

**Australasian Association for Logic  
Fiftieth Anniversary Conference**

2–3 July 2015

University of Sydney

Timetable and Abstracts

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## Timetable

### Thursday 2 July

09:00 09:30 coffee  
09:30 10:15 Cresswell  
10:15 11:00 Badia  
11:00 11:30 morning tea  
11:30 12:15 Sequoiah-Grayson  
12:15 13:00 Smith  
13:00 14:00 lunch  
14:00 14:45 Restall  
14:45 15:30 Parisi  
15:30 16:00 afternoon tea  
16:00 16:45 Colyvan  
16:45 17:30 Mortensen

17:30 AAL history + AGM

19:30 dinner

### Friday 3 July

09:00 09:30 coffee  
09:30 10:15 Withy  
10:15 11:00 Bunder  
11:00 11:30 morning tea  
11:30 12:15 Kowalski  
12:15 13:00 Ripley  
13:00 14:00 lunch  
14:00 14:45 Martin  
14:45 15:30 Varey  
15:30 16:00 afternoon tea  
16:00 16:45 Joaquin  
16:45 17:30 Haze

## Abstracts

**Guillermo Badia**

### **A Lindström Theorem for Relevant Logic**

In the sixties, Per Lindström famously showed that classical first order logic is the most expressive language admitting a Compactness and a Löwenheim-Skolem theorem. From then on, similar model-theoretic characterizations have been obtained for some non-classical logics relative to their particular semantics (e.g. topological logic or infinitary logic). In particular, Maarten De Rijke proved that propositional modal logic is the most expressive language having the finite occurrence property, the finite depth property and invariant under bisimulations relative to the usual Kripke semantics. Similarly, in this talk we will claim that, relative to the Routley-Meyer semantics, propositional relevant logic is the most expressive language having the finite occurrence property, the finite depth property and preserved under directed bisimulations. We will also examine some of the consequences of this Lindström style characterization of relevant logic. This is part of a broader project that aims to develop the model theory of relevant logic as it has already been done for its modal cousin.

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**Martin Bunder**

### **Hilbert- and Natural-style Systems of Illative Combinatory Logic**

Illative Combinatory Logic is a very simple system that can be represented using only 3 or 4 constants, no variables, two rules of inference and a few axioms. It is very powerful in that Predicate Calculus of arbitrarily high order, most of Peano Arithmetic, and much of Set Theory and Category Theory can be derived directly from it. The current paper aims to find equivalent Hilbert-style and Natural Deductionstyle versions of the system. Slightly weaker systems have been shown to be strongly consistent by Barendregt, Bunder and Dekkers in 1993 and by Czajka in 2014.

Mark Colyvan, John Cusbert and Kelvin McQueen

## Two Flavours of Mathematical Explanation

All proofs of mathematical theorems show *that* the theorem in question holds (or is true). Some, but not all, proofs go further and show *why* the theorem in question holds. In this paper we consider several different proofs from different branches of mathematics, including a couple of different proofs of the same theorem. We conclude that there are at least two different, and often competing, virtues found in mathematical proofs and both these virtues deserve to be thought of as kinds of mathematical explanation. If this is right, there would appear to be no unified notion of explanation in mathematics. While this is disappointing it is not altogether unexpected. We end by noting some parallels with debates over explanation outside of mathematics.

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Max Cresswell

## Prior on the Semantics of Modal and Tense Logic

To the best of my knowledge Arthur Prior was never a member of the AAL. Although he visited New Zealand in 1965 a few years before his death he did not, as far as I know, ever attend one of our conferences. Nevertheless I think it is fair to say that logic, not only in New Zealand, but in Australasia more generally, owes a great deal to his influence. Much of this is measured by what others have made of his ideas after his death. In particular his influence on the development of the indexical semantics for tense and modal logics cannot be denied. The focus of this talk however is to look at what Prior himself thought he was accomplishing. In particular it considers Prior's attitude to the semantic metatheory of the logics that he was interested in. I will set out some characteristics of the metalogical study of intensional languages in terms of an indexical theory of truth conditions stated in the language of set theory. In examining Prior's work using these characteristics, it emerges that Prior had serious reservations about this way of studying modal and tense logics. I end with some reflections about how the greatness of a philosopher can sometimes transcend that philosopher's own views of what they were attempting to accomplish.

**Tristan Haze**

## **Logic and Validity**

In this talk I will argue for a thesis in the philosophy of formal logic:

(NGV) Formal logic is not aptly regarded as having, among its aims, that of giving a general account of validity.

By ‘a general account of validity’ I mean, not merely an account of what validity is, but an account which gives us the means to separate all the valid arguments from the invalid ones.

The argument, if any good, should be of considerable interest, since the view which (NGV) denies — call it (GV) — seems to be fairly widely held, and plays a large role in our collective understanding of the nature of formal logic.

My argument in compressed form is as follows: there are glaring lacunae in formal logic construed as a general account of validity; if that were one of its aims, it would be blatantly neglecting certain basic inferences which it is meant to account for. But no one in formal logic cares, and we cannot plausibly put this down to laziness or oversight. Therefore, it is inappropriate to construe formal logic as having a general account of validity among its aims.

I support my argument with a specific example involving ‘only’, and reply to four possible objections.

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**Jeremiah Joven Joaquin**

## **Prospects for an experimental approach to philosophical logic: The psychology of vagueness as a test case**

Over the years, there has been a steady growth of research projects, which fall under what Ripley (2015) has called “experimental philosophical logic”. Experimental philosophical logic might be characterized as an interdisciplinary study, which employs tools both from mathematical logic and experimental sciences (like psychology) to work out a model that accounts for a particular target phenomenon (like linguistic behaviour, cognitive primes, etc.). In this talk, I explore prospects for this kind of project. Particularly, I look at a series of studies on the psychology of vagueness, and inquire about the plausibility of their methodologies, theoretical frameworks, and research aims.

Tomasz Kowalski

### Analytic cut and interpolation for some non-classical logics

Let  $L$  be a logic, presented as a sequent system. We say that  $L$  has analytic cut property if whenever a sequent  $G \Rightarrow D$  is provable in  $L$ , then it has a proof in which only formulas from some finite set  $X(G,D)$ , effectively computable from  $G$  and  $D$ , appear. Intuitively, if  $L$  does not have cut elimination, then analytic cut is the second best. Adapting a method devised by Takano, I will show analytic cut property for some non-classical logics, in particular, for bi-intuitionistic logic.

Another method, devised by Maehara, shows interpolation for certain logics for which cut elimination holds. I will show that the method can be adapted to show interpolation for certain logics with analytic cut property, again, in particular, for bi-intuitionistic logics.

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Ben Martin

### Glutty Dual-Valuation Logics

This paper introduces a new family of logics, dual-valuation logics, and then concentrates on one glutty member of the family,  $gD-V$ , demonstrating that in combination with its modal extension,  $gD-Vm$ , it provides a solution to three prevalent criticisms of dialetheism: 1) Dialetheists' inability to express the meaningful concepts of 'true only' and 'false only', 2) Dialetheists' inability to accommodate important dialetheically invalid but classically valid inferences, and 3) Dialetheists' commitment to the impossibility of the actual world. Dual-valuation logics conceive of the total valuation of a propositional parameter in a zero-order logic as constituted by two relations, a *valuation* and an *anti-valuation* relation, rather than one as with current relational semantics. While the *valuation* relation is the same as those found in other relational semantics, dual-valuation logics' *anti-valuation* relation communicates which truth-values a proposition parameter does *not*, classically understood, have the valuation relation to. We show that by using these two valuation relations we can produce a glutty logic  $gD-V$  with greater expressive power than current glutty logics with relational semantics. It's demonstrated that  $gD-V$  is a *Logic of Formal Inconsistency (LFI)* by being a paraconsistent logic that can recapture classical validity through consistency assumptions in its object language, that unlike other well-known LFI's  $gD-V$  has a 'consistent truth' and 'consistent falsity' operator, and that these properties of  $gD-V$  ensure that it provides the dialetheist with a solution to the three prevalent criticisms.

Chris Mortensen

## The Indiana Collection of Reutersvard’s Impossible Figures

In 2013 Indiana University purchased a large collection of Oscar Reutersvard’s so-called impossible figures. In this paper I show a representative subset of these, and begin the task of classifying them. Reutersvard can fairly claim to have been first among peers such as Escher, Penrose and Shepard to discover most of these types of figures, and this paper makes out the case for that priority.

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Andrew Parisi

## A hypersequent approach to modal logic

The hypersequent approach to modal logic was first introduced by [Av96]. Several approaches have since been developed (see [Re09, La13, Le14]). This paper gives an alternative approach to modal logic in hypersequent systems. Of particular interest is that various different systems of modal logic are not given by alterations in the operational rules of the calculi (rules governing the necessity operator), but by altering the external structural rules of hypersequents (such as external weakening, contraction, and exchange). Philosophically, this account amounts to a way of holding that modal terms vary in meaning because of the context in which they are embedded as opposed to the behaviour of the modal connectives. Several important formal results are proved about the systems, including that the identity axiom need only be enforced in the case of atomics, and that the cut rule is admissible for systems K, D, and S5.

## Bibliography

- [Av96] Avron, A. (1996). The method of hypersequents in the proof theory of non-classical logics. In Hyland, M., Hodges, W., Steinhorn, C., and Truss, J., editors, *Logic: Foundations to Applications*. Oxford Science Publications.
- [La13] Lahav, O. (2013). From frame properties to hypersequent rules in modal logics. *28<sup>th</sup> Annual ACM/IEEE Symposium on Logic in Computer Science*, pages 408–417.
- [Le14] Lellmann, B. (2014). Axioms vs hypersequent rules with context restrictions: Theory and applications. In Demri, S., Kapur, D., and Weidenbach, C., editors, *Automated Reasoning*, volume 8562 of *7<sup>th</sup> International Joint Conference*, pages 307–321.
- [Re09] Restall, G. (2009). Truth values and proof theory. *Studia Logica*, 92(9):241–264.



Greg Restall

### Contingent Existence and Modal Definedness

I motivate and present a straightforward and well-behaved hypersequent system for a simple quantified modal logic which allows for contingent existence. I will show (1) that system is sound and complete for a straightforward Kripke semantics, (2) the system admits a standard cut admissibility argument, and (3) how this proof theory can undergird an understanding of the *meanings* of the quantifiers and the modal operators according to which *necessitism* (the doctrine that all that exists necessarily exists, and that it's impossible for anything to exist that doesn't actually exist) fails, but the quantifiers and the modal operators have natural and well motivated behaviour, and a semantics in which there is no commitment to un-actualised possibilia.

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Dave Ripley

### 'Transitivity'

A binary relation  $R$  on a set  $S$  is transitive iff for every  $x, y, z$  in  $S$ : if  $xRy$  and  $yRz$ , then  $xRz$ . Consequence relations are often called 'transitive' as well. But they are not, at least not in the usual sense. Most often, consequence relations are not binary relations on a set at all: they are not even the right kind of thing to be transitive. (They are relations between sets of formulas and formulas, or something of the sort.) But even when consequence relations between sets of formulas and sets of formulas are considered, they are typically not transitive in the usual relation-theoretic sense.

Worse, there is no single property usually meant when logicians call a consequence relation 'transitive'. This talk attempts to bring some clarity to the situation, by exploring a variety of different properties of consequence relations sometimes associated with transitivity, exploring the implications among them, and showing which ones are important for various applications.

Sebastian Sequoiah-Grayson

## Epistemic Relevance and Epistemic Actions

Abstract: In recent work by Michael Dunn (2015), an operational and informational semantics for the ternary relation  $R$  from relevance logic is explored in relation to informational relevance itself. Here, we extend this framework into robustly epistemic terrain. We take a new perspective on the problem of logical omniscience, using informationalised operational semantics to model the properties of the epistemic actions that underpin the epistemic relevance of certain explicit epistemic states of an epistemic agent as that agent executes said actions.

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Nicholas J.J. Smith

## (I Can't Get No) Satisfaction Truth

There are (at least) two ways of defining truth in a model for standard first-order languages: both are to be found in classic textbooks, but one of them—which proceeds via the notion of satisfaction—is much more prevalent. In this talk I consider the question whether either of these definitions can be regarded as an explication of the ordinary notion of truth (understood as *saying it how it is*). I argue that one can and the other—the one that proceeds via satisfaction—cannot.

The definition of truth in terms of satisfaction bears a structural similarity to the definition of supertruth and this talk is related to previous work [Sm15] in which I argue that the supervaluationist framework cannot provide an adequate model of truth (although it can provide a model of probability of truth).

## Bibliography

[Sm15] Smith, Nicholas J.J. (2015). Truthier Than Thou: Truth, Supertruth and Probability of Truth. *Noûs* forthcoming.

**Simon Varey**

**Directly Referential Definite Descriptions**

Amongst those who have analysed definite descriptions as referential, most have considered them to be indirectly referential. In contrast, I will argue that definite descriptions are directly referential, in the sense of Kaplan (1980). In other words, the informational contents of utterances of definite descriptions are identical to their referents. In this talk I will focus on several potential problems for this view, all related to Frege's Puzzle as presented by Salmon (1986). I will suggest that Salmon's approach to these problems in the case of proper nouns will also apply in the case of definite descriptions.

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**Andrew Withy**

**Cross-contamination between linguistic and logical intuitions**

Our intuitions about consequence, entailment, implication, and inference are closely entwined with how we reason and communicate about propositions. If these logical notions are distinct and distinguishable from our behaviour as logicians, we must be wary of letting our behaviours and patterns of communication and thought unwittingly leach into our intuitions about logic. I will model some well-established constraints on natural language indicative conditionals, and demonstrate some of the logical properties of the resulting deductive systems. This will lead to some speculation about potential cross-contamination between doing logic and merely speaking and thinking about logic. The puzzle I am wrestling with is how we might detect this possible slip from analysing logic to analysing how we think and talk about logic.