly apparitions, time disjunctions, ascriptions of unsettling power to animals and non-human agents, and for its erosion of normative divisions between the worlds of sleeping and waking.

Although Gothic writing's tendency to render everyday objects, structures and events disturbingly repulsive, terrifying and strange—i.e., uncanny—has been predominantly investigated in the Freudian sense, more recently film-philosophy critics have traced a Deleuzian Gothic time-image that supplements and challenges existing psychoanalytic assessments. Drawing on both critical trends this paper investigates the mind-images, or aesthetic stimuli for thought, of the Gothic uncanny, as evoked in tales by E.T.A. Hoffmann and Edgar Allan Poe, in scripts by Antonin Artaud, and in films by Alfred Hitchcock, Stanley Kubrick and David Lynch.

Symposium 10

Emergence and non-fundamentalist metaphysics

John Symons (U. Kansas, United States) / **Gil Santos** (CFCUL, Portugal)
/ **João L Cordovil** (CFCUL, Portugal)

Contact: johnfsymons@gmail.com

Contact: gilcosan@gmail.com

Contact: jlcordovil@hotmail.com

1st Author's Abstract: Emergence, the Ideal of Pure Mechanism and Fundamentality

John Symons (U. Kansas, United States)

This talk examines C.D. Broad's view of mechanism and explains its role in the formulation of his emergentism. I contrast the account of fundamentality implied in his emergentism with discussions of fundamentality in contemporary metaphysics.

2nd Author's Abstract: A Relational Causal Power Theory

Gil Santos (CFCUL, Portugal)

Causal power theory (CPT) constitutes a systematic attempt to overcome Neo-Humean metaphysics, regarding both the ontological nature of properties and causation. Nevertheless, this attempt faces some problems, because (or so I will sustain) CPT is still dominated by an atomistic essentialist perspective. I will argue that we must develop a relational ontological approach to CPT, namely, by criticizing the widespread intrinsicity thesis – something that can only be done by distinguishing the instantiation and the existence-conditions of properties and powers. Ultimately, this will lead us to the necessity of grasping the relationship between properties and relations, under a new perspective.

3rd Author's Abstract: OSR and the question of Fundamentalism?

João L Cordovil (CFCUL, Portugal)

As Steven French puts it, Ontic Structural Realism (OSR) is motivated by "two sets of problems that 'standard' realism is seen to face. The first has to do with apparent ontological shifts associated with theory change that can be observed throughout the history of science. The second is associated with the implications – again ontological – of modern physics" (French, 2010). Precisely OSR's literature stresses the fact that modern physics implies the downfall, or is at least incompatible with, the traditional metaphysics of objects – namely, with the individuality and the ontological independence conditions.

In opposition to the traditional metaphysics of objects, OSR is often presented as the ontological view, according to which at the fundamental level of reality there are, either structures of relations (= R-OSR), or structures of relations and objects, in the OSR's moderate version (M-OSR).

So, in OSR's literature all but one characteristic of traditional metaphysics of objects has been rejected, revised or at least put in question. All but the assumption that there is a fundamental level of physical reality.

But does OSR really need to be committed to fundamentalism?

As stated above, R-OSR and M-OSR are usually distinguished by the specific way of how they address the question of the primacy between objects and relations. However, I will argue that the difference between R-OSR and M-OSR runs deeper; it rests on the different programmatic assessments of the relationship between science and metaphysics.

In this sense, at least at its roots, the distinction between R-OSR and M-OSR lies in the divergence between Radical Naturalistic Metaphysics and Esfeld's account of Natural Philosophy (based on the Primitive Ontology approach).

In this context, we should ask, not only if R-OSR or M-OSR must be committed to fundamentalism, or if non-fundamentalist OSR can be developed, but more strongly: is there a naturalistic ground to the fundamentalist claim of R-OSR? Does Physics entail Metaphysical Fundamentalism? Does R-OSR's commitment to Metaphysical Fundamentalism depend on whether or not our best scientific theories are fundamentalists (and therefore is it a contingent assumption)? Is there a possibility of a non-fundamentalist Primitive Ontology that tackles issues in Modern Physics? And finally, is there any reason for OSR to assume fundamentalism?

From the recent concerns with fundamentalism raised notably by Schaffer (2003, 2010), Markosian (2005), Cameron (2008), McKenzie (2012, 2013, 2014, 2015), Tahko (forthcoming) (see also Ricki Bliss & Graham Priest (eds.) forthcoming), I will in first place try to argue that from both mereological and supervenience relations OSR has severe difficulties to sustain the fundamentalist thesis. Then, I will try to show that there are different non-fundamentalist accounts that can work within R-OSR, and that M-OSR in combination with Primitive ontology has not to be committed to fundamentalism either. And finally I will argue that non-fundamentalism is compatible with the nowadays forms of OSR.

References

- Cameron, R. (2008), "Turtles All the Way down: Regress, Priority and Fundamentality", *Philosophical Quarterly*, 58 (230): 1-14.
- Esfeld, M. and Lam, V. (2010), "Ontic Structural Realism as a Metaphysics of Objects" in Alisa and Peter Bokulich (eds.): *Scientific structuralism*. Dordrecht: Springer 2010, pp 143-159.
- Esfeld, M.; Deckert, D. and Oldofredi, A. (n.d) "What is matter? The fundamental ontology of atomism and structural realism forthcoming in Anna Ijjas and Barry Loewer (eds.): *A guide to the philosophy of cosmology*. Oxford University Press.
- French, S. (2014), *The Structure of the World: Metaphysics and Representation*, Oxford: Oxford University Press.
- McKenzie, K. (2014), "Priority and Particle Physics: Ontic Structural Realism as a Fundamentality Thesis" in *Br J Philos Sci* 65(2) (2013), pp. 353-380.
- Ladyman, J. and Ross, D. (2007), *Everything must go: Metaphysics naturalized*, Oxford: Oxford University Press.
- Schaffer, J. (2003), "Is There a Fundamental Level?", in *Noûs* 37.3 (2003), pp. 498-517.



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