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2010 WINTER MEETING OF THE ASSOCIATION FOR SYMBOLIC LOGIC

The Palmer House Hilton Hotel, Chicago, Illinois
February 18–20, 2010

A meeting of the Association of Symbolic Logic was held February 18–20, 2010, at The Palmer House Hilton Hotel, in conjunction with the annual meeting of the Central Division of the American Philosophical Association. The Program Committee consisted of Philip Ehrlich, James Joyce, and Stewart Shapiro (chair). The ASL hosted a reception on the evening of February 18th.

The program consisted of three symposia:

Symposium on Continuity and Infinitesimals

Kenneth Easwaran (University of Southern California), *Regularity and infinitesimal credences*.

Philip Ehrlich (Ohio University), *The absolute arithmetic continuum and the unification of all numbers great and small*.

David Ross (University of Hawaii), *Nonstandard probability*.

Symposium on Causality

Christopher Hitchcock (California Institute of Technology), *Causation and defaults*.

Peter Spirtes (Carnegie Mellon University), *Causation and search*.

Peter Spirtes (Carnegie Mellon University), *Informal presentation of Judea Pearl's work on causation*.

Symposium on Pluralism

Roy T. Cook (University of Minnesota), *The problem(s) with pluralism*.

Jean-Pierre Marquis (University of Montreal), *Logic and invariance*.

The program also included one session of contributed papers in which three talks were presented.

Abstracts of the invited talks and contributed talks given (in person or by title) by members of the Association for Symbolic Logic follow.

For the Program Committee
STEWART SHAPIRO

Abstracts of invited papers

► ROY T. COOK, *The problem(s) with pluralism*.
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Logical pluralism is the view that there is more than one 'correct', 'best', or 'legitimate' logic. Some of the most interesting variants of this thesis argue for more than one 'legitimate' formal logic, yet retain the intuition that there is a single natural language consequence relation (e.g., [1] and [2]).

Any pluralism of this sort must deal with the apparent incoherence of straightforward formulations of the view. A formal logic is 'correct' (or 'legitimate') if and only if it satisfies the following correctness principle (where I is any appropriate recursive mapping from the formal language into natural language):

$$\text{CP: L validates } \Delta \Rightarrow \Phi \text{ iff } \mathrm{I}(\Phi) \text{ is a logical consequence of } \mathrm{I}(\Delta).$$

Given two 'legitimate' logics which disagree on some inference $\Delta \Rightarrow \Phi$, we can (classically) conclude that $\mathrm{I}(\Phi)$ both is, and is not, a logical consequence of $\mathrm{I}(\Delta)$—an obvious contradiction.

There are two strategies one might pursue here: Reformulate the statement of CP, or weaken the logic used in the metatheory. It turns out that the most promising approach is to do both. Since any logic one accepts as 'legitimate' ought to be legitimately applicable to the metatheory, however, we obtain the following surprising consequence: If one accepts a logic as (or nearly as) strong as classical logic as 'correct', then one must be a monist, since pluralism is only coherent if all of the 'legitimate' logics are relatively weak.

[1] R. Cook, *Intuitionism reconsidered*, ***The Oxford handbook of philosophy of mathematics and logic***, (S. Shapiro, editor), Oxford University Press, Oxford, 2005, pp. 387–411.

[2] H. Field, *Pluralism in Logic*, ***The Review of Symbolic Logic***, vol. 2 (2009), no. 2, pp. 242–259.

► KENNETH EASWARAN, *Regularity and infinitesimal credences*.
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One important application of probability theory is in representing the credences, or degrees of belief, of a rational agent. In this context, many authors (notably David Lewis and Brian Skyrms, among others) have argued that probability functions should be allowed to take infinitesimal values as developed by Abraham Robinson, as well as real values. This argument is based on a principle known as "regularity", which states that a rational agent should have non-zero credence in any proposition that is epistemically possible for her.

I will show that all standard arguments for regularity are flawed, so that there is no reason why a rational agent shouldn't have credence 0 in some epistemically possible propositions. Additionally, I will argue that Robinson-style infinitesimals can't be the credences of any physical agents in any ordinary proposition. Thus, if regularity is to be saved (despite the lack of any good argument for it), we must appeal to some formulation of infinitesimals other than the Robinson style.

► PHILIP EHRLICH, *The absolute arithmetic continuum and the unification of all numbers great and small*.
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In his monograph *On Numbers and Games* [1], J. H. Conway introduced a real-closed field containing the reals and the ordinals as well as a great many less familiar numbers including ω, $\omega/2$, $1/\omega$, $\sqrt{\omega}$ and ω-π to name only a few. Indeed, this particular real-closed field, which Conway calls *No*, is so remarkably inclusive that, subject to the proviso that numbers—construed here as members of ordered "number" fields—be individually definable in terms of sets of NBG, it may be said to contain "All Numbers Great and Small." In this respect, *No* bears much the same relation to ordered fields that the system of real numbers bears to Archimedean ordered fields.

In a number of earlier works (cf. [2], [3], [4] and [5]), we suggested that whereas the real number system should be regarded as constituting an arithmetic continuum modulo the Archimedean axiom, the system of surreal numbers may be regarded as a sort of absolute arithmetic continuum modulo NBG. In this paper, we will outline some of the properties of the system of surreal numbers we believe lend credence to this mathematico-philosophical thesis, and draw attention to important respects in which the theory of surreal numbers may be regarded as a vast generalization of portions of Cantor's theory of ordinals, a generalization that also provides a setting for Abraham Robinson's infinitesimal approach to analysis as well as for the non-Cantorian theories of the infinite (and infinitesimal) pioneered by Giuseppe Veronese, Tullio Levi-Civita, David Hilbert and Hans Hahn in connection with their work on non-Archimedean ordered algebraic and geometric systems and by Paul du Bois-Reymond, Otto Stolz, Felix Hausdorff and G. H. Hardy in connection with their work on the rate of growth of real functions, theories that have been enjoying a resurgence of interest by logicians in recent decades.

[1] J. H. Conway, ***On numbers and games***, Academic Press, 1976.

[2] P. Ehrlich, *Universally extending arithmetic continua*, ***Le Labyrinthe du Continu, Colloque de Cerisy***, (H. Sinaceur and J. M. Salanskis, editors), Springer-Verlag France, Paris, 1992, pp. 168–178.

[3] ———, *Continuity*, ***Encyclopedia of philosophy***, second edition, (D. M. Borchart, editor in chief), Macmillan Reference, USA, 2005, vol 2, pp. 489–518.

[4] ———, *The absolute arithmetic continuum*, ***Synthese***, (forthcoming).

[5] ———, *The absolute arithmetic continuum and its Peircean counterpart*, ***New essays on Peirce's mathematical philosophy***, (M. Moore, editor), Open Court Press (forthcoming).

► CHRISTOPHER HITCHCOCK, *Causation and defaults*.
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A variety of evidence suggests that judgments of *actual causation* are affected by assumptions about defaults. Halpern and Pearl [1] and others have developed structural model accounts of actual causation in which one event (the value of a variable) is an actual cause of another (in a model) if the latter counterfactually depends upon the former in some modification of that model. These accounts are subject to counterexamples in which isomorphic causal structures with different defaults yield different causal judgments [2]. Evidence from experimental philosophy shows that considerations of normality affect causal judgments even in very simple cases (e.g., Hitchcock and Knobe [3]). This talk, based on collaborative work with Joseph Halpern, describes a proposal for incorporating defaults into a structural model account of actual causation. Assumptions about defaults generate a partial normality ordering over possible worlds (assignments of values to the variables in the model). Potential causes for some event are ranked, based on the most normal world in which the effect depends counterfactually on the cause. The model predicts that our causal judgments are comparative: we are more inclined to judge that one event is the actual cause of another when it outranks its competitors. This account not only handles the original problems that motivated it, but explains a number of other features of causal judgment.

[1] J. Halpern and J. Pearl, *Causes and explanations: A structural-model approach. Part I: Causes*, ***British Journal for the Philosophy of Science***, vol. 56 (2005), pp. 843–887.

[2] C. Hitchcock, *Prevention, preemption, and the principle of sufficient reason*, ***Philosophical Review***, vol. 116 (2007), pp. 495–532.

[3] C. Hitchcock and J. Knobe, *Cause and Norm*, ***Journal of Philosophy***, vol. 11 (2009), pp. 587–612.

► JEAN-PIERRE MARQUIS, *Logic and invariance*.
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When looked at from the right angle, category theory and logic can be seen to be two faces of the same coin. We will consider the question of logical pluralism from this perspective and try to extract what categorical logic has to teach us about this issue. This inevitably brings us to the various types of invariance that arise in a categorical setting, in particular what characterizes a logic and how logical systems are related to one another.

► DAVID A. ROSS, *Nonstandard probability*.
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Nonstandard analysis makes it possible to assign positive infinitesimal probabilities to events in a mathematically sensible way. One might expect this ability to be of primary importance in the practice of applying nonstandard methods in probability theory. This talk will survey several applications which suggest that transfer and saturation are more central to nonstandard probability, even at a foundational level.

► PETER SPIRTES, *Causation and search*.
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I will give a history and overview of recent developments in automated methods for searching for causal models from experimental and non-experimental data, and a description of some open questions and controversies related to automated search methods.

Abstracts of contributed papers

► JOHN G. MERSCH, *Pretabular varieties of boolean De Morgan monoids*.
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This talk categorizes the pretabular varieties of De Morgan monoids whose carriers are boolean algebras with respect to negation and the lattice operations. The talk ends with preliminary results demonstrating the use of the contant submatrix to investigate pretabular varieties of De Morgan monoids on non-boolean carriers.

These results constitute the first step of the larger goal of categorizing all the pretabular varieties of De Morgan monoids. Since De Morgan monoids provide an algebraic semantics for Anderson and Belnaps relevant logic **R**, this categorization would lead to a categorization of all the pretabular extension of **R**, thereby paralleling Maksimova's categorization of all the pretabular superintuitionistic logics and of all the pretabular extensions of **S4**.

[1] L. L. MAKSIMOVA, *Pretabular superintuitionist logic*, ***Algebra i Logika***, vol. 11 (1972), no. 5, pp. 558–570.

[2] ———, *Pretabular extensions of Lewis S4*, ***Algebra i Logika***, vol. 14 (1975), no. 1, pp. 28–55.

[3] ROBERT K. MEYER, *Sentential constants in R and $R^{\neg}$*, ***Studia Logica***, vol. 45 (1986), no. 3, pp. 301–327.

[4] JOHN K. SLANEY *3088 varieties: a solution to the Ackermann constant problem*, ***The Journal of Symbolic Logic***, vol. 50 (1985), no. 2, pp. 487–501.

► FRED SEYMOUR MICHAEL, *The cost of Curry*.
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The proposition that gives rise to Curry's paradox is of the form $A \leftrightarrow A \to B$, where B is arbitrary and A is stipulated to be some proposition such that $A \to B$. A variant of this is known as Lob's paradox. In effect A "says" of itself that it implies B. where B is an arbitrary proposition. Curry called it the generalized Russell paradox and it could with equal justice be called the generalized liar's paradox, since both of these can be represented as instances of Curry's schema. From a proposition of the form, $A \leftrightarrow A \to B$, one can, by simple seemingly uncontroversial logical steps derive the arbitrary proposition B. Classically, this is not a serious problem. It is already accepted that a contradiction implies anything; this apparent paradox just shows that the same is true of self-referential propositions. It is interesting as an example of a paradox that does not explicitly involve negation. For paraconsistent and relevant logics, Curry's paradox is of much greater concern. These are logics that reject inferences such as that from $p\ \&\ \neg p$ to an arbitrary q and so are not apt to find the use of self-referential propositions to derive arbitrary propositions any more acceptable. In fact, it undermines much of the motivation for this sort of logic. But rejecting the derivation is costly. One must give up the axiom of contraction and even the standard form of modus ponens; and the logic that results is very weak. I propose to show that such drastic measures are not necessary, because in a paraconsistent logic it cannot both be the case that $A \leftrightarrow A \to B$ is true by stipulation and that B is false or arbitrary.

► GRIGORI MINTS, *Category theory and structural proof theory*.
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Several types of free categories with additional structure are conveniently described by interpreting objects as formulas and morphisms as proofs, more precisely as equivalence classes of natural deductions or (almost the same) Gentzen-style sequent derivations. For example symmetric monoidal closed categories correspond to multiplicative linear logic, that is to proofs without contraction and weakening rules. A general framework connecting categorical notions (functors, natural transformations) with proof-theoretical transformations (like cut-elimination) is presented. For example logical connectives are functors and the relation $F(1_A, 1_B) = 1_{F(A,B)}$ means that axiom $F(A, B) \to F(A, B)$ can be broken into axioms $A \to A, B \to B$.

Abstracts of papers presented by title

► ADIB BEN JEBARA, *Set theory with urelements applied.*
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The assumption is that at the level of elementary particles, time is the infinite set of urelements U of the set theory with urelements (urelements not linearly ordered).

If a particle is at the time u_1 and "then" at the lateral time u_2, it could be again at u_1 sideways. Time would have stopped.

Time at the level of elementary particles is not the arrow of time that we know at our level.

As a result of what could be happening at the level of elementary particles, there might be disturbances of time in an area, at our level, like time slowing down. We cannot go back in time as we cannot jeopardize causality.

The above is correct because of the existence of a Big Bang below (clearer than in what was written ptreviously):

An equivalent of the axiom of choice is that an infinite Cartesian product of non empty sets is non empty.

Set theory with urelements was used to study the negation of the axiom of choice. The urelements are non sets and undistinguishable.

Let U be the infinite set of urelements and Ui sets of urelements associated with elementary particles. The infinite Cartesian product of $U_1, U_2, U_3, \ldots$ is empty if the negation of the axiom of choice is applied.

Let us assume that physical space is U with as elements locations of space of quantum cosmology. When we consider the empty infinite Cartesian product, space disappears (not a point remains).

The particles collapse upon themselves. It is a Big Crunch. The Big Crunch is almost immediately followed by a Big Bang. Space reappears.

There always exist a universe or another. Physical space is infinite. A Big Crunch will occur after an infinite time.

► JOHN CORCORAN, *Hidden consequence and hidden independence*.
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Two related problem types are central to logic: consequence problems and independence problems. *Consequence problems* have the form: to show that a given conclusion is a consequence of a given premise set—if it is. *Independence problems* have the form: to show that a given conclusion is not a consequence of a given premise set—if it is not. Traditionally, a proposition not a consequence of a set of propositions is said to be *independent* of the latter. A lengthy *deduction* that Andrew Wiles discovered shows the Fermat conjecture to be a consequence of arithmetic axioms. Consequence problems were solved by *deduction*: deducing the conclusion from the premises using a series of steps conforming to "rules of deduction". *Reinterpreting* 'number', 'zero', and 'successor' so as to produce true propositions from the other two axioms and a false proposition from the Mathematical Induction axiom shows the latter to be independent of the other two axioms of Gödel's 1931 axiomatization of arithmetic. Independence problems were solved by *reinterpretation*: reinterpreting non-logical constants so as to produce true premises and false conclusion. A proposition that is a consequence of (or is independent of) a premise set is said to be a *hidden* consequence (or a *hidden* independence) if it is not obviously such. Without hidden consequence, deduction would be pointless. Without hidden independence, independence proof would be pointless. Hidden consequence and hidden independence are basic for justifying the study of logic and, indeed, for justifying the existence of logic as a field. This point is rarely made. In fact, the existence of hidden consequence and independence has been denied. This paper studies the treatment of these two phenomena in the literature of logic from Aristotle to Tarski.

► JOHN CORCORAN AND JOSÉ MIGUEL SAGÜILLO, *The absence of multiple universes of discourse in the 1936 Tarski consequence-definition paper*.
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This paper discusses the history of interpretations of *Tarski 1936*, the consequence-definition paper on pp. 409–420 in [2]. The central issue is whether it presupposes a *pluralistic* framework—having multiple universes of discourse serving as different ranges of individual variables in different interpretations as in modern model theory—or whether, to the contrary, it is predicated on a *monistic* framework—like *Principia Mathematica*—keeping the individual variables' range fixed as "the universe" or "the class of individuals" for every interpretation. In the early 1960s, Corcoran had believed that *Tarski 1936* presupposed a modern multiple-universe framework, as did Church and many other logicians. After rereading the paper around 1964, his understanding has been that *Tarski 1936* presupposes a monistic *Principia*-type fixed-universe framework within which the individual variables have a fixed range that does not change from interpretation to interpretation. As Sagüillo [1] noted, contrary to other publications, this is entirely separate from the question whether Tarski in 1936 or before acknowledges the fact—noted by Aristotle in *Posterior Analytics*—that each science has its own separate domain of investigation, sometimes called its subject-matter or genus. However, it is related to, but not determined by, the rarely mentioned question whether the pre-WWII Tarski was aware of the De Morgan–Boole concept of the universe of a *discourse*, and if aware, what theoretical importance in logic he gave it.

[1] J. SAGÜILLO, *Domains of sciences, universe of discourse, and omega arguments*, ***History and Philosophy of Logic***, vol. 20 (1999), pp. 267–280.

[2] A. TARSKI, ***Logic, semantics, metamathematics***, Hackett, Indianapolis, 1983, pp. 409–420.