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## CONTENTS

Guest Editorial	1
Features	1
News	3
What's Hot in ...	4
Events	6
Courses and Programmes	6
Jobs and Studentships	7

Our interviewee this month is someone who has spent his career moving around across those disciplinary boundaries, trying to bridge the gaps. Greg and I first met in the spiritual home of the Reasoner – the University of Kent – at a conference about a topic of central interest to many readers of the Reasoner: the foundations of statistics. Several years later we shared an office in Munich for a while. It was a pleasure to interview Greg, and to learn about his views on a topic that will, I predict, become more and more relevant to those of us interested in reasoning in the coming years: machine learning.

SEAMUS BRADLEY

Philosophy, University of Tilburg

## FEATURES

### Interview with Gregory Wheeler

SEAMUS BRADLEY: Hi Greg, thanks for agreeing to be interviewed.

GREGORY WHEELER: My pleasure, Seamus. It is always good to talk to you.

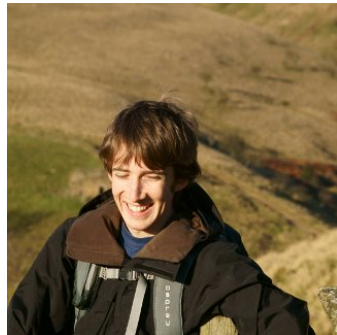
SB: Let's start with a little background. If I remember correctly, you worked in engineering in some capacity before turning to philosophy?

GW: That's right. I worked for I.B.M. and a spin-off called StorageTek as a mechanical vibration test engineer. My job was to simulate earthquakes and military planes landing on remote dirt strips to see whether the hardware we were designing would survive, But I also diagnosed vibration problems that we brought on ourselves. My days were spent breaking expensive prototypes and figuring out why they broke.

SB: And you did your PhD under Henry Kyburg; what was he like?

GW: Kyburg was a lapsed engineer, too. Chemical. And a cattle farmer on the side. He and his wife, Sarah, bought a farm

What makes the Reasoner such an interesting venue is that the topic – “reasoning” – is one that crosses traditional disciplinary boundaries. People interested in reasoning might find themselves in university departments ranging from psychology to economics to statistics to philosophy and beyond. This is, I think, a blessing and a curse. A blessing, because it means that in theory we have at our disposal a very broad range of tools with which to investigate the topic. A curse, because there is a real danger of reasoning researchers in different departments not talking to each other, or talking past one another.



the same time, this is only one part of AI.

Returning to your question about epistemology. Nobody — setting aside the singularity fringe — thinks that these recent advances in machine learning will yield up the judgment and common-sense reasoning that is currently missing from these systems. That said, the variety of problems that can be reduced to a perception problem is staggering, where correct classification is enough to achieve desirable goal. I expect that we will continue to be surprised by the range of problems that will be cracked by these methods. Correct classification is another name for finding the truth or making a reliable judgment. What is surprising is the every-growing domain of problems where truths can be learned and reliable judgments be made without much understanding at all. The link between prediction and explanation, which underpins data models in inferential statistics and Bayesian statistics alike, and pervades epistemology, has been cut. So much for evidentialism.

Now, to be sure, there are good reasons to restore this connection between prediction and explanation: if you are turned down for a loan, it is fair to ask for a reason why. Indeed, the European General Data Protection Regulations (GDPR) that will go into effect next year requires that such an explanation be made available to algorithmic decisions involving EU citizens. But, the point is that the connection between explanation and accurate prediction is strictly unnecessary. We have models that make effective predictions but which are incapable of yielding an explanation.

SB: Do you think advances in machine learning are going to change the debate about philosophy of mind?

GW: The steam-engine. Telephone switching centers. The intuitive statistician. The mainframe computer. All of these technologies were used as metaphors in psychology. So, perhaps it is inevitable that as machine learning techniques spread across society and the sciences, we will see those ideas influence how we understand ourselves or the world around us. I saw a conference paper earlier this year that presented a model and evidence for how neurons in our brains performs back propagation! What was once a knock-down argument against artificial neural networks (ANNs) having anything to do with brain science— ANNs rely on back-propagation; brains don't— is now a subject of inquiry in brain science.

There is some very interesting work by Facebook's AI group in creating object masks for images, all built on a convolutional neural network architecture. This system can pick out occluded or partial objects from a photo and accurately identify them. So, a photo with a ball, the back of a person's head, part of a TV screen, et cetera, can be picked out as individual objects, masked by a border, and correctly labeled. This is a big leap beyond classifying an entire photo as one that includes a ball, a person, a TV, et cetera, which was the state of the art a few years ago. Yet this capability is precisely the sort of achievement that a layman may well see and say, "so what?". A child could take a marker, trace around objects in a photo, and write down a correct label. Because people are so good at this task, it is understandable why we do not realize how difficult it is for a machine to do this. And that this has been done on top of an R-CNN architecture is incredible. This is a small step toward the missing "reasoning" and "representation" that motivates logical approaches to AI, but these capabilities are from a "bottom-up" fashion. From the point of view of analytical philosophy, particularly those branches that remain steeped in logic and language, the details of this algorithm will appear

completely backwards.

Here is one implication for the philosophy of mind, in broad strokes. It is not uncommon for philosophers of mind to view behavior in terms of agency, and to understand agency in terms of language in general, and ideas about languages from the philosophy of language in particular. Let's face it, analytic philosophy is rooted in language. But the advent of systems that begin with effective behavior and work backwards to proto-representations reverse the implications, throwing into doubt chains of reasoning that ascribe agency to robots or passive systems on the basis of purportedly intensional behavior and misguided ideas of what is mentally necessary to realize such behavior. Similar to the break between explanation and prediction, the role of language and representation in effective behavior will call for reevaluation. Here again there are good reasons to tie together language and action. But the presumption there are intimate and necessary links between language and practical action, which is a legacy of 20th century analytic philosophy, is challenged by the performance of these systems, and in any event the last century's obsession with language will not suit philosophy for the current century. The reign of language is over.

## NEWS

### Logic in the Wild, 9–10 November

The workshop *Logic in the Wild* was held on November 9th and 10th in Ghent, Belgium. It was the sixth workshop in the *Logic, Reasoning and Rationality* series supported by the Research Foundation Flanders (FWO) through the scientific research network on *Logical and Methodological Analysis of Scientific Reasoning Processes*. The network brings together research groups from nine European universities carrying out research on relevant topics: Adam Mickiewicz University Poznań, Free University of Brussels, Ghent University, Ruhr-University Bochum, Tilburg University, University College London, University of Antwerp, Utrecht University and VU University Amsterdam. For the duration of the project, from 2015 till 2019, there are two workshops organized per year, one in spring and one in autumn.

The workshop was organized by the Centre for Logic and Philosophy of Science (Ghent University), which coordinates the activities of the network, and the Department of Logic and Cognitive Science (Adam Mickiewicz University, Poznań, Poland). Its title, *Logic in the Wild*, stemmed from Keith Stenning and Michiel van Lambalgen's seminal book *Human Reasoning and Cognitive Science* (MIT Press, 2008) in which the authors both advocate for and exemplify the productivity of the paradigm called a 'practical', or cognitive turn in logical research. The approach draws on enormous achievements of a legion of formal and mathematical logicians, but focuses on the Wild: actual human processes of reasoning and argumentation. Moreover, high standards of inquiry that we owe to formal logicians offer a new quality in research on reasoning and argumentation. In terms of John Corcoran's distinction between logic as formal ontology and logic as formal epistemology, the aim of the practical turn is to make formal epistemology even more epistemically oriented. This is not to say that this 'practically turned' (or cognitively oriented) logic becomes just a part of psychology. This is to say that this logic acquires a new

task of “systematically keeping track of changing representations of information”, as Johan van Benthem puts it, and that it contests the claim that the distinction between descriptive and normative accounts of reasoning is disjoint and exhaustive. From a different than purely psychological perspective logic becomes—again—interested in answering Dewey’s question about the Wild: how do we think? This is the new alluring face of psychologism, or cognitivism, in logic, as opposed to the old one, which Frege and Husserl fought against. And this was the area of research to which this workshop was devoted.

The workshop brought together 23 participants who presented talks on applications of logic to analyses of natural language and everyday reasoning phenomena. The keynotes were delivered by Iris van Rooij (Radboud University), Keith Stenning (University of Edinburgh) and Christian Strasser (Ruhr University Bochum).

In her talk ‘Cognition in the wild: logic and complexity’ Iris van Rooij addressed the issue of computational intractability of models of cognition. Van Rooij’s proposal is that cognitive science should recognize tractability as a fundamental constraint on cognition in the wild. She explained how the tractability constraint can serve as a formal guide in theory development and furthermore illustrated how logic-based approaches may especially benefit from this approach as it may enlarge their recognized scope and relevance for cognitive science.

Keith Stenning started his talk, ‘Memory is the organ of non-monotonic reasoning’ with a question: Nothing is wilder than the human mind? He outlined a program of research which uses Logic Programming (in a particular flavour) as a model of human semantic memory, in the service of nonmonotonic reasoning to an interpretation. He claimed that applying LP to memory will serve as an example of a relation between logic and the mind, and hopefully motivate some researchers of a logical bent to collaborate with the kind of empirical work which needs to go on. Stenning warned that there is a great danger, on both sides of the cognitive/logical fence, of underestimating the density of the problems which live down this crack. The psychologist who denies the relevance of logic’s ‘normative’ systems is as numerous as the logician who thinks that his (usually but not always ‘his’) newly invented logic is straightforwardly a contribution to how human reasoning works.

Christian Strasser’s talk ‘Reasoning by cases (RbC) in the nonmonotonic wilderness’ was concerned with is an inference scheme especially apt for situations in which we deal with incomplete information. He discussed some challenges for defeasible accounts of RbC, highlighted shortcomings of approaches to RbC from the literature on non-monotonic logic, and presented a new account of a defeasible variant of RbC based on formal argumentation.

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## Calls for Papers

**DISAGREEMENT: PERSPECTIVES FROM ARGUMENTATION THEORY AND EPISTEMOLOGY:** special issue of *Topoi*, deadline 31 January.

**DECISION THEORY AND THE FUTURE OF ARTIFICIAL INTELLIGENCE:**

special issue of *Synthese*, deadline 15 February.

**DEFEASIBLE AND AMPLIATIVE REASONING:** special issue of *International Journal of Approximate Reasoning*, deadline 15 February.

**NON-CLASSICAL MODAL AND PREDICATE LOGICS:** special issue of *Logic Journal of the IGPL*, deadline 30 April.

## WHAT’S HOT IN . . .

### Mathematical Philosophy

Reviving the present column is a good resolution for 2018. The plan is that members and friends of the Munich Center for Mathematical Philosophy (MCMP) will take turns to write it.

To kickstart this, I’d like to share some thoughts about one decision-theoretic issue that has been bugging me recently. The issue arises in Savage’s framework. At first, it looks like a terminological puzzle of sorts. But it proves to be more substantial than that.

In Savage’s framework, the options between which the decision-maker chooses are acts, i.e., functions from a set of states to a set of pay-offs (a.k.a. consequences). Assume that the name of the game is the following. You’re supposed to observe the decision-maker’s choices between Savagian acts and, based on that information, to identify her beliefs about the likelihood of the states and her preferences between the payoffs. As is well known, in Savage’s own take on this identification exercise, the decision-maker’s beliefs are quantified by a subjective probability function, her preferences, by a utility function, and her observed choices conform to the rule of maximizing subjective expected utility. As is equally well known, there are many troublesome cases, which Savage’s work was instrumental in identifying, where such a model is not applicable.

One such troublesome case seems to be indifferently referred to as “act-state dependence” or “moral hazard” in most of the literature. The intuition is as follows. In some cases, the decision-maker’s beliefs about the likelihood of the states will, somehow, depend on the Savagian act under consideration—whence “act-state dependence”—and this, in turn, is best understood with reference to the “moral hazard” cases studied in economics—i.e., essentially, cases where the decision-maker’s choices can, somehow, influence the likelihood of the events of interest. Now, here comes the question to which I want to draw your attention: Are “act-state dependence” and “moral hazard” synonyms in decision theory? I’m not denying that there are conditions under which they can be treated as such. I’m asking whether there are not also cases where they cannot.

It turns out that there are, indeed, cases where act-state dependence and moral hazard come apart. Let me start with the simplest of the two stories which I need to tell, namely, that of act-state dependence without moral hazard. In fact, you

