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2013 WINTER MEETING OF THE ASSOCIATION FOR SYMBOLIC LOGIC

The Hilton New Orleans Riverside Hotel
New Orleans, Louisiana
February 20–21, 2013

A meeting of the Association for Symbolic Logic was held February 20–21, 2013, at the Hilton New Orleans Riverside Hotel, in conjunction with the annual meeting of the Central Division of the American Philosophical Association. The Program Committee consisted of Andrew Arana (Chair) and Audrey Yap. The ASL hosted a reception on the evening of Wednesday, February 20.

The program consisted of one invited panel discussion on *Logic in Undergraduate Philosophy Education*, featuring Andrew Arana (University of Illinois at Urbana-Champaign), Danielle Macbeth (Haverford College), Susan Vineberg (Wayne State University), and Audrey Yap (University of Victoria).

The program also included one session of contributed papers in which one talk was 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
ANDREW ARANA

Abstracts of invited talks

► PANELISTS: ANDREW ARANA, DANIELLE MACBETH, SUSAN VINEBERG, AND AUDREY YAP, *Logic in undergraduate philosophy education*.

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Most logicians employed in philosophy departments regularly teach logic to undergraduate students, at several different levels: chiefly, on critical thinking and informal reasoning; on formal reasoning within propositional and first-order logic; and on metatheory. Yet the methods and strategies employed by faculty for such teaching vary significantly. This plurality raises various questions. For one, it raises the question of whether a systematization of such teaching is likely, or even desirable. But it also suggests that a conversation on the various contents, methods, and norms at play in teaching undergraduate logic will provide broad insight into what works, what doesn't, and why. This session aims to facilitate a wide-ranging discussion on these issues, and to consider ways of bringing such discussions to fuller attention in the community. The speakers represent different types of institutions, and within those institutions, different departmental missions. Firstly, each speaker will discuss her own perspective on the successes and challenges of her educational work. Secondly, there will be a panel discussion in which all the speakers consider the topics raised in the individual talks and respond to topics raised by the audience. Topics to be addressed include: how should logicians respond to suggestions that "critical thinking" be emphasized in undergraduate education broadly? Should philosophy departments require logical training of its undergraduate majors, and if so, of what type? How we should we think about the role of temporary faculty in logic education in philosophy departments? What role should logicians play in the rise of online education, and how, if at all, could such courses be integrated into our curricula? What role could the ASL play in advancing the good for logic education in philosophy?

Abstract of contributed papers

► MATTHIAS BAAZ AND RICHARD ZACH, *The epsilon calculus and nonclassical logics*.
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It is possible to add Hilbert's epsilon operator (and its dual) to subclassical logics, such as intuitionistic and Gödel logics, resulting in corresponding $\varepsilon\tau$-calculi. For pure logic, this addition is conservative over the propositional part in the sense that no previously unprovable formulas without quantifiers or epsilons become provable. The addition of epsilon and tau operators results in new provable quantifier shift formulas, however. The status of the analog of Hilbert's epsilon theorem is complicated. It does not hold in intuitionistic or Gödel $\varepsilon\tau$-calculi, but special cases of the result, viz., that ε and τ terms can be elimianted from proofs of ε- and τ-free theorems, can be established.

Abstracts of papers presented by title

► JOHN CORCORAN, *Errors in Tarski's 1983 truth-definition paper*.
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In 1935, at 34 years of age, Alfred Tarski (1901–1983) published a German translation by Leopold Blaustein of the world-shaking truth-definition paper [1, pp. 152–278] begun over six years earlier [1, p. 277]. The main results were achieved when he was 28 years old (ibid.).

The German translation was not flawless. Further errors were introduced in the 1956 English translation by J. H. Woodger: Tarski had been unable to approve final page proofs [1, p. x].

In the 1983 second edition Tarski made scores of corrections—some originally suggested by him, some by me, and some by others. But he noted that more extensive rewriting was desirable [1, p. xiv]. The posthumous second, third, and fourth printings each saw further corrections including restoration of a missing 14-word passage on p. 172 noted by Matthias Schirn in 1997 [1, p. viii].

This essay lists and discusses errors that have come to light since 1983. Most are indisputable, but several will be disputed. An unproblematic example: page 156 calls the expression 'it is snowing' a name of a sentence: add another pair of quotes. Disputable examples include *segmentation errors* throughout his paper: for example, he takes *common-noun phrases* such as 'true sentence' to be *proper names*—denoting classes. In the same contexts, he takes the *incoherent fragment* 'is a' to be a *relational verb* coextensive with 'belongs to'. In short, e.g., he segments

is a true sentence

as 'is a' plus 'true sentence', instead of as 'is' plus 'a true sentence'.

[1] ALFRED TARSKI, *The concept of truth in formalized languages*, ***Logic, semantics, metamathematics***, revised edition, edited with new introduction and analytical index by J. Corcoran, Hackett, 1983, translator J. H. Woodger, fourth printing 2007, originally Oxford University Press, 1956.

► JOHN CORCORAN AND WILLIAM FRANK, *Arithmetic syntax and semantic arithmetic*.
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An *arithmetic syntax*, *AS*, is an interpreted two-sorted theory whose two sort-universes are the natural numbers and the strings over a finite alphabet, not necessarily interpreted. Besides primitive concepts of arithmetic—as "number", "zero", and "successor"—and of string theory—as "string", "character", and "concatenation"—it contains primitives linking the two sorts and used in such two-sorted propositions as "the length of the concatenation of a string with a character is the successor of the length of the string".

An AS provides for natural formalization of substantial parts of Euler's 1735 "Seven-Bridges" paper [3]. One Euler theorem links the number of "juxtapositions" involving a given character in a given string with the number of that character's "blocks" in the string. For any character x, an x-*juxtaposition* is a concatenation of x with some other character. An x-*block* is a string of one or more occurrences of x.

Euler's Theorem: a string having $2n + 1$ x-juxtapositions has $n + 1$ maximal x-blocks.

One lemma for the induction step of a proof is that extending a string by two x-juxtapositions increases the number of maximal x-blocks by one.

A *semantic arithmetic*, *SA*, is an AS in which the strings denote numbers. A typical theorem of an SA is that every Arabic-decimal numeral denoting a positive multiple of six is a string ending with '6'. This paper discusses [3] building on [2] and [1].

[1] John Corcoran, *Semantic arithmetic: a preface*, ***Agora***, vol. 14 (1995), pp. 149–156.
[2] John Corcoran, William Frank, and Michael Maloney, *String theory*, ***The Journal of Symbolic Logic***, vol. 39 (1974), pp. 625–637.
[3] Leonard Euler, *Seven bridges of Königsberg*, ***World of mathematics***, (James Newman, editor), Simon-Shuster, 1956, pp. 573–80.

► JOHN CORCORAN AND JUSTIN LEGAULT, *Aristotle, Boole, and Tarski on contradiction*.
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Continuing [3], we contrast "principles of contradiction" in Aristotle [1, 1005$^{\rm b}$19, 1011$^{\rm b}$13], Boole [2, p. 49], and Tarski [4, pp. 197ff].

Aristotle's first *principle of contradiction* [1, 1005$^{\rm b}$19] is a modal proposition about properties, individuals, and times; approximately:

> It is impossible that a property belonging to an individual at a time does not belong to the individual at that same time.

Incredibly, Boole [2, p. 49] claims to express Aristotle's principle with a non-modal, non-temporal sentence about classes. He uses an equation where 1 is the universe of discourse, 0 the empty set, juxtaposition indicates intersection, and x ranges over 1's subclasses.

$$x(1 - x) = 0 \tag{1}$$

Paraphrasing Boole's explanation:

> Give x the interpretation *men*, then $1 - x$ represents the class "not-men". The product of two classes represents that class of individuals common to both. Hence $x(1 - x)$ represents the class whose members are at once "men" and "not men". Equation (1) thus expresses *that a class whose members are at the same time men and not men does not exist*. In other words [sic], that *it is impossible for the same individual to be at the same time a man and not a man*.

Aristotle's second *principle of contradiction* [1, 1011$^{\rm b}$13] is a non-modal proposition about propositions and times; approximately:

> Contradictory propositions are not true at the same time.

Tarski uses *principle of contradiction* for a non-modal, non-temporal metatheorem about sentences. Paraphrasing [4, p. 197]:

> For every sentence x, x and x's negation are not both true.

[1] Aristotle, ***Metaphysics***.
[2] George Boole, ***Laws of thought***, Prometheus, 1854/2003.
[3] John Corcoran, *Notes on Aristotle, Boole, and Tarski*, ***Current topics in logic***, (Concha Martínez et al., editors), University of Santiago de Compostela Press, 2007.
[4] Alfred Tarski, ***Logic, semantics, metamathematics***, Hackett, Indianapolis, 1956/ 1983.

► JOHN CORCORAN, JUSTIN LEGAULT AND DANIEL NOVOTNÝ, *Aristotle: necessary conclusions and necessarily concluding*.
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This Bulletin, vol. 15 (2009), p. 461, suggests that *argument with a necessary conclusion* might denote an argument whose conclusion either (1), whether assertoric or apodictic, is necessarily true, or (2), whether true or false, is apodictic, or even (3), ineptly, whether assertoric, apodictic, true, or false—follows necessarily from its premises.

Moreover, *act of necessarily concluding* might denote either (1) any of several non-obligatory, voluntary acts of deducing a "necessary conclusion" (in any of several senses) or (2) any of several obligatory or involuntary acts of deducing under psychological, moral, social, or other compulsion—as in a debate, examination, dispute, or dialectic contest.

We study similar distinctions in ***Posterior Analytics***, especially 75a18–27, where—according to Fait [1]—Aristotle deploys the distinction between *an argument* with a necessarily true conclusion and *an obligatory act* of concluding. Ross came to a very different interpretation [2, p. 530]:

> Aristotle points here to the distinction between (1) the formal necessity which belongs to the conclusion of any valid [sic] syllogism and (2) the material necessity which belongs only to the conclusion of a demonstrative syllogism based on materially necessary premises.

Ross's *material necessity* and *formal necessity* roughly correspond, respectively, to the above first and third senses of *argument with a necessary conclusion*.

Contrary to Ross's implicit claim, some "valid syllogisms" have "materially necessary" [sc. necessarily true] conclusions and yet fail to be demonstrative.

Furthermore, there is an apparent contradiction between Ross's reference to "the material necessity that belongs *only* to the conclusion of a demonstrative syllogism" and his explicit recognition that demonstrative syllogisms have "materially necessary *premises*".

[1] Paolo Fait, *Aristotle on [...] necessity of being vs. necessity of saying*, ***Topoi***, vol. 23 (2004), pp.101–112.

[2] David Ross (editor), ***Aristotle's Analytics***, Oxford University Press, 1965.

► JOHN CORCORAN AND SRIRAM NAMBIAR, *Understanding Boole's primary equations*.
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We analyze equations in Boole's first "primary" or class logic [1, pp. 15–47]. This includes (1) Boole's operation calculus, (2) his reformulation of Aristotelian syllogistic as equation logic [2, §§ 2.3–2.6], and (3) his stunning reconstrual of proposition-expressing equations as algebra problems [2, § 2.4]. Lowercase letters appearing in his equations have several distinct *uses*. We mention only three here.

(1) Sometimes they are *variables* tacitly bound by universal quantifiers in equations intended to convey *identities*, general "laws of thought" [1, p. 17].

$$xx = x$$
$$xy = yx$$

(2) Sometimes they are *constants* temporarily assigned a denotation. The equations

$$xy = x$$
$$xy = 0$$

"express" the propositions "All Xs are Ys" and "No Xs are Ys"—where 'Xs' and 'Ys' have been assigned plural common nouns, as 'men' and 'animals', or 'sheep' and 'oxen' [1, p. 21].

(3) Sometimes they are "arbitrary constants", formal *proxies*—"knowns" and "unknowns" —as in elementary-algebra problems where students, given an equation—without assignments of values to the letters—are required to solve for the unknown, say, x in terms of knowns: other letters in the given equation [1, p. 24]. The last two equations above—now regarded as problems—both have the following equation as solution.

$$x = 0y$$

Substituting $(0y)$ for x in them yield the following, which read as Boolean identities, are

implied by the identity $(0y) = 0$ (Cf. [2, §§ 2.2]).

$$(0y)y = (0y)$$
$$(0y)y = 0$$

Equations using variables as in (1) or constants as in (2) have truth-values; those in (3) do not.

[1] George Boole, ***Mathematical analysis of logic***, Macmillan, 1847.

[2] John Corcoran and Susan Wood, *Boole's criteria of validity and invalidity*, ***Notre Dame Journal of Formal Logic***, vol. 21 (1980), pp. 609–639.

► JOHN CORCORAN AND LEONARDO WEBER, *Substitution and replacement in Tarski's schema T*.

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We discuss *string-token* manipulations including those known as *substitution* and *replacement*—with special attention to constructing concrete tokens of instances of Tarski's schema T [2, p. 155ff]. These two humanly-performed actions "resemble" similarly-named abstract operations on *string types* ([1, p. 626, fn 5]; [2, p. 174, fn 2]).

Usually when *we* substitute a *token*, the result contains *that* token; but when we replace a token, the result does not contain *that* token. Substituting tokens inserts them; replacing tokens removes them. Substitution and replacement manipulations are closely related: in a sense they are "four-place converses".

One might *try* the following.

NEWHAM is the result of someone's *substituting* NEW *for* OLD *in* OLDHAM.

NEWHAM is the result of someone's *replacing* OLD *by* NEW *in* OLDHAM.

But, substitution and replacement are manipulations of concrete string tokens and not operations on abstract string types. Strictly, the result of substituting (respectively replacing) one three-character token for (respectively by) another the same size in a six-character token is *in the same place* as the original—just as the result of substituting (respectively replacing) one book for (respectively by) another the same size on a shelf is in the same shelf-space as the original.

Strictly, the result of someone's substituting *a token of* NEW for *a token of* OLD, *the same size*, in *a token of* OLDHAM *at a certain place is a token of* NEWHAM in the *same* place.

[1] John Corcoran, William Frank, and Michael Maloney, *String theory*, ***The Journal of Symbolic Logic***, vol. 39 (1974) pp. 625–637.

[2] Alfred Tarski, *The concept of truth in formalized languages*, ***Logic, semantics, metamathematics***, Hackett, 1983, pp. 152–278.

► DON FAUST AND JUDITH PUNCOCHAR, *Base logics of explorationism*.

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Explorationism [1] is a perspective wherein all of our knowledge is (so far) less than certain, and naturally would come equipped with *base logic* entailing machinery for representing and processing evidential knowledge. One such *base logic* is Evidence Logic [2], which strives to deal with the phenomenon of the gradational presence of both confirmatory and refutatory evidence [3]. From this perspective, we will address questions surrounding sociological problem areas that we see as deeply infused with substantial epistemological factors. By designating a theory in Evidence Logic with the term *framework*, we will attempt to see each sociological milieu as a largely unelaborated framework. A dearth of elaboration leads to **both** a lack of awareness of presuppositions and implications inherent within each framework **and** an overconfidence regarding the veracity and applicability of the framework. For example, some sociological milieux involve Belief Systems [4], below which lurk poorly elaborated frameworks (e.g., Wittgenstein's *forms of life* [5]). The lack of elaboration allows believers to assert that their beliefs should apply to 'the other' as well as themselves. We consider the possibility that, even when further elaboration of a framework seems infeasible, increasing the awareness of the framework and its unelaborated status will mitigate the likelihood that believers will assert the veracity of their beliefs.

[1] D. Faust, *Conflict without contradiction*, 1999, `http://www.bu.edu/wcp/Papers/Logi/LogiFaus.htm`.

[2] ———, *The concept of evidence*, ***International Journal of Intelligent Systems***, vol. 15 (2000), pp. 477–493.

[3] ———, *On the structure of evidential gluts and gaps*, ***Handbook of Paraconsistency***, pp. 189–213, 2007.

[4] ———, *Explorationism, Evidence Logic, and the question of the non-necessity of all belief systems*, 2008.

[5] L. Wittgenstein, ***Philosophical Investigations***, 3rd edition, translated by G. E. M. Anscombe, Macmillan Publishing Company, New York, 1958.