



International Workshop

Explanatory Practices: Interaction, Dialogues, and Cognitive Processes

Centro de Filosofia das Ciências da Universidade de Lisboa

15-16 February 2018

Room 6.2.45

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Program

Thursday 15th February

9h30 - opening

10h - **Non-causal Asymmetries in Topological Explanation** - Daniel Kostić (IHPST/CNRS/ University Paris 1 Pantheon-Sorbonne)

10h50 - **Semantic tableaux for probabilistic propositional logic** - Nino Gullart (University of Seville)

11h40-12h - Break

12h - **The Possibility of Unrestricted Quantification** - Gonçalo Santos (CFCUL)

13h-14h30 - Lunch

14h30 - **Abduction after the dynamic turn** - Angel Nepomuceno (University of Seville)

15h20 - **From preference between arguments to preference between explanations** - Antonio Yuste and Alfredo Burrieza (University of Málaga)

16h10 - Break

16h30 - **Estructuras predicativas y redes semánticas para predicados cognitivos y de percepción en inglés y español** - Teresa López Soto and Francisco J. Salguero Lamillar (University of Seville)

17h20 - Discussion

Friday 16th February

10h - **Abduction in a Pragmatic Framework** - Daniele Chiffi (Tallinn University of Technology)

10h50 - **Explanatory practice in Mesopotamian Medicine** - Cristina Barés Gómez (University of Seville)

11h40-12h - Break

12h - **Egalitarian epistemology: Gossip as a shared and abductive explanatory practice** - Tommaso W. Bertolotti (University of Pavia)

13h00-14h30 - Lunch

14h30 - **Beyond blindness: On the role of organism and environment in trial generation** - Lorenzo Baravalle (Universidade Federal do ABC / CFCUL) and Davide Vecchi (CFCUL)

15h20 - **Abductive Hypotheses in Dialogical Games** - Matthieu Fontaine (CFCUL)

16h10 - Discussion

Non-causal Asymmetries in Topological Explanation

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Any good and successful explanation has to be asymmetric, i.e. if A explains B, then B cannot be explaining A. In causal explanations, the explanatory asymmetry simply follows the causal asymmetry, i.e. we generally tend to think that causes explain their effects, and not the other way around. For example, if we say that the changes in the air temperature cause the mercury to expand and thus to climb up the glass column in a barometer, it seems absurd to say that expanding of the mercury causes the changes in air temperature. However, if we assume that non-causal explanations are also asymmetric, whence does their asymmetry come from, if it isn't from some causal asymmetry?

I propose a heuristic for distinguishing explanatory and representational roles of mathematics in a specific kind of non-causal explanation, the topological explanation, that is based on a simple question:

Would any change in the network always change the global pattern of connectivity?

I argue that, if a change in the network doesn't affect a global pattern of connectivity, we are talking only about representational role of mathematics. In this case, there is a casual asymmetry between the system and the particular mathematical values of topological properties. Conversely, a change in the network that changes the global pattern of connectivity in an explanatorily relevant way, will have nothing to do with this sort of causal asymmetry. It has to do with mathematical asymmetries between local and global levels of mathematical dependencies in a graph.

Semantic tableaux for probabilistic propositional logic

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In this work we propose a system of analytic tableaux for probabilistic propositional logic. It is a kind of modal propositional language. Whereas classical modal logic considers two operators, necessity and possibility, probabilistic modal logic considers a single probability operator and an operator for conditional probability. They can also be seen also as a family of modal operators, if we consider four types of probability operators and other four for conditional probability: less than, greater than, less or equal than and greater and equal than a value, which is a number in the interval $[0,1]$. However, it is easy to reduce them to just one case, as we will see. After the introduction of the syntax, we discuss the axiomatic system. Since we are not considering the usual operators, we have to modify the classical axioms and explore its interpretation in terms of probability. The first axiom we can consider is a generalisation of axiom K for probability, which allows us to introduce axiomatically

the concept of conditional probability. The second one, reflexivity axiom T for probability, poses no problem but is essential for a meaningful interpretation of probability in which an event which probability equal to 1 is actually true. A third axiom that considers transitivity is not included in the system, but the question of the possible meaning of composition of probability operators, the probability of a probability, is studied briefly and tentatively. The issue could be the topic for a future work.

Following the usual Kripke semantics, we consider a language and its semantics in which sets of worlds instead of just worlds satisfy the probabilistic and conditional probabilistic propositions, defining the concepts of space of probability of a world, which is not empty since the probability accessibility relationship is defined as reflexive, and space of satisfaction of a proposition for a world. In this case, we can work with rational probabilities in the interval $[0,1]$. The extension to real probabilities leads to a variation of the standard Kripke semantics in which we deal with a continuum of worlds isomorphic to the real numbers. Also, we have to explain the probabilistic modal operators, that correspond to generalised quantifiers over the set of worlds which state the proportion of worlds that satisfy a certain proposition within all accessible worlds from the world that satisfies the propositional proposition.

The central part of the work is dedicated to the tableau system itself, focusing in the study of the rules for the different types of probabilistic expressions. Although we have to deal with a relatively large number of them, the basic scheme of all of them is the same, so in practice the explanation for a very few rules allows us to understand the rest of them. A key difference with classical modal tableaux is that we have to consider two levels, intervals of labels (which correspond to intervals of worlds) and labels themselves (worlds). This introduces a procedure that although effective might be slightly cumbersome for the resolution of tableaux, in future works it would be desirable to simplify the system.

In the last part of the work we show that the semantic tableau for this probability propositional language is sound and complete, following (Fitting and Mendelsohn, 1998). As expected, the only relevant part of the soundness and completeness proofs are those dedicated to the probability operator. We just have to consider the case of the probability greater or equal than a given value, the other cases can be reduced to it.

The Possibility of Unrestricted Quantification

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Context sensitivity occurs in different contexts. For instance, imagine that, before going on a trip, someone says:

- (1) Everything is in my hand luggage.

It is obvious that, in this context, 'everything' refers to a collection of objects that does not contain absolutely everything. There are many things that cannot fit in a hand

luggage and yet (1) can be true. Nevertheless, explaining this obviousness is not easy. As a starting point, we could assume that the content of the sentence is context sensitive. Context seems to contribute to the content of the sentence by somehow identifying a collection of things that includes all and only the objects that are necessary for the trip. When the context somehow draws a distinction between relevant and irrelevant objects, we can say that there is a contextual restriction of the domain of quantification. It is only in very particular contexts that our use of 'everything' does not appear to assume a distinction between relevant and irrelevant objects. For instance, imagine a philosophical discussion where someone says:

(2) Everything obeys the laws of physics.

In this context, determining the truth-value of the sentence does not presuppose a distinction between relevant and irrelevant objects. Actually, it is the opposite that happens. Given that the truth-value of (2) does not suppose a distinction between relevant and irrelevant objects, it would appear that contextual domain restriction does not occur in this context. We could then say that in (2) our quantifiers are completely unrestricted.

The two previous examples seem to illustrate the following facts. Our use of 'everything' in everyday discourse allows us to make claims about all the things that are relevant in a certain context. Our use of 'everything' in certain theoretical contexts allows us to make claims about absolutely everything. Contextualists like Michael Glanzberg have denied this second fact, arguing that we can never talk about absolutely all things.

One of my goals is to dispute this claim. I will argue that in theoretical contexts where a sentence like (2) might be employed, contextual domain restriction does not occur and our quantifiers can be said to be unrestricted. My other goal is to argue that unrestricted quantification allows us to make claims about absolutely everything, without assuming a domain of quantification with absolutely everything.

Abduction after the dynamic turn

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Abduction has been recognized as the most important problem of modern epistemology. One of the most known logical treatment is the so called AKM-model, which to detect when an abductive problem has arisen, considers three parameters namely, knowledge base or background theory, a fact that has to be explained (in terms of the language of the theory) and the inferential parameter, which constitutes a specification of the underlying logic used in the corresponding scientific practice. But after the dynamic turn in logic new approaches should be taken into account, since the logical theory explores more sophisticated modes of argumentation or inference. This is the case of multimodal systems that can allow us to capture more faithfully abductive processes. On the other hand, we shall show how the corresponding system could be applied to design dialogue systems.

From preference between arguments to preference between explanations

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A recent branch of studies within the field of epistemic logic has been the analysis of justifications that an epistemic agent possesses to support one or another belief regarding a specific topic. Nevertheless, there is something that has not received enough attention yet: how epistemic agents might prefer certain justifications to others, in order to have better pieces of evidence to support a particular belief. It seems clear that the manner we prefer one justification to another for our beliefs depends on a variety of factors. In an ongoing work, we have developed a formal analysis of the preference between a particular kind of justifications: *deductive arguments*.

More concretely, let a be an epistemic agent, let ϕ be a proposition and let t, s be a couple of (possibly different) deductive arguments: i) Which of the arguments (t or s) is preferred by a if she pretends to support ϕ ? The motivation for this question and the applications of our answer are diverse and belong to different fields. For example, knowing which argument is better for a given agent would imply knowing which argument will be selected by her in the context of an argumentative dialogue.

According to our approach, the preference between deductive arguments is reducible to other notions. In particular, it can be analysed attending to the following list: the syntactic shape of the arguments, the epistemic attitudes of the agent with respect to the arguments, the sources from which arguments are taken from or construed, and lastly the quantity and complexity of information contained in both arguments. We have built a system that is able to capture this analysis using tools taken from epistemic logic, justification logic and logics for belief dependence; and that allows us to reason systematically about particular problems that may arise in this context. The mentioned system has some natural connections with some earlier works in abstract argumentation frameworks.

If we move our attention from arguments to explanations, we could reformulate question i). There are some structural similarities between arguments and explanations as was frequently stated. An argument, roughly defined, is a pair (Γ, ϕ) where Γ is a set of propositions (*premises*) that try to support a proposition ϕ (*conclusion*). An explanation, roughly defined, is a pair (Γ, ϕ) , where Γ is a set of propositions describing established facts and principles (*explanans*) and ϕ is a proposition describing a fact (*explanandum*) to be understood in terms of Γ . Accepting this analogy, we could then reformulate the question above as follows: given two explanations t, s for the same fact ϕ and given an agent a that is considering them: ii) Which of the explanations (t or s) is preferred by a to explain ϕ ?

A proper answer to question ii) represents a new approach to abductive reasoning understood as explanatory practice. Knowing the logical mechanisms through which the agent considers which explanation is better from her epistemic point of view would allow us to understand why she chooses such an explanation. Of course, some of the criteria that have been taken to solve question i) might be modified or even deleted, and some new other criteria might be introduced in the analysis of ii) to simulate what in the literature on abduction are called *explanatory virtues*. During the talk, we will pursue two goals: explaining our solution to i) and sketching a solution for ii).

Estructuras predicativas y redes semánticas para predicados cognitivos y de percepción en inglés y español

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La contextualización de los actos de habla que constituyen un diálogo es fundamental para el control del flujo de información entre un agente humano y un sistema de diálogo. Esta contextualización requiere una lógica subyacente como apoyo del módulo de comprensión del lenguaje natural (NLU). La lógica que proponemos es una lógica epistémica dinámica de anuncios públicos con abducción, en la que los operadores modales se aplican sobre una estructura predicativa enriquecida semánticamente con papeles temáticos y rasgos semánticos atribuibles a los argumentos que saturan el predicado. La clasificación de las expresiones predicativas, la selección de los papeles temáticos y de los rasgos semánticos básicos que definen el léxico —tanto predicativo como argumental— permiten crear una red semántica de enriquecimiento del significado necesaria para la contextualización de los actos de habla correspondientes y la aplicación de las inferencias lógicas que pueden conducir a la resolución de presuposiciones e implicaturas.

Abduction in a Pragmatic Framework

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This talk presents an enrichment of the Gabbay–Woods schema of Peirce’s 1903 logical form of abduction with illocutionary acts, which draws from logic for pragmatics (Dalla Pozza & Garola 1995; Carrara, Chiffi, De Florio 2017; Chiffi & Schang 2017) and its resources to model justified assertions. It analyses the elements of this enriched schema of abductive reasoning and puts it into the perspective of Peirce’s logic and philosophy.

Peirce once remarked to Royce that “the art of making explanatory hypotheses is the supreme branch of logic” (Charles Peirce to Josiah Royce, 30 June 1913). This assertion conceals an important and the hitherto understudied fact. In *abduction*—a congenial part of logic in the wider sense—this scientific art concerns not only being able to conclude certain conjectures, but also being able to *make* them, that is, for scientists to *become justified in asserting* those hypotheses indeed as plausible scientific conjectures. Peirce presented the broadly logical form of abduction in his 1903 *Harvard Lectures on Pragmatism* (Peirce 1998). The present paper gives an enrichment of what has become the standard elaboration of Peirce’s 1903 form, namely the Gabbay–Woods (2006) ignorance schema, by taking into account this illocutionary dimension of abduction-making. While the G–W schema has presented us what may be to date the best, or at least the most widely acknowledged explication of Peirce’s logical form, we believe that there is room for its improvement precisely in the direction that Peirce hinted at in his letter to Royce. We begin this task by presenting a logic of assertions that can handle the pragmatic senses of logical connectives. We then extend this logic of pragmatics to the logic of hypotheses. At this point, we will be ready to also present the G–W schema of abduction, to explain its main features, and to proceed to our strategies for enriching it with illocutionary forces thus advertised. In the final part of the talk I present the enriched schema, analyzing and discussing all of its elements.

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Explanatory practice in Mesopotamian Medicine

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This is a study of Akkadian medical diagnosis [1, 6, 4, 8, 7, 5] from the perspective of philosophy and argumentation. We face the problem of deciding whether it is a science or a magical practice. In fact, it does not seem possible to talk about a rational medical science because Mesopotamian medical practice is completely “contaminated” by magical practices. So, we could consider that the Mesopotamian medicine is more a magical practice than a rational one. The problem has always been how to recognize

Babylonian epistemology and theory with the biased sources at our disposal ([4] p. 11-12). Nevertheless, does Babylonian medicine is as un-rational as it has been said?

If we focus on the inference, and not in the magical aspect, does the Babylonian medical argumentation really differ from the medical diagnosis that we know nowadays? The point of this study is to analyze the inference itself in Mesopotamian medical diagnosis without taking into account if we are in front of a magical or scientific practice. I will explain the inference at stake in modern medical diagnosis and why I consider that it is an abductive inference [9, 2], at least sometimes. Then, I will put forward different examples of Akkadian medical diagnosis and I will confront them with abductive reasoning for medical diagnosis. By taking into account the inference at stake in Akkadian medical diagnosis, we see how the inference and the reasoning are not so different from the modern one. In fact, it seems that ancient medical texts use the same kind of reasoning than the modern ones. This reasoning (abduction) is ignorance preserving and it is different from induction and deduction. We are not led to a new belief or knowledge, but we work with hypotheses that remain conjectural, even if we use them in a further reasoning. Here, we could go back to my starting point and set the following questions. If we consider modern medical diagnosis is a rational thinking and it is an abductive reasoning, why would we consider that the Ancient medical diagnosis, in which the same kind of inference is used, is an irrational thinking? If we only check the inference at stake, both rely on the same schema. At this point I will use some of the Claude Bernard's analysis [3] to medical diagnosis to show how the Akkadian medical reasoning is a real medical practice. Nevertheless, further analysis would be needed to really clarify the role of the different elements in an abductive schema in Ancient Mesopotamian diagnosis and in modern one. However, it provides the basis for a deeper understanding of medical practice in general and Ancient medical practice in particular.

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Egalitarian epistemology: Gossip as a shared and abductive explanatory practice

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Gossip is the practice of entertaining an evaluative discourse about an absent third party the speakers are both at least acquainted with. Associated with bad-mouthing and lie-mongering, gossip has always been stigmatized, although it is one of the most ancient linguistic practices employed by human beings, and one of the most common (Dunbar, 2003).

The rehabilitation of gossip, at least as a theoretical topic, was triggered in the 1950s by anthropological studies. The positive trend extended to philosophy and psychology.

Ayim (1993) first recognized that the structure of gossip is an abductive one, akin to how Peirce described a research community. Bertolotti and Magnani (2014) further elaborated on this notion, showing how the abductive gossiping interaction amounts to an explanatory update of the individual and the group knowledge-base.

Gossip requires at least two participants and aims at reaching a shared evaluation of a person, an act, or a situation: it can be seen as the sandbox for future negotiations of hypotheses and explanations, including complex ones (where a situation is accepted to be explained by several explanatory strains).

Because of the social dimension of gossip, its diffusion and its antiquity, gossip could be seen as the prime form of “egalitarian” epistemic practices: a shared curation of a certain kind of knowledge, in which the epistemic operations (abductions, refutations, connections etc.) are constantly questioned in terms of testimony (*how do you know?*) and strategic intention (*why do you say so?*) that is always public for the party’s scrutiny.

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Beyond blindness: On the role of organism and environment in trial generation

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In this talk we aim to amend the traditional analogy at the heart of evolutionary epistemologies. We shall first argue, contrary to what has been frequently done, that both hypothesis generation and the processes of generation of genetic and phenotypic change are often directed as well as environmentally conditioned. Secondly, we shall argue that environmental influence does not affect trial generation directly but that environmental information is processed by the epistemic agent and by the biological organism respectively. Thirdly, we suggest conceiving hypothesis generation as a process of manipulative abduction and the generation of biological variation as a process mediated by phenotypic plasticity. Finally, we argue that manipulative abduction and environmentally-induced biological variation modulated by plasticity are analogous because they both involve a conjectural response to environmental cues. Our analysis thus vindicates a revised version of evolutionary epistemology ascribing a fundamental role to both organism and environment in trial generation. This perspective, in our opinion, offers support to the thesis, inspired by the theory of embodied cognition, that hypothesis generation is sometimes explained by an appeal to phenotypic plasticity.

Abductive Hypotheses in Dialogical Games

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Since the well-known schema of Peirce [CP 5.189], a lot of divergent interpretations of abduction have been defended. Recently, Gabbay and Woods [2005] and Woods [2013] have argued that most of them miss some of its fundamental features; overall they neglect its pragmatic dimension and the conjectural aspect of the conclusion. In order to renew with this pragmatic and dynamic dimensions of abductive reasoning, we define the basis for a dialogical understanding of abduction. In particular, we have to identify the conditions of use of abductive conjectures. When and how can they be introduced in the course of an argumentative interaction? How can they be challenged, and defended?

Standard dialogical logic is defined for deductive logics. Dialogues are presented as games between the proponent of a thesis and the opponent who criticizes this thesis. The thesis is claimed to be valid if and only if the proponent is able to defend it against all possible challenges available to the opponent. In this context, we have to define

rules for non-deductive reasoning, in particular abduction. And these rules must reflect three general features, namely *triggering*, *guessing* and *committing*. When abductive conjectures can be introduced in an argumentative dialogue (triggering)? How abductive conjectures are introduced (guessing)? What are we committed to when we introduce abductive conjectures (committing)?

According to the GW-model, abduction is triggered by an ignorance problem that acts as a cognitive irritant. That is, an agent faces a surprising fact, something that cannot be explained by his background knowledge. In such a situation, the agent may (among other possibilities) conjecture a hypothesis that allows him to continue reasoning or acting despite a persisting state of ignorance. The relation of explanation is only subjunctive; that is, the hypothesis is such that if it *were true*, it *would provide* an explanation to the surprising fact. Moreover, abductive conclusions are only conjectural; they cannot be stated as new pieces of knowledge. They are hypotheses, released in further reasoning, but they are not confirmed, and are defeasible. According to the GW-model, abduction is an ignorance-preserving inference in which what is unknown at the level of the premises remains unknown at the level of the conclusion.

As stressed by Barés & Fontaine [2017], abductive hypotheses are not assertions of standard dialogical games. They arise in the context of a concession-problem, and they do not require the same justifications as assertions of standard deductive dialogical games. In other words, they are used in games that go beyond the moves allowed by the rules of standard deductive dialogical logic. Our aim is thus define rules for their use in argumentative interaction and to provide a dialogical understanding of abductive reasoning.

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