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The 2003 Annual Conference of the Australasian Association for Logic took place in Adelaide, Australia on July 5–6, 2003. The conference was organized by Peter Quigley and Chris Mortensen, both of the University of Adelaide. The program comprised 11 contributed talks of 50 minutes in length. Participants of the conference came from four countries: the US, Belgium, New Zealand and Australia. The conference was run in conjunction with the Australasian Association of Philosophy Conference.

Abstracts of the contributed talks that were presented at the conference follow.

AAL Secretary
ROSS BRADY

Abstracts of contributed talks

► ROSS T. BRADY, *Normalized natural deduction systems for sentential relevant logics*.
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Following my previous method of normalizing natural deduction for relevant logics, we set out to see what full sentential relevant logics can be normalized using this method. Because the Subformula Property easily follows, as does Decidability, from the normalization, one would not expect the stronger logics such as T, E and R to be normalizable. I have already shown the weak relevant logic DW to be normalizable and decidable by this method. We push ahead with the logics B, DJ (MC), TW, TJ and RW and try to determine where the limitations of our method reside. We find that B and DJ are fine, but a difficulty arises with TW which extends to stronger logics.

Because of Urquhart's undecidability result for the derivations of TW, EW and RW (see Brady [2003]), we need to be careful in our investigation of the normalizability of the deductions of the weaker logics DW and DJ (MC). We distinguish a number of types of deduction with a view to establishing normalization and decidability for a brand of relevant deduction (see also [2003]).

R. T. Brady (editor) [2003], ***Relevant logics and their rivals***, vol. 2, Ashgate, Aldershot, UK.

► OTÁVIO BUENO, *A defence of second-order logic*.
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Second-order logic has a number of attractive features, including the strong expressive

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resources it offers, and the possibility of articulating categorical mathematical theories (such as arithmetic and analysis). But it also has its costs. Five major charges have been launched against second-order logic: (1) It is not axiomatisable: as opposed to first-order logic, it is inherently incomplete. (2) It also has several semantics, and there is no criterion to choose between them (Putnam [1980]). Therefore, it is not clear how this logic should be interpreted. (3) Second-order logic also has strong ontological commitments: (i) it is ontologically committed to classes (Resnik [1988]), and (ii) according to Quine [1970], it is nothing more than 'set theory in sheep's clothing'. (4) It is also not better than its first-order counterpart, in the following sense: if first-order logic does not characterise adequately mathematical systems, given the existence of non-isomorphic first-order interpretations, second-order logic does not characterise them either, given the existence of different interpretations of second-order theories (Melia [1995]). (5) Finally, as opposed to what is claimed by defenders of second-order logic, this logic does not solve the problem of referential access to mathematical objects (Azzouni [1994]). In this paper, I argue that the second-order theorist can solve each of these difficulties. As a result, second-order logic provides the benefits of a rich framework without the associated costs.

J. Azzouni [1994], *Metaphysical Myths*, ***Mathematical Practice***, Cambridge University Press, Cambridge.

J. Melia [1995], *The significance of non-standard models*, ***Analysis***, vol. 55, pp. 127–134.

H. Putnam [1980], *Models and Reality*, ***The Journal of Symbolic Logic***, vol. 45, pp. 464–482.

W. Quine [1970], ***Philosophy of Logic***, Prentice-Hall, Englewood Cliffs.

M. Resnik [1988], *Second-order logic still wild*, ***Journal of Philosophy***, vol. 85, pp. 75–87.

► MARTIN BUNDER, *The inhabitation problem for $\lambda(\Lambda\mathrm{I})$*.
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We show for the type theory $\lambda(\Lambda\mathrm{I})$, which has →i, →e and Λi that, for any type either an inhabitant can be found or it can be shown that there is none. The corresponding logic, thereby proved to be decidable, has intuitionistic →i and →e rules and |-AΛB follows from |-A and |-B if A and B have the same proof steps.

► M. J. CRESSWELL, *Completeness in modal predicate logic*.
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A system of modal logic is said to be complete if it is characterised by a class of (relational) frames. While most historically important modal propositional logics are complete, completeness in modal predicate logic is quite rare. This talk will be a survey of some recent and not so recent results on completeness in modal predicate logic. Where a logic is incomplete the question arises of how to complete it. Completion requires De Re formulae. The first example is S4M, characterised by frames in which each world can see a 'final' world—a world which can only see itself. This logic is incomplete with or without the Barcan formula, but can be easily completed. I next consider some incompletable logics, i.e., incomplete predicate logics where recursive completion is impossible. These include such logics as the 'provability' logic, the logics of discrete time and so on. In these cases the 'second-order' nature of modal propositional logic combines with the power of first-order logic to enable the representation of arithmetic. I finally consider an area with open problems. S4.2 is the logic of reflexive and transitive frames which are convergent, in the sense that if a world can see two worlds, those two can together see another world. It is a very old logic discussed by Peter Geach in the 1950s. The predicate extension of S4.2 with the Barcan formula (S4.2 + BF) is incomplete, but complete without it. It is not known whether S4.2 + BF is completable. For convergence alone the predicate logic with the Barcan formula is incomplete. Without BF it is not known whether the predicate extension is complete, though a 'free logic' version with an existence predicate is complete.

► LLOYD HUMBERSTONE, *A left-structural right-substructural sequent calculus for fission*.
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We study a multiple-succedent sequent calculus with both of the structural rules Left Weakening (or Left Thinning) and Left Contraction but neither of their counterparts on right, for possible application to the treatment of fission (multiplicative disjunction) against the background of intuitionistic logic. We find that, as S. Hirokawa dramatically showed in a 1996 paper with the rules for implication, the rules for fission result in the derivability of new structural rules, even though, unlike the rules for implication, those for fission are what we call "ipsilateral": an application of the rule does not make any (sub) formula change sides—from the left to the right of the sequent separator or vice versa.

► THIERRY LIBERT, *Abstract structures and topological models for set theory*.
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In this paper we explore a generating way of looking at models of set theories. Within the framework of a standard one, say *ZF* or *ZFA* (with large cardinals assumptions if necessary), a set-theoretical universe can be conceived as an *abstract structure* $\mathcal{U} = \langle U; \in_{\mathcal{U}} \rangle$), or equally $\mathcal{U} = \langle U; [\cdot]_{\mathcal{U}} \rangle$, where U is a set, $\in_{\mathcal{U}}$ is a binary relation on U, and $[\cdot]_{\mathcal{U}} : U \to \mathcal{P}(U)$ is the corresponding *extension* function, i.e., for any $x, y \in U$, $x \in_{\mathcal{U}} y$ iff $x \in [y]_{\mathcal{U}}$. Such a structure is *extensional* when $[\cdot]_{\mathcal{U}}$ is injective; then U can be identified with a (proper!) subset of $\mathcal{P}(U)$, namely $[U]$, the range of $[\cdot]_{\mathcal{U}}$, so that we may write $U \equiv [U]$. Typical examples of abstract structures are thus provided by canonical models of *ZF* or *ZFA* which satisfy $U = P_{<\kappa}(U)$, where this latter is the set of κ-finite subsets of U, and κ is an inaccessible cardinal. In those theories, only the "small" subsets of the universe are collectable. This paper shows how to go beyond this, by reviewing two attempts at providing a universe of type-free sets [1, 2]. The idea is to let the *indiscernibility* associated with some topology on U govern the collecting process. Accordingly, $[U]$ shall be a family of *distinguished* subsets of U (e.g., compact, closed, clopen, ...) such that $U \equiv [U]$ is realizable. Here we only consider topologies generated by a single equivalence relation or by a uniform family of equivalence relations, as in [1] and [2] respectively. In both cases, the natural non-standard set theory that emerges from the properties of the models is described.

[1] P. Apostoli and A. Kanda, *Parts of the continuum : towards a modern ontology of science*, ***The Poznan Studies in the Philosophy of Science and the Humanities*** Leszek Nowak (editor).

[2] M. Forti and R. Hinnion, *The consistency problem for positive comprehension principles*, ***The Journal of Symbolic Logic***, vol. 54 (1989), pp. 1401–1418.

► CHRIS MORTENSEN AND PETER QUIGLEY, *Inconsistent moving images*.
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Artists have long been interested in how perspective is constructed and used in pictures. Hogarth's False Perspective altered the expected occlusions between foreground and background objects. Escher drew waterfalls which continually fell downwards but formed a closed loop. We have studied these elsewhere, and proposed to describe them as inconsistent. The current work extends this study in the direction of moving pictures, and ultimately into 3-D via virtual reality. Bruno Ernst conjectured that it is impossible to rotate an inconsistent picture. We argue that this is false. Due to our naive expectations about the constancy of 3-D objects, inconsistent moving pictures appear more striking than motionless drawings. As well as inconsistencies of occlusion we will present inconsistencies due to the breaking of grouping rules and solidity rules.

► JARI PALOMÄKI, *Reasoning with improper concepts*.
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There are at least two specific groups of problems to which extensional logic has failed to give satisfactory answers, and which intensional logic aims to study:

1. Two non-identical concepts can be co-extensional in the given universe of discourse. Then, especially, in the universe of discourse of all possible things, all contradictions would be co-extensional, i.e., the empty set. The empty set being a subset of every set, it follows that all contradictions would be included in the extension of every concept. So, evidently, concepts and their extensions cannot be identified in all cases.
2. The logical inference formalized by using a material implication satisfies the requirement that from the true propositions only true propositions follow. However, since it is always true when the antecedent is false or the consequent is true, its use may lead to some paradoxical situations.

Thus, the reciprocity between extensional and intensional logic is not one-one. In particular, when dealing with the definition of negation, the difference between intensional and extensional logic is the most striking. In extensional logic the negation corresponds to the complement set, and if every set has a complement, from the extensional point of view every concept has a negation.

In intensional logic the negation is usually taken as a primitive. It is supposed that every concept has a negation, which is incompatible with it, where the incompatibility in turn is defined by means of the negation. Also, the double negation of the concept is supposed to be identical with it as well. On the other hand, for every concept to have a negation, it is presumed that for every concept there is a concept with which it is incompatible. This, however, is not always the case. However, there are concepts, called *improper concepts*, which are compatible with every concept, and hence they have either no intensional negations or no intensional double negations.

► GRAHAM PRIEST, *Inconsistent arithmetics: Issues technical and philosophical*.
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Inconsistent models of arithmetics are structures based on an underlying paraconsistent logic and which validate at least all the sentences true in the standard model of arithmetic. The study of these structures is about 25 years old, but has already occasioned a number of both interesting technical results and philosophical controversies. This paper is in two parts. The first part is technical, and reviews what is known about the structure of these models. It ends with a number of open problems. The second part of the paper is philosophical, and discusses an argument to the effect that true arithmetic is inconsistent. The argument is to the effect that true arithmetic ought to be able to prove its own "Gödel sentence". The inconsistent models are deployed to show the technical coherence of this possibility, as well as to reply to some recent objections to the effect that the existence of such theories has totally unacceptable consequences.

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I argue for the following four theses.

1. Denial is not to be analysed as the assertion of a negation.

2. Given the concepts of assertion and denial, we have the resources to analyse logical consequence as relating arguments with multiple premises and multiple conclusions. Gentzen's multiple conclusion calculus can be understood in a straightforward, motivated, non-question-begging way.

3. If a broadly anti-realist or inferentialist justification of a logical system works, it works just as well for classical logic as it does for intuitionistic logic. The special case for an anti-realist justification of intuitionistic logic over and above a justification of classical logic relies on an unjustified assumption about the shape of proofs.

4. This picture of logical consequence provides a relatively neutral shared vocabulary which can help us understand and adjudicate debates between proponents of classical and non-classical logics.

► JOHN SLANEY, *Semipositive LTL with an uninterpreted past operator*.
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$LTL is a version of linear temporal logic in which negation is confined to atemporal propositions and in which eventualities are not expressible, but in which there is a sentential constant $ intended to be true just at the end of some behaviour of interest—that is, to mark the end of the accepted (finite) words of some language. There is an effectively recognisable class of $LTL formulae which express behaviours, but in a sense different from the standard one of temporal logics like LTL or CTL. This representation is useful for solving a class of decision problems with temporally extended goals.