

# Fifth Young Researchers Days in Logic, Philosophy of Science and History of Science (Brussels, Royal Academy of Science)

**Fifth Young Researchers Days in Logic, Philosophy of Science and History of Science  
(Brussels, Royal Academy of Science, Prigogine room)**

**Friday the 25<sup>th</sup> of November**

**9h-10h :** *Teresa Esposito* : ‘Ignis artificiosus’: Images of God and the Universe in Rubens’ depiction of antique shields

*Jetze Touber* : ‘In my intestines the marble grows from which my grave is carved’: The multiple meanings of body stones in early modern culture

**10h-11h :** *plenary lecture of keynote speaker Dominique Pestre* : Between knowledge and power: Turning the environment into economy, 1970-2010

**11h :** coffee break

**11h30-13h :** *Pieter Present* : Institutionalising experimental philosophy: The sovereignty of Newtonian methodology in Petrus van Musschenbroek’s work

*Jip van Besouw* : ’s Gravesande’s reworking of the laws of nature and their role in physics

*Yannick Van den Abeel* : Maupertuis and the Principle of Least Action. Perspectives on the changing relationship between metaphysics and science in the eighteenth century

**13h :** lunch break

**14h-15h30 :** *Iulia Mihai* : Explanatory dualism and Leonhard Euler’s vibration theory

*Thomas Müller* : The temperature of the brain

*Walter Leclercq* : Gabriel de Mortillet (1821-1898) and his impact on Belgian prehistory : Networks beyond artefacts

**15h30 :** coffee break

**16h-17h :** *plenary lecture of keynote speaker Omar Nasim* : Between Conception and Perception: Whence the Hand in Observation?

**17h-18h :** *Guillaume Lejeune* : What is the implicit meaning of the traditional principles of logic ? Outlines of F.H. Bradley’s semantics

*Liesbet De Kock* : Helmholtz and J.S. Mill on experience and the self: Overcoming reflective circularity

**Fifth Young Researchers Days in Logic, Philosophy of Science and History of Science  
(Brussels, Royal Academy of Science, Prigogine room)**

**Saturday the 26<sup>th</sup> of November**

- 9h-10h :** *Quentin Hiernaux* : Towards an ever more empirical conception of plant individuality? The example of cellular theory  
*Massimiliano Simons* : The many shapes of constructivism: The case of synthetic biology
- 10h-11h :** *plenary lecture of keynote speaker Ole Hjortland* : The indispensability of logic
- 11h :** coffee break
- 11h30-13h :** *Fons Dewulf* : Is a relativized a priori possible for the historical sciences?  
*Anna Drozdzewska* : Intentions and causality: Why genuine mental causation is crucial for free will  
*Sydney Katherine Green* : The impossibility of causal claims in psychiatry: An analysis of the Russo-Williamson thesis and its implications
- 13h :** lunch break
- 14h-15h30 :** *Valeriya Chasova* : Direct empirical status: Utility and shortcomings  
*Koen Lefever* : Interpreting special relativity in terms of classical kinematics  
*Jan Potters* : Studying the practice of unifying reality: Einstein's theory of special relativity
- 15h30 :** coffee break
- 16h-17h30 :** *Sylvia Pauw* : Abstraction and mathematics: The case of Descartes  
*Stéphanie Ponsar* : Conceptions of foundations of mathematics : Digging into their differences to better understand what these should provide  
*Nigel Vinckier* : Flattening the sharply pointed peak. The dynamics of narratives and social arenas in mathematics

# Keynote speakers

## HJORTLAND Ole (*University of Bergen*)

### *The indispensability of logic*

Anti-exceptionalism about logic is the Quinean view that logical theories have no special epistemological status, in particular, they are not self-evident or justified a priori. Instead, logical theories are continuous with scientific theories, and knowledge about logic is as hard earned as knowledge of physics, economics, and chemistry. Once we reject apriorism about logic, however, we need an alternative account of how logical theories are justified and revised. A number of authors have recently argued that logical theories are justified by abductive argument (e.g. Gillian Russell, Graham Priest, Timothy Williamson). This paper explores one crucial component of the abductive strategy: what counts as evidence for a logical theory? I discuss three possible sources of evidential confirmation: (1) intuitions about validity, (2) the Quine-Williamson account, and (3) indispensability arguments. I argue that each proposal leads to systematic underdetermination of the choice of logical theory. It follows that, as opposed to what Quine and Williamson have claimed, anti-exceptionalism does not support classical logic.

## NASIR Omar (*University of Regensburg*)

### *Between conception and perception: Whence the hand in observation?*

For a long time now, philosophical and historical studies about scientific observation have been centered chiefly on the eye and mind. Institutions and instruments, to be sure, have also played a role in some of these discussions, but these too have been regarded as extensions of the eye or mind. It takes little, however, to notice that the hand has also been an important element of scientific observation. Whether it is fidgeting with instruments or touching materials, drawing or writing in notebooks or laptops, the hand is present during most acts of observing. Whether intervening or representing, the hand has been essential to observation in science. This talk will attempt to articulate the significance of this active presence for an understanding of observation. It will do so by exploring the role played by the hand in not just hand-made drawings but also in photography, and all within the observational science of astronomy—a science that is at one and the same time an exceptional *and* a paradigm case for observation in science.

## PESTRE Dominique (*EHESS*)

### *Between knowledge and power: Turning the environment into economy, 1970-2010*

The economization of environment is a program that started in the 1970s and that became the main way to frame the economics/ecology question in most countries and international organizations. Taking OECD as a privileged space of observation, I intend to show how notions of Environment and Economization were both matters of debate, how different conceptualizations and interests led to various tools and expert work – but also why they directly led us to the quite disastrous Anthropocene situation today.

## Doctoral or postdoctoral researchers

CHASOVA Valeriya (*PhD student, UCL, CEFISES*)

### *Direct empirical status: Utility and shortcomings*

It has been thought that the direct empirical status (DES) can clarify the ontology of theoretical symmetries (see Kosso [BJPS, 2000]), but the way it can do so has remained largely unexplained. I will reflect on the utility and the shortcomings of this proposal using Faraday's cage empirical symmetry as an example (see Healey [BJPS, 2009]). Saying constant shifts of the electrostatic potential have DES means theoretical states linked by such transformations can be used to represent observationally different states constituting Faraday's cage empirical symmetry. So what the DES could show is that global transformations such as constant potential shifts are not always gauge symmetries (i.e. they do not always link observationally indistinguishable and physically identical states). But first, any representation ascribing some constant absolute potentials to the cage and the environment is observationally equivalent to an infinity of representations featuring other constant absolute potentials but the same differences in potentials between the cage and the environment. This suggests that absolute though not relative values of the electrostatic potential are a gauge surplus even in DES contexts. Second, Faraday's cage empirical symmetry can be modelled equally well using local transformations of the electromagnetic potential (which comprises the electrostatic potential as its part). There, potential differences between the cage and the environment cannot be all-important because they are not even well-defined. Indeed, absolute values are allowed to vary within the two regions. Summing up, global and local representations of empirical symmetries do provide insights into the ontology of theoretical symmetries, but these insights apparently diverge: global representations give representational weight to relative differences between regions characterised by constant values, while local representations rely on relative differences in values within relevant regions. I finish by reviewing some possibilities for dismissing either local or global representations, or for reconciling the ontologies they suggest.

DE KOCK Liesbet (*Postdoctoral researcher FWO, VUB, Centrum voor Logica en Wetenschapsfilosofie*)

### *Helmholtz and J.S. Mill on experience and the self: Overcoming reflective circularity.*

As is well-known, Hermann von Helmholtz was inspired by John Stuart Mill's account of inductive inference in his characterization of perception as a process of unconscious inference. Apart from this self-professed indebtedness to Mill's *A System of Logic*, however, Helmholtz's intellectual relation to Mill, and to British associationism in general, is hard to disentangle. This contribution aims at exploring this problem from a particular vantage point. That is to say, I will focus on the systematic continuity and differences between Helmholtz' and Mill's psychological theories of the genesis of phenomenal experience, and more particularly, on their struggle to account for the equiprimordiality of the I and the Not-I and the correlative problem of (the role of) self-consciousness. I will argue that Helmholtz' approach to the problem of phenomenal experience (i) resonated with Mill's *Psychological Theory of the Belief in an External World* (1878 [1865], p. 188-239), in which the belief in externality is said to be generated from the (associatively acquired) belief in the 'Permanent Possibilities of Sensation', but (ii) transgressed the associationist framework when it posited the self-reflexive, free ego as a condition of possibility for experience. I will explore the hypothesis that this shift towards a more idealist conception of subjectivity in Helmholtz's psychology was motivated at least in part by an attempt to avoid the (now well-known problem) of reflective circularity in the conceptualization of self-consciousness (most notably, see Henrich, 1967). In conclusion, the merits and limits of Helmholtz' approach will be discussed.

DEWULF Fons (*PhD student, UGent, Centre for Logic and Philosophy of Science & Centre for History of Philosophy and Continental Philosophy*)

### *Is a relativized a priori possible for the historical sciences?*

In this paper I argue that Michael Friedman's notion of a relativized a priori can be applied to the historical sciences. I also argue that such application yields an account of historical evidence and objectivity which is better in line with actual historical practice than the available accounts in philosophy of historiography. First, I defend an epistemological distinction between a proper empirical part of historical investigation on the one hand and some fundamental principles on the other hand. While the former consists of descriptions, analogies and causal relations that historians ascertain about the actors and institutions of their study, the latter constitute the empirical objects that operate in the empirical assertions of the historian. The fundamental principles, thus, form the possibility of historical knowledge and play a proper

constitutive role. I argue for this distinction by looking at the arguments that Lucien Febvre gave to defend the thesis that François Rabelais was not an atheist. I show that Febvre is not arguing about empirical material, but about the conditions in which the empirical material of the 16<sup>th</sup> century should be constituted as objects of empirical, historical experience. Second, I argue that introducing this distinction solves some of the problems in the holistic, Quinean epistemology of historical evidence that has been given by Kosso and Hurst. The holistic account lacks any normative assessment of how the sources should cohere, even though coherence needs such a norm to function properly. I point out through the example of Febvre that historians in their practice cannot find such a norm in their material, but impose it on their material. These norms are the constitutive a priori, and historians can discuss their applicability: they are constitutive, but not irreversible.

### DROZDZEWSKA Anna (*PhD student, UCL, CEFISES*)

#### *Intentions and causality: Why genuine mental causation is crucial for free will.*

Our daily life is filled with decision making, and most of us, without hesitation would claim that those decisions stem from our plans and intentions and play a causal role in the execution of our actions. These intuitions, however, stand in opposition to the scientific image of the world as a causally closed system. The causal power of intentions and decisions is often implicitly assumed in various discussions on decision making, and most importantly for this presentation, on the problem of free will, where for action to be free it should originate from our conscious decision rather than physical brain activation. Since the discussions on the topic came to include not only philosophers but also neuroscientists, I will show how this assumption is applied in both neuroscientific experiments (Libet, 1983, 1985; Haggard 1999; Soon et al. 2008) and theories (Tse, 2013) as well as in philosophical discussions (Mele, 2009; Searle, 2010). I will claim that real and efficacious mental causation is one of the conditions for the possibility of free will. In the second part of the presentation, I will discuss different approaches to causation and their connection with the free will problem. I will focus on the manipulation account of causation or interventionism, which captures the core of experimentation and is based on the commonsensical idea that the cause of an event can be exploited in order to change its effect. The most detailed accounts of the position were developed by Menzies and Price (1983), Pearl (2000) and Woodward (2003). The ideas presented here were initially inspired by the realization that interventionism, although applied in both domains in a very similar manner, leads to contradicting results- in neuroscience to the conclusion that free will does not exist (or has limited scope) and to the contrary in philosophy (mental events are causal). The interventionist positions differ in specifics, but the main assumption is that causes can be seen as tools through which we manipulate effects. In other words, if an event X is a cause of an event Y, the manipulation of X will change Y. In this framework I will discuss one position and its application to the free will problem in particular, namely the argument by List and Menzies (forthcoming). The authors conclude that, since mental is multiply realizable on the physical the intentions could have supervened on a different physical event. Thus manipulating the physical could still bring about the same intention and also action, while manipulating the intention will change the outcome. From it, it follows that the manipulable cause which, changes the action is the intention and not its (multiply realizable) physical basis. I will conclude the presentation by showing that, although promising, interventionism does not solve the mental causation puzzle, but can be used to further confirm some of the compatibilist claims about free will. Additionally I will discuss why interventionism works best when applied to two unrelated causes, rather than two connected through supervenience as is the case for mental causation.

### ESPOSITO Teresa (*Phd student, UGent*)

#### *'Ignis artificiosus': Images of God and the universe in Rubens' depiction of antique shields*

Rubens' intellectual pursuits are not new among art historians. Much ink has been spilled to illustrate how much and in which way both the classical heritage and Lipsius' neo-Stoic thought have influenced his artistic production. This article aligns with this scholarly tradition, by concentrating on a peculiar motif depicted by Rubens on antique shields between 1616 and 1618 and by showing how ancient ekphrasis and Lipsius' natural philosophy, imbued with Platonic and Hermetic notions, played a fundamental role in the invention of this original and powerful image. The latter represents the embodiment of the laws of Nature and God, bringing to mind the theological and philosophical discussions circulating among intellectuals at the beginning of the seventeenth-century.

### GREEN Sydney Katherine (*PhD student, UAntwerpen, Centre for Philosophical Psychology*)

#### *The impossibility of causal claims in psychiatry: An analysis of the Russo-Williamson thesis and its implications*

The Russo-Williamson Thesis holds that, in order for a causal claim to hold water, evidence of both statistical correlations and mechanisms is required (Russo & Williamson [2007]; Illari [2011]; Clarke *et al.* [2014]). For instance, in order to

prove that Drug X cures Disease Y, researchers must provide both (1) evidence that there is a strong statistical correlation between the use of X and the elimination of Y, and (2) evidence of a mechanism by which X cures Y. This idea runs counter to the current hierarchy of evidence as set forth in EBM. EBM maintains that evidence of statistical correlation, as gathered in RCTs and other statistical trials, is the strongest evidence for a causal claim, and that evidence of mechanisms is far less important (OCEBM [2011]). While the RWT has been widely discussed in connection to medicine and the social sciences, its implications for the fields of psychiatry and psychotherapy have not. I argue that these implications are of great importance. Namely, the RWT eliminates the possibility of causal claims within psychiatry and psychotherapy. This is because causal claims made in these fields do not rely on two separate bodies of evidence, one of statistical correlations and one of mechanisms. Instead, such claims merely *derive* mechanistic explanations from statistical correlations. In order to illustrate this point, I point to historical examples from psychiatry, including the dopamine hypothesis for schizophrenia and the serotonin hypothesis for depression. I also discuss the role of the placebo effect in psychiatry and psychotherapy, and consider whether it can be considered a mechanism in the way that the RWT demands.

## HIERNAUX Quentin (*PhD student FRS-FNRS, ULB, PHI*)

### *Towards an ever more empirical conception of plant individuality? The example of cellular theory*

The question of whether biological individuality is an essential notion for biologists' work is controversial. If the biological individual is defined as a living being organized in such a way that the end of this organisation leads to the disappearance of all or part of its most important functions, then the relativity of the notion immediately appears and is likely to describe many degrees or forms of organisation. However, beyond morphological characterizations, the discovery and understanding of cellular mechanisms have promoted a more empirical or concrete hypothesis according to which the 'elementary' or 'simplest' individuality in life would be the cell. I would like to contextualize the epistemological stakes of this hypothesis by positioning myself in the field of botany and its history. What's the extent of this biological hypothesis within the vegetal kingdom? What adjustments or corrections does such an interpretation need for botany? Finally, which philosophical conceptions underlie this hypothesis applied to vegetal life? Without looking for exhaustiveness, I would like to show through some pieces of information, extracts of botanists and philosopher's thinking what the forces and limits of such an approach are.

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## LECLERCQ Walter (*Postdoc researcher, Attaché scientifique, Centre National d'Histoire des Sciences*)

### *Gabriel de Mortillet (1821-1898) and his impact on Belgian prehistory: Networks beyond artefacts.*

Gabriel de Mortillet is a major actor in the development of the international prehistory. On several occasions, he showed a deep interest in the evolution of Belgian prehistory, particularly on the question of the existence of a Belgian Bronze Age. As one of the founders of the *Congrès internationaux d'anthropologie et d'archéologie préhistoriques*, he had the vision of science as an international field, without borders. In 1872, the Congress was held in Brussels. Belgian scientists were confronted with the famous names of the international prehistory introducing their innovative theories. The discussion, during the congress of Stockholm (1874), around the establishment of an archaeological map with an international legend was decisive in the development of the Emile de Munck and Alfred de Loë's pre- and protohistorical

archeological map. In 1891, with his class of the *Ecole d'Anthropologie de Paris*, de Mortillet - considered at this time as one of the fathers of prehistory - travelled around Belgium to explore famous sites of Belgian Prehistory. A simple educational trip ? The evidence we have collected suggests otherwise. Beyond this scientific / educational trip, Gabriel de Mortillet met some of the main of Belgian prehistorians and some characters sharing his political and philosophical ideas. Count Eugène Goblet d'Alviella gave him a great reception in Brussels. The count shares the same philosophical opinion tinged with an anti-clerical touch; they struggled on their respective country for the funeral freedom. This paper aims to demonstrate Gabriel de Mortillet impact on Belgian Prehistory and the importance of professional and social networks in the circulation of ideas and theories between Belgian prehistorians and their French colleagues. To reach this purpose, the author will present unpublished and forgotten correspondence/data, preserved in Belgian and foreign Institutions.

**LEFEVER Koen (PhD student, VUB, Centre for Logic and Philosophy of Science) & SZÉKELY Gergely (co-promotor, MTA Alfréd Rényi Institute for Mathematics - Budapest)**  
*Interpreting special relativity in terms of classical kinematics*

The aim of this paper is to present a new logic based understanding of the connection between special relativity and classical kinematics. We show that the axioms of special relativity can be interpreted in the language of classical kinematics. This means that there is a logical translation function from the language of special relativity to the language of classical kinematics which translates the axioms of special relativity into consequences of classical kinematics. We will also show that if we distinguish a class of observers (representing the Newtonian observes stationary with respect to the "Ether") in special relativity and exclude the non-slower-than light observers from classical kinematics by an extra axiom, then the two theories become definitionally equivalent (i.e., they become equivalent theories in the sense as the theory of lattices as algebraic structures is the same as the theory of lattices as partially ordered sets). So within an axiomatic framework of mathematical logic, we explicitly show that the transition from classical kinematics to special relativity is the knowledge acquisition of that there is no "Ether" and inertial observers can only move slower than the speed of light.

**LEJEUNE Guillaume (Postdoctoral researcher, Humboldt-Stipendiat, Universität Leipzig & Chargé de recherches FNRS, ULg, MéThéor)**

*What is the implicit meaning of the traditional principles of logic ? Outlines of F.H. Bradley's semantics*

In 1883, Bradley writes his *Principles of Logic*. He presents in it a theory of judgment, which is completed by a theory of inference. To some extent any judgment is categorical. That is why judgment can only be understood fully once we consider it as an inference of reality. It remains to characterize this reality to which we have access only indirectly through piecemeal judgments. This is the task that Bradley assigns to its masterpiece, *Appearance and Reality*. Bradley's logic is therefore based ultimately on a metaphysics of experience. The first principles of logic are less judgments and inferences, than a feeling of reality. This one forms the background of any inference and judgment. Bradley's logic differs also from what is called since Kant "formal logic," to the extent that it is interested in the content. It could be better described as a theory of meaning, which is correlative with a metaphysics of which the function is to indicate what reality is (instead of the pretension of saying what it is, which one would be an Hegelian one). In this perspective, Bradley's inquiry in logic stands as a critique of traditional logic. Bradley considers the basic principles of logic (the principle of identity, the principle of contradiction and principle of the excluded third) and shows their inability to work as the foundation of any informative thought about reality. He criticizes by the way their implicit presuppositions: the independence of fixed terms and the theory of external relation. Our thesis is that: this critic of the logical principles does not lead Bradley to a "cheap and easy monism," but rather to a refusal of the semantic of possible worlds.

**MIHAI Iulia (PhD student, UGent, Centre for Logic and Philosophy of Science and Sarton Centre for History of Science)**

*Explanatory dualism and Leonhard Euler's vibration theory*

I argue that Leonhard Euler explains the motion of the taut string not only in equations and mathematical language, but that his mathematical explanation is to be understood as dualistic, being composed of two layers: one mathematical and the other natural. The standard view is that Leonhard Euler's vibrating string project is mechanical and focused on using the partial differentiation technique that he had just encountered in Jean d'Alembert's treatment of the same problem. However, Euler is concerned with the vibrational phenomenon as it unfolds in time, to which the purely mathematical solution cannot offer an answer. This is made explicit by way of explanatory dualism, and how the mathematical and the

natural layer contribute to the explanation. My analysis focuses on the structure and the functions of the two layers within the explanation. First, the two layers cannot be reduced to one another. Second, correspondences within their respective conceptual clusters ensure their connection, even though such correspondences do not spread over the entire conceptual cluster. Third, the most important function of the mathematical layer is to construct a range of possibilities, which also act as boundaries, for the motion of the string. The natural layer brings in non-mathematical information about the vibrational phenomenon, that would not have otherwise made its way into the explanation, and points to the limits of the mathematical model. Finally, explanatory dualism can account for and incorporate Euler's own views about the relationship between mathematics and nature on the topic of the vibrating string. It can also bring more insights into the structure of explanation in post-Newtonian eighteenth century science.

## MÜLLER Thomas (*Postdoctoral researcher, UCL, CEFISES*)

### *The temperature of the brain*

In 1881 Francis Ysidro Edgeworth famously claimed that utility could be measured. Edgeworth also asserted that the utility units – as physical units – were both independent on the individual perceiving them and on time. This hypothesis, that Edgeworth recognized to be problematical, was justified analogously to the hypothesis of probability theory. This paper will attempt to show the importance of the physical analogies in Edgeworth's understanding of utility measurement. Edgeworth was reading, and also wrote, about statistical physics. Statistical physics was using probability theory to show that temperature was a macroscopic equivalent of the energy of molecules, thus transforming the cardinal Celsius scale into the classical Kelvin scale of measurement. Thus, Edgeworth's metaphor of the thermometer may have been a valuable one in distinguishing cardinal and classical measurement. But temperature was also a matter of psychological measure, since it had to do with the hot/cold perception. Saying that something is warmer than something else is an ordinal scale. Thus, Edgeworth analogy may have been much less innocent than expected. Probabilities were also a major concern in transforming average energy per molecule into temperature. The very root of the well-known debate about cardinal vs. ordinal measurement may thus be found into thermodynamics. A careful and systematic analysis of Edgeworth texts and of his use of the evolving analogy between utility and temperature and utility and probabilities, will thus shed new light on an unexplored historical topic, while at the same time helping in clarifying the complexity of Edgeworth's thinking.

## PAUW Sylvia (*PhD student, University of Amsterdam and UGent, Centre for Logic and Philosophy of Science and Centre for History of Philosophy and Continental Philosophy*)

### **Abstraction and mathematics: The case of Descartes**

This paper argues that Descartes' views on the relationship between abstraction and mathematics changed in the course of his career. I set out Descartes' views on abstraction, and examine which considerations may have led Descartes to change his mind with respect to this issue. The topic of abstraction plays an important role in early modern debates on mathematization. Abstraction is relevant, for instance, to questions concerning the nature of mathematical objects. Many early modern thinkers regard mathematical objects as ideas that the human mind abstracts from objects given in experience. One advantage of this view is that it makes it relatively easy to account for the applicability of mathematics to reality (cf. Jesseph, 2005: 268-271). As I show in this paper, there seems to be a version of this abstractionist view discernible in Descartes' early work *Rules for the Direction of the Mind*. The *Rules* suggests, I argue, that we obtain mathematical ideas from figures given in the imagination. In his later work, Descartes abandons this view. According to the *Meditations*, our ideas of mathematical objects are implanted in our minds by God. As Nolan (1997) points out, this provides mathematical objects with a status similar to that of Platonic forms (184). The change in Descartes's view is quite striking, I claim, because, at first sight, his later conception of mathematical objects makes it more difficult to account for the applicability of mathematics than his account in the *Rules* did. Moreover, the innateness thesis of the *Meditations* does not square well with the views on abstraction Descartes held around the time he wrote this work. I consider which reasons Descartes may have had for changing his views on the relationship between abstraction and mathematics.

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**PONSAR Stéphanie (PhD student, UCL, CEFISES)**

***Conceptions of foundations of mathematics: Digging into their differences to better understand what these should provide***

A wide variety of conceptions of what foundations of mathematics should be exists amongst the community of philosophers. This is in particular illustrated in the conceptions they have of the role of category theory as a background theory of structuralism. Structuralism is one of today's prominent theories in philosophy of mathematics. It defines mathematics as the science of structures. Category theory is a general mathematical theory of structures and systems of structures. It is abundantly studied in philosophy of mathematics both as a background theory of structuralism and as a theory for foundations of mathematics. We show that the answer of philosophers such as Awodey, Hellman, Goldblatt, Landry and Marquis as well as Mac Larty on the role of category theory in structuralism depends on their conception of foundations of mathematics. From these answers, different conceptions of foundations of mathematics are extracted. At least two motivations justify to link our study to category theory. First of all, category theory is proposed as a possible candidate for a theory of foundations of mathematics. However, it is not unanimously accepted as such and the question is still a matter of controversy. The second reason is that it provides one of the most adequate bases for examining this question in light of the practice of mathematics as "category theory provides a framework (indeed the currently dominant one) for the practice of modern, abstract mathematics" [Awodey, 2003]. Having made clear these different statements of what the foundations of mathematics should provide, we will examine their differences in epistemological, ontological, metaphysical, and methodological terms. This will allow to identify the common requirements of these different conceptions and provide a better understanding of what foundations of mathematics should be.

**POTTERS Jan (PhD student, UAntwerpen, Centre for Philosophical Psychology)**

***Studying the practice of unifying reality: Einstein's theory of special relativity***

Since long, the (dis)unity of science has been a central topic for philosophers of science. The last few decades, however, have seen a particular shift in these discussions. Whereas before, (dis)unity claims mainly concerned the products of science, nowadays many philosophers of science study these issues by reference to 'scientific practice', i.e. the way in which science approaches its phenomena of interest. My aim here is to clarify how we can conceptualize 'scientific practice' if we are interested in questions surrounding unification. I will proceed as follows. I start with a sketch of how some philosophers have argued, in general, for either a unified [2] or a dappled reality [1] on the basis of scientific practice. I will then evaluate these approaches by means of [3]'s claim that even some of the most famous examples of scientific unification do not provide any evidence for metaphysical claims. Rather than ending with this negative claim, however, my aim is to outline what this can entail for doing metaphysics based on scientific practice: can we extend our study of science to make metaphysical claims about unity? I will do this by means of one of [3]'s historical cases: Einstein's theory of special relativity. This will allow me to argue conceptions of scientific practice such as those employed by [1] and [2] leave an important issue implicit, which can be described as 'the problem-context which led to a unificationattempt'. Picking up some elements from the context of Einstein's STR will then allow me to suggest some ways to extend these philosophical conceptions of scientific practice.

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**PRESENT Pieter (PhD student, VUB, Centre for Logic and Philosophy of Science)**

***Institutionalising experimental philosophy: The sovereignty of Newtonian methodology in Petrus van Musschenbroek's work***

In this paper, I discuss Petrus van Musschenbroek's (1692-1761) defence of Newton's experimental philosophy, in relation to his views on natural laws and their dependence on the power and will of God. At the time van Musschenbroek started his academic career, several universities in the Dutch Republic had been plagued by intellectual and institutional struggles between Aristotelians and Cartesians. In contrast to these philosophies, van Musschenbroek presents experimental philosophy as an enterprise characterised by harmony and consent. This harmony in experimental philosophy is premised on the order in nature. Natural phenomena are governed by universal and unchanging laws instituted by God. Therefore, as a diligent study of natural phenomena, experimental philosophy cannot but produce agreement. Divine law guarantees order in science. The order in the world is based on a free and arbitrary act of will by God, whose will and power are beyond our comprehension. The sovereign and free will of God is used by Van Musschenbroek to ban a priori reasoning (and therefore Cartesianism) from philosophy and guarantee the sovereignty of

the method of experimental philosophy. I will situate van Musschenbroek's insistence on the stabilising nature of Newtonian experimental philosophy, and his invocation of natural law and God's sovereignty in the broader religious and political landscape of the Dutch Republic. More specifically, I will focus on the place and function of the university within the Dutch society. Van Musschenbroek's (and other Dutch Newtonians') use of the concept will be shown to be part of a strategy to institutionally implement the new experimental philosophy by exploiting the nature and specific embededness of the university.

**SIMONS Massimiliano** (*PhD Student, KULeuven, Centre for Metaphysics, Philosophy of Religion and Philosophy of Culture*)

***The many shapes of constructivism: The case of synthetic biology***

In recent philosophy of science constructivist perspectives have gained prominence. Science is increasingly seen as 'technoscience', meaning that rather than consisting of a mere observation of a passive nature out there, it is argued that science is also always intervening due to the use of scientific instruments and techniques. In this sense, science 'constructs' the object it studies, rather than merely observe it. There are, however, different varieties of constructivism that are often confused with one another and are in need of conceptual differentiation. These different forms will be examined using the case of synthetic biology, a new discipline in biology which aims to create or redesign novel biological systems using engineering methods. Synthetic biology, thus, seems to be a more radical case of constructivism than previous disciplines in the life sciences. This radicalization demands, however, a more elaborate conceptualization of what constructivism can mean. Using a historical epistemological approach three claims will be made. Firstly, I will argue that the constructivist aspect of synthetic biology must be understood by confronting it with other disciplines within the history of biology, such as molecular biology or metagenomics. Secondly, the claim will be made that the notion of constructivism must be historicized or regionalized: rather than stating that 'science in general is constructive', the extent to which science is constructive depends on the specific period and discipline under consideration. Thirdly, I will claim that a specific science or discipline can be constructivist in different ways at the same time and that the dominance of one form of constructivism can significantly shift within the history of science.

**TOUBER Jetze** (*Postdoctoral researcher, Utrecht University, Depart. of Language, Literature and Communication*)

***"In my intestines the marble grows from which my grave is carved": The multiple meanings of body stones in early modern culture***

This paper questions the place of medical knowledge and practice in the configuration of early modern culture, by engaging with an omnipresent but underexposed affliction: bladder, kidney and gall stones. Body stones were problematic to explain, having the material qualities of inorganic matter but originating in the human body; and they were impossible to ignore, being excruciatingly painful. Consequently they were variously subject to preservation, explanation, sensation, contemplation and veneration. This paper will consider how body stones were marked as divine or natural, organic or inorganic, meaningful or senseless objects between the late sixteenth and late seventeenth centuries, a period of profound changes both in medicine and in religion. In that way I intend to show how early modern society reappraised the reciprocal impact of God, astral forces, lifeless nature and physiological processes in the human body.

**VAN BESOUW Jip** (*PhD Student, VUB, Centre for Logic and Philosophy of Science*)

***'s Gravesande's reworking of the laws of nature and their role in physics***

In history of science, Willem Jacob 's Gravesande is known as one of the most influential experimental physicists of the early eighteenth century. To his contemporaries, however, 's Gravesande's ideas on the philosophical foundations of this empiricism were equally important as his physics itself. Up to now, these foundations have almost exclusively been studied in relation to the work of Isaac Newton, as 's Gravesande is still regarded primarily as a 'Newtonian' in historiography. Here, I will provide a richer understanding of his philosophy of science by comparing him to a broader set of authors. This talk will focus particularly on 's his concept of laws of nature. It has been shown before that 's Gravesande's interpretation of the laws and their function is incongruent with Newton's views on induction. However, I will argue that it is also incompatible with the probabilistic epistemology of for instance Boyle and Locke. Instead of to British philosophers, we must look at German, Dutch and French influences in order to understand 's Gravesande's interpretation of the laws of nature and his epistemology in general. As I will show, 's Gravesande had a very particular concept of these laws, one that combined a strict belief in God's providence and his goodness to mankind with a radical scepticism towards the question of how God actually operated the laws of nature. With this combination, 's Gravesande

strictly separated questions of physics from those of metaphysics. By doing so, 's Gravesande paved the way for more modern conceptions of the laws of nature, conceptions in which the idea of laws as 'ordained by God' would become replaced by the idea that laws of nature are merely brute facts of nature.

**VAN DEN ABBEEL Yannick** (*PhD student, VUB, Centre for Logic and Philosophy of Science*)

***Maupertuis and the Principle of Least Action: Perspectives on the changing relationship between metaphysics and science in the eighteenth century***

The principle of least action is a fundamental principle in modern physics. Contemporary physicists consider the PLA to be a purely *mathematical principle* – even an axiom which they cannot completely justify. However, when the principle was first introduced in the 1740s by Pierre Louis Maupertuis its meaning was much more versatile. For Maupertuis the principle of least action signified that nature is thrifty or economical in all its actions, i.e. nature aims not to do anything unnecessary or needless. Maupertuis understood this in teleological terms and even considered the principle as an expression of God's wisdom. In my presentation I shall show how Maupertuis developed his philosophical views *through* his research in physics. (i.e. optics, statics, dynamics). I shall also point out that Maupertuis – often said to be the first Newtonian in France – reinterpreted many elements of Leibniz's philosophy (e.g. choice of best possible world preceding the laws of nature, harmony between efficient and final causes, etc.). These reflections will contribute to a more nuanced understanding of the relationship between metaphysics and physics in the eighteenth century. It is often assumed that with the publication of Newton's *Principia* physics immediately took a positivistic and mathematical turn. My discussion of Maupertuis intends to show that the situation in the first half of the eighteenth century was much more complex and metaphysics was still able to contribute to the development of physics.

**VINCKIER Nigel** (*PhD Student, VUB, Centre for Logic and Philosophy of Science*)

***Flattening the sharply pointed peak. The dynamics of narratives and social arenas in mathematics***

In recent decades, a turn can be observed in the philosophy of mathematics. Cultural influence, the social organisation of mathematics, historical factors, the role of heuristics in the context of mathematical discovery, the role of mistakes, explanation etc. are more and more taken seriously and their influence recognised by philosophers of mathematics (usually put under the denominator of "philosophy of mathematical practice", or PMP for short). However, the recognition of these factors in itself leaves us balancing on an unstable equilibrium at the top of a sharply pointed peak. There exists a risk that the balance tips to either a position in which all mathematical content is reduced to the societal/cultural/practical or either to a view in which it is taken seriously, but remains a footnote while negotiating the "real" philosophical issues at hand; interesting yet not essential. In this paper, I present a model aimed to deal with this issue. I look at mathematical concepts living as a narrative in a social arena and analyse their mutations as they migrate through the mathematical landscape. I will test the model by applying it to some of the burning issues of PMP and argue that our stance can shed light on some of its problems, such as the notion of (reducibility to formal) proof, the "exalted status" of academic mathematics or the discussion about the "front" of mathematics (its certain, perfect, formal, infallible presentation) versus the "back" of mathematical practice (containing elements of discovery, fallibility, uncertainty). I hope to address how and where the societal/cultural elements prove indispensable to understand the mathematical practice, without sliding down from either slopes, thus flattening the sharply pointed peak.

## Map



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