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Editorial

The last time I edited *The Reasoner*, in December 2008, I discussed the field of higher category theory and interviewed Tom Leinster. Much has happened in the intervening three and a half years, so this is a good opportunity for an update and an interview with a leading practitioner, Urs Schreiber. Urs works in the Topology Group in the

Mathematics Department at Utrecht University. He has been instrumental in bringing together fundamental ideas from mathematics, physics and, lately, logic in the form of homotopy type theory, otherwise known as Univalent Foundations. With Hisham Sati, he has co-edited the important volume Mathematical Foundations of Quantum Field and Perturbative String Theory, Proceedings of Symposia in Pure Mathematics, volume 83, AMS (2011). For details of his Habilitation – *Differential cohomology in a cohesive* ∞*-topos* – see here. A huge amount of information on what has been discovered has been written up at the wiki *n*Lab.

One key discovery in recent years has been that rather than, as I outlined in Chapter 10 of *Towards a Philosophy of Real Mathematics* (2003), we ascend the category theoretical ladder—0-categories (sets), 1-categories, 2-categories, …—adding in higher morphisms to represent processes between processes, it is often preferable to jump straight to the $(\infty, 0)$-stage and then proceed $(\infty, 1)$, $(\infty, 2)$, and so on. (See the entry (n, r)-category for what the two numbers mean.) What this amounts to is a way to allow us to consider straightaway a *space* of ways of passing from one object, state, or whatever, to another, rather than a mere *set*, and it isn't hard to imagine that this greater range of expression offers many benefits. One early sign that this approach is important is the proof by Lurie and Hopkins of the Baez-Dolan tangle hypothesis. But this is one small part of an enormous research program, see, e.g., Lurie's work.

As you will discover from the interview, and by wandering about the wiki, a large number of independent developments in mathematics, physics and logic have been found to be related. On the one hand, this presents a daunting prospect for those with an interest to learn about what is happening; on the other, it is a strong indication of the importance of this work. What you learn from spending time with mathematicians and physicists is that a theory has to prove itself over and again before it is accepted. Profound and surprising connections have to be found—the formalism must reveal more hidden within it than has been placed there during its construction process.

As for applications of this work outside of mathematics and physics, perhaps the most promising area is the modelling of concurrent processing by directed homotopy theory in computer science. But what then about its bearing on philosophy, aside from its prospects as a foundational mathematical framework and ensuing use in physics? Generally speaking, philosophers have been rather slow to appreciate what ordinary category theory could offer them. Things are likely to alter when what Urs describes for us now comes to be more generally recognised. Imagine a change to geometry of the scale of Riemann's with a change to logic of the scale of Frege's combining to assist the development of fundamental physics.

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Interview with Urs Schreiber

David Corfield: Urs, thank you for agreeing to this interview. You have made clear in your writings that you believe higher category theory provides us with the best resources to understand modern fundamental physics, what do you mean by this and what was your path to this point of view?

Urs Schreiber: In our age, three centuries after Newton, it is commonplace to acknowledge the proverbial "unreasonable effectiveness of mathematics in the natural sciences". But mostly, people refer thereby just to the fact that *given* the postulated laws of Newton, or, today, given Einstein's and Yang-Mills' theories, it is striking how much their mathematics indeed says about the observed world—the discovery of the Higgs particle a few days back being the latest highlight of this story.

But there is an even deeper "unreasonable effectiveness" at work here: for among all possible theories of physics that one can write down (technically: among all local Lagrangians on jet spaces), those that govern our world—such as Einstein's gravity, the standard model of particle physics based on Yang-Mills theory, as well as various auxiliary Chern-Simons-type theories that these are closely related to—are very special. There seems to be a "theory of theories" which singles them out as the *theories observed in nature*.

When particle physicists are asked to comment on this, they usually highlight "the gauge symmetry principle" as the deep guiding insight of all of fundamental physics since at least the 1950s. This is true, and profound. And yet, it is just the tip of an iceberg. For "the gauge symmetry principle", formulated in modern mathematical language, is nothing but the realization that *groupoids*, hence *categories*, structure physical systems: a gauge transformation in physics is mathematically a morphism in a groupoid. Moreover, this groupoid is equipped with geometric structure, and so its true home is the flavor of category theory now known as *higher topos theory*, the unification of the ancient theory of geometry with one of the highlights of 20th century mathematics: homotopy theory. So what particle phyicists value as the most precious general guiding principle of the fundamental structure of the physical world is at the same time a hallmark of higher category theory.

While this will still sound alien to many researchers, it should not come as a surprise that category theory plays a role in a "theory of physical theories". At the International Congress of Mathematics in 2010, Jacob Lurie—the central figure in turning higher category theory from a long-standing hope into a powerful tool—brought it to the point:

> I don't want you to think all this is theory for the sake of itself. It's theory for the sake of other theory.

There's not much more about all this that can be conveyed without actually introducing some mathematics, but doing so shows a rather marvelous story unfolding. Taken all together, maybe we are seeing the first glimpses of a deeper explanation of the effectiveness of mathematics in the natural sciences. And that explanation is rooted in category theory.

Now, all this of course was not clear to me when I embarked on this journey. I was academically brought up in a pure physics department where few modern insights into the structure of mathematical physics were taught, let alone category theory. But personally I had always wanted to understand the deeper mechanisms at work, and following my nose and learning from many great people eventually helped. What also helped was that the unfortunate schism in mathematicians' awareness between category theory and homotopy theory was bridged a few years back, finally ending a huge delay in intellectual progress of a whole community.

DC: Readers may not have heard of a topos, let alone its higher version, so let's give them an idea. A *topos* is a construction which emerged out of 1960s algebraic geometry, and was formulated in a beautifully small set of axioms by Lawvere and Tierney around 1970. It combines in a powerful way a range of different viewpoints, from the spatial to the logical. On the logic side, the discovery of topological semantics for intuitionistic logic and Kripke frame semantics for modal logic are precursors to the emergence of the topos, and its internal language, higher-order intutionistic logic. Now with higher toposes comes the internal language known as *Univalent Foundations* or *homotopy type theory*. You've likened our situation with regards to it as a 'dot-com bubble'. Could you elaborate on that?

US: One striking aspect of higher topos theory is that it makes deep phenomena conceptually simpler. Often people regard higher topos theory as hideously complicated, as scary. But this is a deception, resulting from conflating simplicity with familiarity and theory with its phenomena. Similar to how people on the street will say that it is simple to understand why apples fall to the ground, but hard to understand what happens in a nuclear power plant. What they really mean is that they are used to apples falling to the ground. In the actual sense of understanding, the theory of gravity is still mysterious (just think of the MOND issue and the cosmological constant problem), while the nuclear forces have been understood to great depth.

Homotopy type theory may be regarded as expressing the essence of the conceptual simplicity of higher topos theory. It says effectively that if only you reason in constructive logic, but doing genuinely so by also regarding identity constructively, then you are reasoning in the internal logic not of an ordinary topos, but of an ∞-topos. To turn this around: homotopy type theory teaches that the concept of ∞-toposes is nothing but the semantics of sheer logic, in its formulation known as dependent type theory with consistent ("univalent") intensional identity.

This insight, originating with Vladimir Voevodsky, gave the two communities involved the delighted surprise of two far-away puzzle pieces unexpectedly fitting together. What I had compared to the dot-com bubble was the ensuing enthusiastic activity, which to a large part consisted in type theorists learning homotopy theory and translating it into their language, and, to a lesser extent, homotopy theorists similarly learning type theory. There was excitement driven by the strong feeling that something big was going to happen; without however this vague hope as yet finding much reflection in the usual currency of mathematical progress: proof of new insights—instead of just re-proof of old insights in new language.

But the dot-com bubble stands out among stock market bubbles as being based on entirely correct hopes, that just took their while to pan out. Today the dreams that drove the bubble back then have long been realized and been way surpassed by reality. Similarly, I think we are beginning to gain genuine new insights into higher topos theory from its unexpected relation with type theory. Mike Shulman has made impressive contributions in this direction, notably in the course of formulating the axioms of cohesion in type theory, which is the fragment of higher topos theory relevant to the relation to physics, that I mentioned at the beginning.

DC: The idea of cohesiveness is originally due to Lawvere, isn't it?

US: It was in March 2010 in Oxford, at the workshop "Categories, Logic and Foundations of Physics VI". I happened to speak about the relation of cohesive ∞-toposes to gauge theory in physics, without however using that term yet. Instead I was focusing on "locally and globally ∞-connectedness" of ∞-toposes, one half of what now are the axioms of cohesive ∞-toposes. It was enjoyable to see how a good bit of Galois theory and of étale homotopy theory, two classical subjects going back to Grothendieck, is naturally subsumed by the axioms of ∞-connected ∞-toposes. But for my purposes I was most interested in the further observation that in a topos of smooth geometry they induced a natural notion of what mathematically are called *connections* or *differential cocycles* and what physically are *gauge fields*.

The night before I had met Richard Williamson, then a PhD student of Raphaël Rouquier in Oxford, over a beer. A few months earlier he had contacted me by email and given me a decisive hint that led to this understanding. Then, the same day, after my talk, by coincidence, Peter Johnstone spoke in the Oxford math colloquium, and he spoke on the occasion of Lawvere's latest article on "axiomatic cohesion", thereby introducing at least my subconsciousness to the existence of that article. I headed home without having read it, only to happen a few days later into a discussion with my Utrecht colleague David Carchedi, who amplified to me what we then understood as an application of locality of ∞-toposes, now the second ingredient of cohesive homotopy type theory. I realized that it is a quadruple of adjoint functors on an ∞-topos that gives it the structure necessary to formulate the physics of gauge theory inside it.

But that sounded vaguely similar to something I seemed to have heard before. That night I went and opened Lawvere's article. And sure enough, that adjoint quadruple is what he proposes in the context of 1-toposes to ensure that the objects in a 1-topos behave like generalized spaces equipped with a notion of *cohesion* among their points.

Later I found that essentially these axioms were formulated—in words—already in his preface "Some thoughts on the future of category theory" to the proceedings of the famous 1990 Como conference—now that I knew how to decipher the prose there with terms like "categories of being and becoming" and read them as formal mathematics.

So at this point I followed Lawvere and started using the word "cohesive" for the ∞-toposes that I had been thinking about. It is however noteworthy that interpreting the axioms for cohesion in an ∞-topos instead of in a topos, hence in homotopy type theory instead of just in type theory, makes a big difference. I would dare to say that their full power is only made visible by ∞-topos theory.

DC: You explain that cohesion allows us to talk about processes undergone in space, in other words, it adds dynamics to the kinematics.

US: This is related to the remarkable fact that cohesion in homotopy type theory induces an intrinsic notion of *paths*, or *trajectories* and of what is called *parallel transport* along such paths. Such parallel transport encodes all forces observed in nature, and for the obvious reason: it encodes how the state of a "charged" object changes as it runs along a trajectory in spacetime. This is dynamics.

It is interesting to see how this comes about from the point of view of "homotopy logic". The heuristic idea of cohesion in topos theory is simply that it describes how nearby "points in space" hang together, and what it even means for them to be nearby. In this respect cohesion is akin to topology, but it is more flexible. In fact topology (of locally sufficiently connected spaces) is an example of a cohesive structure. Another example, with a richer notion of cohesion, is smooth geometry. Lawvere had proposed to axiomatize this, in parts, with the notion of a (locally and globally) connected topos, which is a structure where each object comes with the information of how it decomposes into a set of *connected components*. This allows one to ask whether two points in a space are connected at all. But if one takes the same axiom and interprets it not in an ordinary topos but in an ∞-topos, hence in homotopy type theory, then it knows much more: it becomes a structure which encodes not just *that* but *how* any two points may be connected—namely what the possible paths running between them are—and in turn how these paths are connected to each other by paths-of-paths, and so on. So a (locally and globally) ∞-connected ∞-topos is a structure where each object comes with the information of its fundamental ∞-groupoid of paths.

A special case of this idea is famous as A^1-homotopy theory in algebraic geometry, used for the formulation of motivic cohomology; another one of those grand ideas that go back to Grothendieck and which find their realization these days. The symbol "A^1" refers to the abstract line that serves as the real line in algebraic geometry and to the idea that A^1-shaped paths are to be regarded as geometric connectivity between the points that lie on them. In the context of smooth geometry the abstract line is instead the ordinary smooth real line $\mathbb{R}^1$, and one finds that the local ∞-connectedness of the smooth ∞-topos is precisely its "$\mathbb{R}^1$-homotopy theory" in this sense.

However, it is helpful to abstract away from all these examples and write down just the plain ∞-topos theoretic structure that underlies them. Given these, there are a handful of universal constructions—which is what category theory is all about—that suggest themselves to be performed on them. Working out what this yields, one finds a rich structure of what is called differential cohomology existing in such ∞-connected ∞-toposes. And this is what force fields and hence dynamics are formulated in in modern physics.

DC: Roughly speaking, might we say that you are attempting to write dynamics into the logical foundations?

US: Originally I had never intended to do so, nor had I been even qualified to. What I did attempt all along was to abstract as much as possible the formal structure needed to formulate gauge theory—such as seen in particle physics—and higher gauge theory—such as seen in string theory, which is a proposal for how to solve problems with the current best models of particle physics. It is only in combination with Voevodsky's rather recent insight of homotopy type theory that the ∞-topos theoretic formulation which I considered find themselves living in such close neighbourhood to the very foundations of mathematics.

The following little story might help to illustrate this. In 2011 I was visiting my coauthor and string theorist Hisham Sati at Pittsburgh university. A colloquium talk about aspects of our joint work on differential cohomology in string theory which I gave happened to be attended also by Chris Kapulkin, from the homotopy type theory group of nearby Carnegie-Mellon University. When afterwards he invited me over to speak also at CMU the next day, I was initially reluctant, worried that there would be no common ground to communicate on. Then I decided to use the occasion to publicly pose as a little exercise the question which had been developing in my subconsciousness for a while.

So I went and explained the axioms on a cohesive ∞-topos and briefly indicated how these alone imply so much of the structure seen in differential geometry and differential cohomology. I tried to amplify how remarkable that is by pointing out that if instead you opened any textbook on differential geometry and then any review article on differential cohomology and tried to translate the definitions given there, one by one, into the formal language of type theory, it would be a rather hopelessly intricate task, which, even if successful, would likely result in an entirely unusable structure. By contrast, to formulate the axioms of cohesion in homotopy type theory, it seemed clear by their simplicity and their natural ∞-topos theoretic nature that they would be much more easily and more naturally expressed in homotopy type theory. One or two months later it was Mike Shulman who solved this "exercise". Ever since then we may speak about cohesive homotopy type theory.

Now indeed it does seem that, together with the relation between cohesive ∞-topos theory and physics that I mentioned, this establishes a bridge, not to say a path, that provides a short-cut between the foundations of mathematics and the fundamental structures in gauge physics and string theory in an unexpected way. This suddenly seems to allow us to seriously ask questions as you just did, which alone is already somewhat remarkable—even if I should sleep on it before replying with a definite "Yes".

DC: Let's end on that exciting note. Thank you very much for talking to us, Urs. For more information on what we have been discussing, please see this file. We shall be discussing issues arising in the interview at our blog—The *n*-Category Café —in a post 'Urs Schreiber in The Reasoner'.

Personal taste ascriptions and the Sententiality assumption

I defend the assumption that an expression like "for Anna," as it occurs in a sentence like "Whale meat is tasty for Anna," is a sentential operator, against two related, albeit opposite worries. The first is that in some cases the putative operator might not be selective enough. The second is that in other cases it might on the contrary be too selective. I argue that these worries have no tendency to cast doubt on the assumption of sententiality for the relevant expressions.

Suppose that asked about what kind of exotic food she likes, your friend Anna answers:

(1) Whale meat is tasty

In this context what she is telling you is that whale meat is tasty *for her* (or *according to her taste*). Here, a challenge for the truthconditional semanticist is to account for the contribution that (the relevant notion of) context makes, in such a case, to the truth-conditions of the *implicit* personal taste ascription in (1). Clearly, the contribution it makes must somehow coincide with that of the prepositional phrase (PP) "for Anna", as it occurs in the more *explicit* ascription in (2):

(2) Whale meat is tasty *for Anna*

But what exactly is this contribution? To put it more in a more focused way: Should we think of a PP like "for Anna," as it occurs in a sentence like (2), as a predicate modifier, or instead as a sentential operator which, when affixed to a sentence, operates on it to yield another, more complex sentence?

Max Kölbel (2009: "The Evidence for Relativism", *Synthese* 166, 375–95) considers the second option as he explores a "relativist" semantics on which those PPs are intensional sentential operators that shift the standard of taste parameter (supposedly part) of the circumstance of evaluation:

(S1) For all sentences ϕ and all singular terms α, $\ulcorner$FOR α, $\phi\urcorner$ is a sentence.

(S2) For all ϕ, α, w, s, and a, if ϕ is a sentence and α is a personal name referring to a, w is a possible world, and s is a standard:
$\ulcorner$FOR α, $\phi\urcorner$ is true in a circumstance $\langle w, s\rangle$ iff ϕ is true in $\langle w, s(a)\rangle$ (where $s(a)$ is a's standard of taste). (p. 384)

This "assumption of Sententiality" for the relevant PPs raises an *underselectiveness* issue, which Herman Cappelen and John Hawthorne (2009: *Relativism and Monadic Truth*. Oxford: Oxford University Press) express as follows:

> Suppose something is tasty for Anna, while other things are dignified for Anna. Consider the sentence
>
> (3) [Bob] ate something that was tasty for Anna in a dignified way
>
> If we treat "for Anna" as a sentential operator, it begins to look insufficiently selective. "For Anna, Bob ate something that was tasty in a dignified way" fails to tie "for Anna" to being tasty rather than to being dignified. (pp. 75–6, fn.10)

Cappelen and Hawthorne's point is well taken, if indeed within the scope of the Sententiality assumption about "for Anna," there is no representation of (3) available that might capture its intended reading, one on which Anna may not find it dignified at all to eat like Bob did. But there is.

A natural suggestion is to avail ourselves of a version of an event semantics *à la* Donald Davidson (1967: "The Logical Form of Action Sentences", in *The Logic of Decision and Action*, ed. N. Rescher. Pittsburgh: University of Pittsburgh Press) that allows quantification over events and reference to "ways" that events might occur, so as to make it possible to say of an event *e* and a way *w* that *e* occurred in way *m*. On this suggestion, the appropriate structure for (3) can be made perspicuous by

(4) For some *e*, *m*, and *x*, ⟨ *e* was an eating of *x* by Bob ⟩ and ⟨ *e* occurred in way *m*⟩ and ⟨ *m* was dignified ⟩ and ⟨ for Anna, *x* was tasty ⟩

(4) does tie "for Anna" to being tasty rather than to being dignified, just as expected. As for being dignified, we can see that it is not tied to a "for" affix. On a relativist semantics *à la* Kölbel, this is rather unproblematic if we assume that when evaluating an unprefixed sentence-like construction with a taste predicate but no articulated reference to a particular judge, the standard of taste parameter is set, by default, to the utterer's. For then, an utterance of (3) is true only if Bob's way of eating the food was dignified according to the utterer's standard of taste, not Anna's. Again, this is just as expected. So, the underselectiveness issue raised by Cappelen and Hawthorne is not to worry the proponent of the Sententiality assumption for such expressions as "for Anna".

(Remark. Some might find it too costly to admit both events and ways in their ontology. We could certainly do without bringing events into the picture. An option here would be to let "eat" denote a three-place relation that holds between an agent, some food, and a way iff that agent eats the food in that way, and, as suggested by the surface grammar, to let "dignified" in (3) be about ways. Assuming again that the default standard of taste parameter is the utterer's, an utterance of (3) would then be true if there is a way *m* in which Bob ate some food *x*, Anna finds *x* tasty, and the utterer of (3) finds *m* dignified. This too would match the expected reading. Doing without ways might, by contrast, be difficult.)

Interestingly, a related, yet somewhat opposite issue, to do with *overselectiveness* this time, might also be raised. Consider the sentence

(5) Bob ate something disgusting that was (nonetheless) tasty for Anna

It has a natural reading on which Bob ate something that was disgusting on the speaker's standard of taste, yet was tasty on Anna's standards of taste. But if we treat the PP "for Anna" as a sentential operator, it might begin to look *excessively* selective, this time. Because

(6) For Anna, Bob ate something disgusting that was tasty

would tie "for Anna" both to being disgusting and to being tasty, this would amount to ascribing to a single judge, Anna, contradictory taste judgements about the same thing, and the natural reading on which being disgusting and being tasty are tied to different judges should not be available—or so one might worry.

But the appropriate reading *is* available within the scope of the Sententiality assumption for "for Anna". Simply, the appropriate structure for (5) is not the one associated with (6), but rather one made perspicuous by

(7) Bob ate something x such that x was disgusting and for Anna x is tasty

If again we assume something akin to Kölbel's clause (S2) and let the "default" standard of taste parameter be the utterer's, we get the following truth-conditions for an utterance of (5):

(8) For some d, Bob ate d in $< u_w, s(u_a) >$ and d was disgusting in $< u_w, s(u_a) >$ and d was tasty in $< u_w, s(\text{Anna}) >$

where u_w and u_a are respectively the world and the agent of the context of the utterance u. We thus recover the natural, noncontradictory reading of (5).

So, if we agree that the surface structure of personal taste ascriptions need not reflect their "deeper" structure, neither the underselectiveness concern voiced by Cappelen and Hawthorne, nor the related, albeit opposite overselectiveness concern can be used to put pressure on the assumption that "for" PPs occuring in those ascriptions are sentential operators.

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Why We Should Not Be Surprised By the Knobe Effect

A standard analysis of the intentionality of actions and their consequences is that if someone knows (or at least believes) that doing x will cause y then y has to be intended if x is intended. However, data from Joshua Knobe's famous "chairman" experiments demonstrate that this analysis regarding intentionality is not consistent with the way people actually assess intentionality regarding intending the good, or helpful, consequence (Joshua Knobe 2003, Intentional Action and Side Effects in Ordinary Language, *Analysis*, 63). In his experiments, people believe that the proposed action will cause both x and an additional effect, y, that is either harmful or helpful to the environment. It seems reasonable to think that if someone intentionality brought about the harmful consequence, y, by intentionally doing x in one scenario, then that person would also intentionally have brought about the helpful consequence, y, in the other scenario. However, the results (known as the *Knobe effect*) demonstrates that a significant number of people who took part in the experiments do not accept this idea of intentionality as it relates to helping. They ascribe intentionality only to the person who causes foreseeable harm. How do we account for this asymmetrical relationship that the folk's intuitions turned out to demonstrate?

One plausible explanation can be found in Aristotle's understanding of the roles that habit and intentionality play in our moral lives (see Aristotle, Book Two (particularly section 2.1) of *Nicomachean Ethics*, Translated by Terrence Irwin, Indianapolis, Hackett Press 1985). Aristotle maintains that a virtuous person performs the right action out of habit. The basic idea is that we implement virtues in our lives over time to the point where through repetition and reinforcement we come to "naturally" act as we should—we act unreflectively, therefore we act unintentionally. The more we tell the truth, keep our promises, etc., the less we need to think beforehand about doing these actions, the more they become habitual ways of acting. We no longer need to think (reflect) about telling the truth, keeping our promise, etc.—we simply do these things out of the habit of doing them in the normal course of our repeated interactions with other people. We are not even normally aware that we are doing these things—these actions represent nothing out of the ordinary. We become morally mature beings. On the other hand, when we are confronted with a situation where we knowingly and freely choose to tell a lie, or not keep a promise, etc., we have to think about performing these actions before we perform them. One reason for this is that these actions are morally impermissible because they cause harm. We need to explain to ourselves why we would not act as we normally would. When we critically reflect upon telling a lie, for example, and we decide to tell a lie, we know that we are trying to convince another person that something we know to be false is true. Furthermore, telling the lie is something we desire to do. It is the conscious desire to deceive that differentiates lying from simply giving misinformation. We can misinform another person without lying to them if the desire and the intention to deceive are not present. It is the conscious desire to knowingly and freely deceive that makes the action of telling a lie impermissible and allows us to hold the liar blameworthy for the lie and for any harm that results from telling it. Because virtuous people act out of habit and unreflectively we tend not to praise them for what they are doing. We do not need to reinforce the desired behavior in them because it is already an essential part of their character. They are doing what is expected of any of us—they are doing nothing special and/or out of the ordinary. In practice, we knowingly and freely enter into relationships with others and assume that people are virtuous until we have reason to think otherwise. It is the default position from which we start. It is people who intentionally decide not to act virtuously who we subject to negative sanctioning in terms of blaming them for what they do and the harm they cause. We disassociate ourselves from these types of people if their behavior warrants doing so.

Therefore, we should not be surprised that this asymmetry exists. The fact that people do not ascribe intentionally to the chairman when his actions helps the environment is simply a reflection of what we habitually expect of people—we expect them to be virtuous by not causing harm. This reaction is perfectly normal given the way we perceive virtuous and non-virtuous behavior. It is perfectly normal for us to experience people doing what we expect them to do and not to praise them for doing what we expect them to do. Of course, sometimes we are disappointed in that some people will not do what we expect them to do. This is what occurs when the chairman decision leads to harming the environment. It is part of our understanding of virtuous behavior that this disappointment is the result of someone intentionally deciding to perform an action that is morally impermissible, or at least questionable. Although some people might become habitual non-virtuous moral agents, their reputation usually precedes them, so we are reluctant to enter into trusting relationships with them. Consequently it is normal for us to blame people for causing harm as a result of doing an action that requires forethought (intentionality), such as lying or breaking a promise, or causing harm, while it is normal for us not to praise people for doing what they should do out of habit.

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New book: *Probability and social sciences*, by Daniel Courgeau, Springer, Methodos Series 10, 2012, 308 p.

This work examines in depth the methodological relationships that probability and statistics have maintained with the social sciences. It covers both the history of probabilistic thought from the seventeenth century up to its most recent developments, and the history of statistical methods used in social sciences, particularly population sciences, during the same period.

First, it examines in detail the history of the different paradigms and axioms for probability, from their emergence in the seventeenth century up to the most recent developments of the three major concepts: objective, subjective and logicist probability. It shows the statistical inference they permit: the objectivist approach can only estimate the probability of obtaining the observed sample if the hypothesis underlying this prediction is met; the subjective and logicist approach provide a clearer answer, while using a *prior distribution* and a data set, it allows an estimation of a *posterior distribution*, which predicts a future phenomenon. To ensure this last outcome, the notion of *exchangeable* events, becomes indispensable. Different applications to social sciences are given for each concept. The main problems each approach encounters are finally discussed and we examine if there is some cumulativity in probability.

In the other side, from social sciences—particularly population sciences—to probability, it shows the different uses they made of probabilistic concepts during their history, from the seventeenth century, according to their paradigms: cross-sectional, longitudinal, event-history, hierarchical, contextual and multilevel approaches. While the ties may have seemed loose at times, they have more often been very close: some advances in probability were driven by the search for answers to questions raised by the social sciences; conversely, the latter have made progress thanks to advances in probability. A closer examination of the estimation of age structure in paleodemography shows how the use of Bayesian methods can solve a more general problem: why objective statistics may lead to incorrect solutions? The examination of closer links between population sciences and probability permits to enlighten the concept of *statistical individual*, which informs all paradigms of population sciences, by showing that each paradigm corresponds to a different statistical individual Finally this notion leads us to examine if cumulativity exist in population sciences and to show that, according to Granger:

> [...] scientific knowledge of the human fact cannot be gained except through different planes, but only if one discovers the controllable operation that reproduces the fact stereoscopically from those planes.

We believe that the multiplicity of paradigms effectively corresponds to the multiplicity of angles of vision, and that the relationship we have been able to demonstrate between paradigms enables us to obtain a stereoscopic reproduction of them.

A general conclusion shows first the generality of the use of probability and statistics in social sciences and examines the limits of the application of probability to certain social sciences. It revisits the notion of causality in social sciences and shows the possibility of predicting behaviour. This dual approach sheds new light on the historical development of the social sciences, probability and statistics, and on the enduring relevance of their links. It permits also to solve a number of methodological problems encountered all along their history.

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Applied Science, 2–13 July

From July 2 until July 13, approximately 30 scholars from diverse countries and working within different disciplines (ranging from philosophy to sociology, medicine and history) gathered at the 11th Vienna International Summer University, a joint activity of the Institute Vienna Circle and the University of Vienna, in Vienna, Austria. The summer program, which began in 2001, has already established a well-known reputation in interdisciplinary inquiry, in memory of 'der Wiener Kreis'.

This year's topic related to the concept of 'Applied Science' and its historical, epistemological, and institutional characteristics. The main lecturers Martin Carrier (Bielefeld University), Rose-Mary Sargent (Merrimack College) and Peter Weingart (Bielefeld University) presented competing theoretical frameworks and discussed what applied science (could) entail(s) in our respected disciplines.

Professor Sargent, both historian and philosopher of science, presented the historical background and origins of the notion of applied science. By tracing how Francis Bacon's conception of 'science for the common good' transformed into 'science in the public interest', Sargent took us through the last six centuries in recapturing how the incentive of science as an applied endeavor originated and evolved, tackling topics such as the Royal Society, experimental reform, commercialism and popularization of science, professionalization of science and its rhetoric of pure science, the influence of national politics, and the commodification of science.

Professor Carrier, as a philosopher of science, pondered the epistemological aspects applied science entails, by analyzing values and objectivity in science, pluralistic approaches governed by epistemic attitudes, conceptual structures of research in the context of application, and conditions of scientific expertise. To conclude, he offered a philosophical perspective on the effect that the politicization and commercialization of research has on knowledge production and objectivity as an epistemic ideal.

Professor Weingart, being a sociologist of science, presented us with institutional insights from European (mainly German) programs covering applied science. He addressed topics such as institutional patterns for basic and applied science, discipline organization, the self-referential direction of research, and science funding. Professor Weingart also introduced the concept of national innovation systems and explained how the conditions that produce new knowledge often defy formulaic description because they are exceedingly varied and complex.

The public evening lecture on Tuesday July 10 was given by guest lecturer William Butz, a senior economist and demographer who worked among others at the US National

Science Foundation. Butz's practical experience on innovation policy and programs served as a welcome clarification of what is at stake when the interests of academia, state, and industry meet.

It is remarkable how philosophers, historians and sociologists are able to fundamentally agree in certain respects (such as to the detrimental effects of political biases on fundamental scientific research), but just as equally disagree (such as to what status the notion of 'objectivity' is to have in future science research and its application). Such critical interaction inspired the participants to further challenge their own discipline-related 'dogmas' and to step outside of their comfort zone to question some basic assumptions they often take for granted.

A wide variety of perspectives and topics were discussed during VISU 2012, but they were all grounded on interrogating the classic separation between applied and basic science which, in turn, foregrounded questions about the epistemic nature of science itself. Participants shared various ideas and strategies for making finer distinctions about the complex relationship of industry, academia, and state to better understand how these often agonistic forces shape today's science as they interact. There was a general consensus regarding the importance of fostering pluralistic epistemic views in the practice of science and of recognizing that innovation systems and science itself cannot be grasped in one-dimensional ways.

On behalf of the participants of this summer program we offer our sincere gratitude to the VISU lecturers, academic and local organizing committee for yet another enriching experience.

Laszlo Kosolosky
Centre for Logic and Philosophy of Science, Ghent
Lynn Badia
English and Comparative Literature, University of North Carolina at Chapel Hill
Rodolfo Hernandez
Institute of Science, Technology and Society, Tsinghua University

Agent-Based Modelling and Simulation, 9–12 July

This was a workshop on methods and applications of Agent-Based Modelling (ABM), also known as Individual-Based Modelling, hosted by the Faculty of IT, Monash, and organized by Alan Dorin and Kevin Korb for CRIS. ABM is a computer simulation method by now widely used across the sciences, but perhaps with special intensity in economics, ecology, epidemiology and optimization methods. It constrasts with the more traditional numerical simulation methods of dynamical models using differential equations in that the latter simulate populations as a whole (maintaining mean population states), whereas ABMs simulate populations by way of simulating their individuals. In some sense, they realize the methodological individualist interpretation of social science, for example. The ABM approach allows the implications of heterogeneous populations to be explored, rather than averaged out.

The workshop incorporated a very wide range of ideas and applications. Seventeen speakers presented work on the simulation study of: Ecology (bee foraging, the evolution of flowers, ants and bin packing, ant colony optimization); Evolution (evolutionary Artificial Life, evolution of misperception, evolution of decision making, evolution of extravagent honesty); Architecture & Design (emergency exit design, architecture, industrial management); Epidemiology (mathematical models of infectious disease, ABM models of infectious disease). One of the two keynote speakers, Prof Corey Bradshaw, Director of Ecological Modelling at the University of Adelaide, spoke to the simulation of ecosystem population dynamics. Our second keynote speaker, Prof Seth Bullock (Southampton, UK), gave a public lecture on Simulation and Public Policy. In it, he emphasized that one of the principle advantages of ABMs is that they allow us to look inside to see the *mechanisms* whereby systems develop, rather than forcing us to treat simulations as black boxes, oracles that deliver indecipherable predictions (as with artificial neural nets).

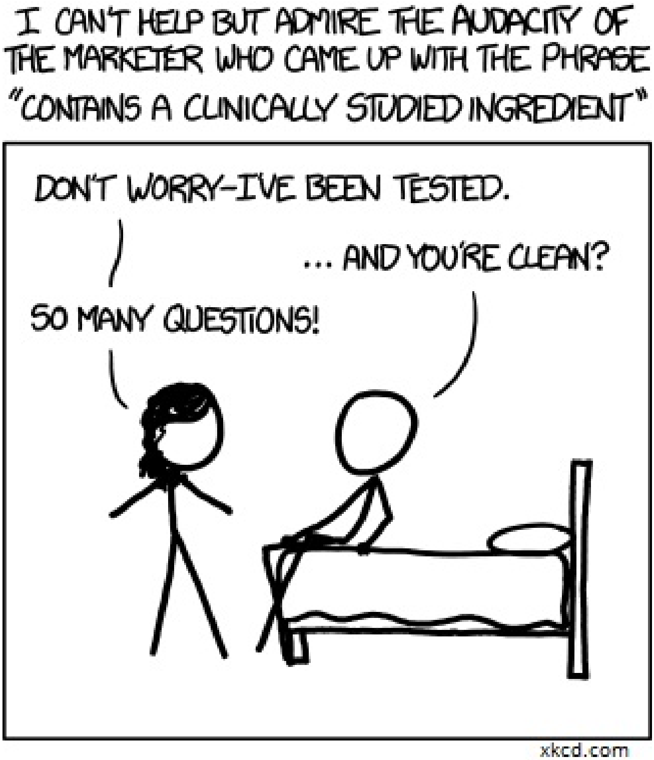
There was some consensus that as ABMs have come of age, it's time to start considering the relation between dynamic population models and ABMs more maturely and systematically. In particular, Dr Bernd Meyer's talk, in which he showed how an analytical model of ant behavior allowed a detailed analysis, under idealized circumstances, of the qualitative behavior demonstrated by a corresponding ABM model, suggested to many that a meta-methodology that allocates different roles to the two simulation approaches is called for.

Kevin B. Korb
Information Technology, Monash

Paradox and Logical Revision, 23–25 July

On July 23–25, 2012 the Munich Center for Mathematical Philosophy (LMU, Munich) hosted a conference on *Paradox and Logical Revision*, organised by Massimiliano Carrara (University of Padua), Ole T. Hjortland (MCMP, LMU, Munich) and Julien Murzi (University of Kent and MCMP, LMU, Munich). The conference was generously supported by the Deutsche Forschungsgemeinschaft (DFG) and the Alexander von Humboldt Foundation. The talks were original and stimulating, and the discussion was very lively. All the talks are available as video podcasts on MCMP's iTunes U channel.

Day 1 started with *Michael Glanzberg* ("Syntax and Logical Revision"), who raised a novel challenge to what he called 'logical conservatism', and argued that classical logicians can meet the challenge. Next up was *Yannis Stephanou* ("Logic and the Liar"). Stephanou argued that, on certain assumptions, semantic paradoxes arise even without a satisfaction or truth predicate in the language, and presented a new paracomplete theory of truth satisfying the law of noncontradiction. *Zach Weber* ("Contraction and Naive Validity") considered whether a failure of structural contraction can be plausibly motivated, and tentatively suggested that it can, on the assumption that the naïve validity predicate is built out of a transfinite hierarchy of non-naïve validity predicates. *Elia Zardini* ("Getting One for Two: on the Contractors' Bad Deal") compared his preferred contraction-free semantic theory to standard paracomplete and paraconsistent ones, and argued that his semantic theory fares better than its rivals on several counts. *Dave Rip-*



ley ("Anything goes") sketched a broadly inferentialist account of meaning and consequence on which the transitivity of consequence isn't obviously justified, and argued that, if transitivity goes, anything goes: our language can consistently contain Prior's connective `tonk`, a naïve truth-predicate etc.

Day 2 began with a talk by *Timothy Williamson* ("Logical Revision and Scientific Methodology"), who argued that logics should be thought of as scientific theories, and that the purpose of logic is to produce highly general generalisations, such as $\forall p \forall q (p \wedge q) \rightarrow p$. Williamson did not exclude that semantic paradoxes could be solved via logical revision, but he argued that logic is more basic than semantics, and that, for this reason, revising the logic as opposed to the naïve semantic principles would be a bad methodological call. *Stephen Read* ("Saving logic from paradox") suggested that the Liar and Curry's Paradox can be blocked without revising the logic, expanding on ideas of Thomas Bradwardine. *Grahram Priest* ("Revising Logic") proposed to distinguish three kinds of logic: *logica docens*, *logica utens*, and *logica ens*. Priest argued that *logica docens* and *logica utens* can be rationally revised, but offered reasons for doubting that *logica ens* can be revised at all. *Giulia Terzian* ("Norms of Truth and Logical Revision") discussed possible conflicts in underlying desiderata of formal theories of truth. She argued that formal theories of truth too often fail to provide a transparent connection between background philosophical assumptions about truth and formal choices. The second day closed with a talk by *Stewart Shapiro* ("Paradox and Revision"). Shapiro first wondered whether logical revision should be understood in a descriptive or in a prescriptive sense, and then argued that this is a false dilemma. He finally suggested that both logical and semantic concepts exhibit what Waisman calls 'open texture', a suggestion that, as Timothy Williamson observed in the Q&A, might already lean towards non-classical logic.

Day 3 started with *Alan Weir* ("Naive Set Theory and Non-Transitive Logic") who outlined a new naive set theory based on a non-transitive logic. Weir motivated his insistence on unrestricted set comprehension, and subsequently provided semantics and proof theory for his new consequence relation. *Mark Jago* ("Revisionary Metaphysics without Logical Revision?") sought to derive a contradiction from Roy Sorensen's account of vagueness—one that is epistemicist, on one hand, but postulates the existence of 'fact gaps', on the other. In the very lively Q&A, all three main assumptions of Jago's argument were challenged on various grounds. In her talk ("Logical Truths and Their Instances"), *Corine Besson* offered a defence of classical logic against some standard objections from existential commitments. Besson argued that classical logicians need not resort to a free logic in order to meet the challenge, and suggested that sentences such as 'Alice = Alice' are not logical truths. In her view, only formal sentences such as 'a = a', of which 'Alice = Alice' is a concrete instance, are logical truths, and, for these reason, such sentences are not existentially committed. *Branden Fitelson* ("Paradoxes of Consistency and (Revising) the Logic of Belief") considered some standard epistemic paradoxes, and argued that they are best interpreted as showing that deductive consistency is not a rational requirement for belief. In the second part of his talk, Fitelson provided a formal framework for grounding formal coherence requirements, and briefly considered how it fares in presence of some self-referential sentences. The conference closed with a talk by *Keith Simmons* ("Paradox and Revenge"). He offered a diagnosis of certain revenge paradoxes, and argued that both paracomplete and paraconsistent attempts at preventing revenge are unsatisfactory—in particular, Simmons sketched a new revenge objection against paraconsistent approaches. Finally, Simmons sketched, motivated and defended his own singularity approach to the semantic paradoxes.

Massimiliano Carrara
Philosophy, University of Padua
Ole T. Hjortland
MCMP, LMU, Munich
Julien Murzi
Philosophy, University of Kent
MCMP, LMU, Munich

Calls for Papers

Agreement and Disagreement: Logical and Rhetorical Perspectives: special issue of *Rivista Italiana di Filosofia del Linguaggio*, deadline 9 September.
The Aim of Belief: special issue of *teorema*, deadline 15 September.
Dummett's Legacy: special issue of *teorema*, deadline 15 October.
Science vs. Society? Social epistemology meets the philosophy of the humanities: special issue of *Foundations of Science*, deadline 31 October.
Evidence and Causality in the Sciences: special issue of *Topoi*, deadline 1 November.
Machine Learning for Science and Society: special issue of *Machine Learning*, deadline 16 November.
Grammatical Inference: special issue of *Machine Learning*, deadline 1 December.

What's Hot in ...

Logic and Rational Interaction

The formal study of rational interaction probably started with von Neumann and Morgenstern and their book about *The Theory of Games*. Since these early beginnings, much has happened in the field of game theory. One of the major milestones on the way was the epistemic turn. That is the insight that the behaviour of players in a multi-agent game does not depend upon the game structure alone. It also depends upon the other players: their beliefs about the game, their beliefs about each others' beliefs about the game and the like. Starting from Harsanyi's seminal papers in 1967/68, epistemic game theory turned into a huge and active research programm. Surprisingly enough, until now there has been no textbook introduction to this vibrant field of research.

This gap has finally been filled by Andres Perea's *Epistemic Game Theory—Reasoning and Choice*, published this June by Cambridge University Press.

His book gives an accessible account of epistemic game theory aiming at a great variety of readers, from undergraduates to researches looking for a concise introduction. The nine chapters of the book each introduce one particular concept, followed by many exercises, examples and solution algorithms. The content progresses from simple first order beliefs (that is: beliefs *about* the game) in a static setting to complex beliefs in dynamic games and their revision throughout time.

LORIWEB is always happy to publish information on topics relevant to the area of Logic and Rational Interaction—including announcements about new publications and recent or upcoming events. Please submit such news items to Rasmus Rendsvig, our web manager or to the loriweb address.

Dominik Klein
TiLPS, Tilburg University

Uncertain Reasoning

According to Wikipedia,

> 42 (forty-two) is the natural number immediately following 41 and directly preceding 43. The number has received considerable attention in popular culture as a result of its central appearance in The Hitchhiker's Guide to the Galaxy as the "Answer to the Ultimate Question of Life, the Universe, and Everything".

Evidently, the secret of this planetary success has all to do with the disproportionate amount of information which we feel is being lost by summarising the answer to such a grandiose question in a (two-digit) number.

Supporters of non-additive measures of belief argue along rather similar lines against the probabilistic representation of uncertainty. Dempster-Shafer belief functions, and the rich class of related measures, such as Choquet capacities, are often motivated in reaction to the excessive loss of information caused by the additivity of standard, single-valued, probability. One frequently invoked example is the so-called "probabilistic excluded middle". Suppose θ is an event about which the agent knows nothing. If rational degrees of belief $Bel(\cdot)$ are to be additive, as demanded by the standard Bayesian framework, $Bel(\theta \vee \neg\theta)$ should equal 1. Critics of additivity, clearly building on the constructive criticisms to classical logic, argue that this is utterly undesirable, for it fails to reflect the state of (total, in this case) *ignorance* about θ under which the agent is quantifying their uncertainty. To the critic $Bel(\theta \vee \neg\theta) = 1$ for such a θ sounds as unjustified as Deep Thought's "42".

One rather solid counter-argument consists in noting that additivity is a direct consequence of the interpretation of probabilities as betting quotients, a central feature of the Bayesian framework. In de Finetti's version of it, $Bel(\theta)$ is the price a rational agent is willing to pay in return for a monetary unit if θ occurs and nothing otherwise. Under a set of modelling conditions defining de Finetti's betting problem, prices are linear and hence, probabilities must be additive, or else the agent will be open to sure loss—a clearly irrational behaviour. Hence, *in de Finetti's betting problem* there is no space for non-additive degrees of belief.

This betting interpretation links transparently the irrationality of incurring into sure loss to the necessary and sufficient properties that degrees of belief must satisfy to avoid that. Hence, this interpretation has been often invoked to support a claim of foundational superiority of belief-as-probability over its non-probabilistic alternatives. This claim is challenged by G. Shafer (2011: "A betting interpretation for probabilities and Dempster-Shafer degrees of belief", *International Journal of Approximate Reasoning* 52: 127–136). The goal of Shafer's paper is to show that, under what he calls the *Ville interpretation of probability*, a betting framework can be put forward supporting both additive and non-additive measures of rational belief. Since de Finetti's betting interpretation fails to support non-additive measures, the Ville interpretation is argued to provide more robust foundations to the quantification of rational degrees of belief.

The intuition behind the Ville interpretation is that $Bel(\theta)$ corresponds to a price for which there exists no strategy that, by exploiting $Bel(\theta)$, will multiply the risked capital by a large factor. According to Shafer

> The Ville interpretation derives from an older interpretation, neglected in the English-language literature, which I call the *Cournot interpretation* af-

> ter Antoine-Augustine Cournot [. . .]. According to the Cournot interpretation, the meaning of a probabilistic theory lies in the predictions that it makes with high probability. (p. 127)

There is a rather obvious difficulty with the Cournot interpretation: events with very low probability do happen, in which case we must decide between two options. Either to accept that something truly random happened or to reject the "probabilistic theory" as wrong. Shafer only considers this latter option and points out that two conditions must be satisfied for it to make sense: the event which leads to the rejection of our theory must be sufficiently "salient" and it should be given "sufficiently small" probability. There is obviously much freedom in pinning down the precise meaning of those conditions. Yet Shafer argues, in the first half of the paper, that under the Ville interpretation, this is not a cause for serious concern. After laying down the basics of the Cournot-Ville interpretation, Shafer outlines its applicability in probabilistic forecasting problems and in market forecasting problems "where the price for a security at the beginning of the day can be thought of as the price for a ticket that pays what the security is worth at the end of the day" (p. 130).

The second half of the paper is devoted to sketching how the Ville interpretation—unlike de Finetti's—supports both additive and non-additive degrees of belief. As to the former, Shafer argues that the Ville interpretation is closer in spirit to De Moivre's original argument for "conditionalisation" than de Finetti's. As to the Dempster-Shafer calculus, the argument pivots on giving a Ville interpretation to the probabilistic component of the belief function (not to the belief function directly).

This paper builds on four decades of Shafer's own work on belief functions and belongs to a wider research project aimed at combining the foundations of probability and statistics with their applications to finance. The project's web-page gives open access to a large number of working papers, mostly by Glenn Shafer and Vladimir Vovk, on giving game-theoretic, as opposed to measure-theoretic, foundations to probability. It also includes a rich list of references to the history of probability and statistics.

Hykel Hosni
Scuola Normale Superiore, Pisa
CPNSS, LSE

Events

September

CSL: 21st EACSL Annual Conference on Computer Science Logic, Fontainebleau, France, 3–6 September.
BPPA: British Postgraduate Philosophy Association Annual Conference, Edinburgh, 3–6 September.
WoLLIC: Workshop on Logic, Language, Information and Computation, Argentina, 3–6 September.
ABS: Applied Bayesian Statistics School, Italy, 3–7 September.
ICLP: 28th International Conference on Logic Programming, Budapest, 4–8 September.

iKNOW12: 12th International Conference on Knowledge Management and Knowledge Technologies, Graz, Austria, 5–7 September.

ECitS
Evidence and Causality in the Sciences, University of Kent, 5–7 September

GAMES: Games for Design and Verification, Napoli, Italy, 7–12 September.
Intuitions, Experiments and Philosophy: University of Nottingham, 8–9 September.
Logic and Relativity: 1st International Conference on Logic and Relativity, Budapest, 8–12 September.
WEO-DIA: 1st Workshop on Well-founded Everyday Ontologies–Design, Implementations & Applications, Wroclaw, Poland, 9 September.
COMMA 2012: 4th International Conference on Computational Models of Argument, Vienna, Austria, 10–12 September.
OEC: Operationalizing Epistemic Concepts Workshop, Aachen, Germany, 10-13 September.
ITA13: 5th International Conference on Internet & Applications, Glyndwr University, Wrexham, North Wales, UK, 10–13 September.
LATD: Logic, Algebra and Truth Degrees, Japan, 10–14 September.
WPMSIIP: 5th Workshop on Principles and Methods of Statistical Inference with Interval Probability, Munich, Germany, 10–15 September.
Datalog 2.0: 2nd Workshop on the Resurgence of Datalog in Academia and Industry, Vienna, Austria, 11–14 September.
Inductive Logic: University of Kent, 12–13 September.
L&R: Workshop on Lattices and Relations, ILLC, University of Amsterdam, 12–14 September.
WUPES: Workshop on Uncertainty Processing, Czech Rep., 12–15 September.
ENFA: 5th Meeting of the Portuguese Society for Analytic Philosophy, University of Minho, Braga, 13–15 September.
SOPhiA: Salzburg Conference for Young Analytic Philosophy, University of Salzburg, Austria, 13–15 September.
Colloquium Logicum: Paderborn, Germany, 13–15 September.
SIFA: 10th National Conference of the Italian Society for Analytic Philosophy, Alghero, 13–15 September.
SUM: 6th International Conference on Scalable Uncertainty Management, Marburg, Germany, 17–19 September.
ILP: 22nd International Conference on Inductive Logic Programming, Dubrovnik, 17–19 September.
GAP8: 8th Conference of the Society for Analytic Philosophy, Konstanz, Germany, 17–20 September.
Logical Form: University of Cambridge, 18–19 September.
SemDial: 16th Workshop on the Semantics and Pragmatics of Dialogue, Université Paris-Diderot, 19–21 September.
PGM: 6th European Workshop on Probabilistic Graphical Models, Granada, Spain, 19–21 September.

Formal Methods in Argument Reconstruction: Konstanz, Germany, 20–21 September.
CaLintSS: Causation and Laws in the Special Science—Metaphysical Foundations, Konstanz, 21–22 September.
Philosophical Issues in Belief Revision, Conditional Logic and Possible World Semantics: Konstanz, Germany, 21–22 September.
ENPOSS: 1st European Network for the Philosophy of the Social Sciences Conference, University of Copenhagen, 21–23 September.
MLSP: IEEE Workshop on Machine Learning for Signal Processing, special session on Causal Discovery, Spain, 23–26 September.
Judgement and Justification: University of Tampere, Finland, 24–26 September.
Structure and Uncertainty: Workshop on Modelling, Inference and Computation in Complex Stochastic Systems, Bristol, 24–27 September.
ECML-PKDD: European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases, Bristol, UK, 24–28 September.
JELIA: 12th European Conference on Logics in Artificial Intelligence, Toulouse, 26–28 September.
Consciousness and Volition: 1st International Krakow Conference in Cognitive Science, Krakow, Poland, 27–29 September.
LNK: 5th Conference on Non-Classical Logic. Theory and Applications, Poland, 27–29 September.
MEW6: 6th annual Midwest Epistemology Workshop, Indiana University, Bloomington, 28–29 September.
LSFA: 7th Workshop on Logical and Semantic Frameworks with Applications, Rio de Janeiro, 29–30 September.

October

Departing from Sainsbury: University of Barcelona, 1–2 October.
SMPS: 6th International Conference on Soft Methods in Probability and Statistics, Konstanz, 4–6 October.
FPMW: 4th French PhilMath Workshop, Collège de France, Paris, 4–6 October.
Philosophy of Scientific Experimentation: University of Colorado, Boulder, 5–6 October.
The Evolution of Argumentation: University of Windsor, Canada, 5–6 October.
TiC2: Turing in Context II: Historical and Contemporary Research in Logic, Computing Machinery and AI, Brussels, 10–12 October.
Formal Ethics: Munich, 11–13 October.
CoMiC: Graduate Conference in Philosophy of Mind and Cognitive Science, Edinburgh, 12–13 October.
The Roles Of Experience in A Priori Knowledge: University of Cologne, Germany, 13–14 October.
PhiloSTEM: Midwest Workshop in Philosophy of Science, Technology, Engineering, and Mathematics, Indiana University-Purdue University, Fort Wayne, IN, 19–20 October.

Numbers & Truth: The Philosophy and Mathematics of Arithmetic and Truth, University of Gothenburg, Sweden, 19–21 October.
ATAI: Advanced Topics in Artificial Intelligence, Bali, Indonesia, 22–23 October.
ECREA: 4th European Communication Conference, Istanbul, Turkey, 24–27 October.
IDA: 11th International Symposium on Intelligent Data Analysis, Helsinki, Finland, 25–27 October.
ISELL: International Symposium Of Epistemology, Logic And Language, Lisbon, Portugal, 29–30 October.

November

MAgg: AAAI Fall Symposium on Machine Aggregation of Human Judgment, Arlington, VA, USA, 2–4 November.
ACML: 4th Asian Conference on Machine Learning, Singapore, 4–6 November.
BotB: Bayes on the Beach, Queensland, Australia, 6–8 November.
Cultures of Mathematics and Logic: Guangzhou, China, 9–12 November.
URSW: Uncertainty Reasoning for the Semantic Web, Boston, USA, 11–12 November.
Arché/CSMN: Graduate Conference, University of Oslo, Norway, 17–18 November.
SILFS: Italian Society of Logic and Philosophy of Science Conference, University of Milan-Bicocca, 20–21 November.
Modal Logic in the Middle Ages: University of St Andrews, 22–23 November.
CogSc: ILCLI International Workshop on Cognitive Science, Donostia, San Sebastian, 28–30 November.
René Descartes Lectures: Tilburg Center for Logic and Philosophy of Science, 28–30 November.
ABNMS: 4th Annual Conference of the Australasian Bayesian Network Modelling Society, University of Wollongong, 28–30 November.
Intentions: Philosophical and Empirical Issues, Rome, Italy, 29–30 November.
LEMMing: Graduate Conference, Cologne, Germany, 29 November–1 December.
Weighing Reasons: Princeton University, 30 November–1 December.

December

LENLS 9: Logic and Engineering of Natural Language Semantics, Miyazaki, Japan, 1–3 December.
NIPS: Neural Information Processing Systems Conference and Workshops, Nevada, USA, 3–8 December.
MM2012: Models and Mechanisms, TiLPS, Tilburg, Netherlands, 6–7 December.
K-NMTD: Konstanz-Naples Model Theory Days, University of Konstanz, Germany, 6–8 December.
AGI12: 5th Artificial General Intelligence Conference, University of Oxford, 8–11 December.
AGI-Impacts: 1st Conference on Impacts and Risks of Artificial General Intelligence, University of Oxford, 10–11 December.

ICMLA: 11th International Conference on Machine Learning and Applications, Florida, USA, 12–15 December.
EGaCRiS: Conference on Epistemic Groups and Collaborative Research in Science, Nancy, France, 17–19 December.
International Triennial Calcutta Symposium on Probability and Statistics: Kolkata, West Bengal, India, 27–30 December.

Courses and Programmes

Courses

TISS: Tübingen International Summer School—How do we make decisions?, 24–27 September.

Programmes

APhil: MA/PhD in Analytic Philosophy, University of Barcelona.
Doctoral Programme in Philosophy: Language, Mind and Practice, Department of Philosophy, University of Zurich, Switzerland.
HPSM: MA in the History and Philosophy of Science and Medicine, Durham University.
Master Programme: in Statistics, University College Dublin.
LoPhiSC: Master in Logic, Philosophy of Science & Epistemology, Pantheon-Sorbonne University (Paris 1) and Paris-Sorbonne University (Paris 4).
Master Programme: in Artificial Intelligence, Radboud University Nijmegen, the Netherlands.
Master Programme: Philosophy and Economics, Institute of Philosophy, University of Bayreuth.
Master Programme: Philosophy of Science, Technology and Society, Enschede, the Netherlands.
MA in Cognitive Science: School of Politics, International Studies and Philosophy, Queen's University Belfast.
MA in Logic and the Philosophy of Mathematics: Department of Philosophy, University of Bristol.
MA in Logic and Philosophy of Science: Faculty of Philosophy, Philosophy of Science and Study of Religion, LMU Munich.
MA in Logic and Theory of Science: Department of Logic of the Eotvos Lorand University, Budapest, Hungary.
MA in Metaphysics, Language, and Mind: Department of Philosophy, University of Liverpool.
MA in Mind, Brain and Learning: Westminster Institute of Education, Oxford Brookes University.
MA in Philosophy: by research, Tilburg University.

MA in Philosophy of Biological and Cognitive Sciences: Department of Philosophy, University of Bristol.

MA in Rhetoric: School of Journalism, Media and Communication, University of Central Lancashire.

MA programmes: in Philosophy of Language and Linguistics, and Philosophy of Mind and Psychology, University of Birmingham.

MRes in Cognitive Science and Humanities: Language, Communication and Organization: Institute for Logic, Cognition, Language, and Information, University of the Basque Country, Donostia, San Sebastian.

MRes in Methods and Practices of Philosophical Research: Northern Institute of Philosophy, University of Aberdeen.

MSc in Applied Statistics: Department of Economics, Mathematics and Statistics, Birkbeck, University of London.

MSc in Applied Statistics and Datamining: School of Mathematics and Statistics, University of St Andrews.

MSc in Artificial Intelligence: Faculty of Engineering, University of Leeds.

MSc in Cognitive & Decision Sciences: Psychology, University College London.

MSc in Cognitive Science: University of Osnabrück, Germany.

MSc in Cognitive Psychology/Neuropsychology: School of Psychology, University of Kent.

MSc in Logic: Institute for Logic, Language and Computation, University of Amsterdam.

MSc in Mathematical Logic and the Theory of Computation: Mathematics, University of Manchester.

MSc in Mind, Language & Embodied Cognition: School of Philosophy, Psychology and Language Sciences, University of Edinburgh.

MSc in Philosophy of Science, Technology and Society: University of Twente, The Netherlands.

MRes in Cognitive Science and Humanities: Language, Communication and Organization: Institute for Logic, Cognition, Language, and Information, University of the Basque Country (Donostia San Sebastian).

Open Mind: International School of Advanced Studies in Cognitive Sciences, University of Bucharest.

PhD School: in Statistics, Padua University.

Jobs and Studentships

Jobs

Associate Professor or Professor: in Logic and the Philosophy of Science, University of Calgary, until filled.
Post-doc Position: in Probabilistic Reasoning, Vienna University of Technology, Austria, until filled.
Post-doc Position: in cognitive psychology and/or computational modelling at the Center of Experimental Psychology and Cognitive Science, Justus Liebig University Giessen, until filled.
Post-doc Position: in Graphical Models / Structural Learning, Uncertainty Reasoning Laboratory, Queens College / City University of New York, until filled.
Post-doc Position: in Artificial Intelligence / Biomedical Informatics, Stevens Institute of Technology, until filled.
Associate Professor: in Theoretical Philosophy, University of Oslo, deadline 1 September.
Research Associate: in Statistics on the project "Novel simulation-based statistical inference with applications to epidemic models," Lancaster University, deadline 4 September.
Research Programmer: on project "Logics for Autonomous Systems," Department of Computer Science, University of Oxford, deadline 7 September.
Post-doc Position: in Computational Social Choice, ILLC, University of Amsterdam, deadline 17 September.

Studentships

PhD Positions: in the Statistics & Probability group, Durham University, until filled.
PhD Position: in Logic and Theoretical Philosophy at the Institute for Logic, Language and Computation at the University of Amsterdam, until filled.
Four PhD Positions: in "Foundations of the Life Sciences and their Ethical Consequences," European School of Molecular Medicine, University of Milan, deadline 3 September.
PhD Position: on the project "Knowledge Representation and Inference Based on Type-2 Fuzzy Sets and Systems," School of Computer Science, University of Nottingham, deadline 30 December.