AAL 2012

Timetable and Abstracts

Contents

Timetable

Friday 29 June

08:30	coffee (provided)
09:00	Smith
09:40	Tucker
10:20	Breckenridge
11:00	morning tea (provided)
11:30	Slater
12:10	French
12:50	lunch (own arrangements)
14:20	Ripley
15:00	Coutts
15:40	afternoon tea (provided)
16:10	Su
16:50	Nair
17:30	AGM
19:30	conference dinner

Saturday 30 June

08:30	coffee (provided)
09:00	Brady
09:40	Kachapova
10:20	Duparc
11:00	morning tea (provided)
11:30	Heathcote
12:10	Bunder
12:50	lunch (own arrangements)
14:20	Haze
15:00	Withy
15:40	afternoon tea (provided)
16:10	Roeper
16:50	Varey

Logic and Computation

Ranjit Nair

Computability, physics and logic

The use of terms such as 'computability' and of Gödel's theorem by mathematical physicists has drawn criticism from mathematical logicians who emphasize the precise bounds of these ideas. Within a formal system S with a finite number of axioms and syntactic rules of reasoning or inference rules, in which a certain amount of elementary arithmetic can be done, Gödel showed that there are undecidable sentences (first incompleteness theorem) and the consistency of S cannot be proved within S (second incompleteness theorem). Stephen Hawking conceded his first bet made in 1980 concerning the completeness of physics or the attainment of a 'theory of everything' (TOE) in 20 years in 2002, in 'Gödel's theorem and the end of physics'. The same bet was repeated with the author in 2001 and with the first concession on logical grounds it would appear prima facie that the second bet was also conceded. However, from a rigorous application of the incompleteness theorems, all that follows is that elementary arithmetic accompanying the putative TOE is incomplete. Hawking's conception of the centrality to self-referential sentences in Gödel's theorem which he maps on to physics turns out to be misleading as the theorems can be proved without invoking self-referentiality. Is there then no connection between incompleteness in Gödel's sense and in Hawking's sense? In my paper I suggest that the central feature shared is the complete absence of semantics and a dependence on syntactic rules. While it was not patently wrong for Gödel to have left semantics out entirely, theoretical physics as ordinarily understood, requires semantic interpretation. Perhaps, however, that is Hawking's point. Theoretical physics may be fundamentally of an algorithmic nature, without semantic interpretations. Arguably the Copenhagen interpretation of quantum mechanics was committed to such a view, hence the connections must not be so cavalierly dismissed.

Che-Ping Su

Connecting Argumentation Theory with Justification Logic

Argumentation theory studies the activities in which rational agents debate with each other. In artificial intelligence, since the late 1980s there has been research that tries to use formal methods to approach argumentation theory [5]. One perspective taken by those formal accounts for argumentation is this: given a set of arguments, to decide which arguments to accept, we should look at not only the inner structure of each argument, but also the relationship among those arguments.

One very young approach in formal argumentation theory is to study argumentation under the framework of modal logic [2] [3] [4]. Two possible advantages of doing so are: (1) this is a new angle, from which to look at argumentation we might have new insights, and (2) techniques in modal logic become available for studying argumentation. In my talk, I would like to sketch a way of connecting argumentation theory and modal logic that is more different from [2] and [4], but closer to [3]. More specifically, I would like to try to locate argumentation theory within the framework of justification logic.

References:

1. Artemov, S.: 2008, 'The Logic of Justification', *The Review of Symbolic Logic* **1**(4), 477–513.

2. Boella, G., Hulstijn, J. and van der Torre, L.: 2006, 'A logic of abstract argumentation', in S. Parsons, N. Maudet, P. Moraitis, and Y. Rahwan, (eds), *Proceedings of ArgMAS 2005*, Springer, pp. 29–41.

3. Caminada, M. and Gabbay, D.: 2009, 'A logical account of formal argumentation', *Studia Logica*, **93**(2), pp.109–145.

4. Grossi, D.: 2010, 'On the Logic of Argumentation Theory', in W. van der Hoek, G. Kaminka, Y. Lesperance, M. Luck and S. Sandip (eds.). *Proceedings of the 9th International Conference on Autonomous Agents and Multiagent Systems (AAMAS'10)*, IFAAMAS 2010, pp. 409–416.

5. Rahwan, Y. and Simari, G.(eds.): 2009, *Argumentation in Artificial Intelligence*, Springer.

Logic and Language

Wylie Breckenridge

Word Sense

Proper names such as 'Superman' and 'Clark Kent' have certain things associated with them, typically called their referent. There is reason to think that they have certain other kinds of things associated with them as well, typically called their sense. For example, the sentences 'Lois believes that Superman is strong' and 'Lois believes that Clark Kent is strong' differ in truth value, a difference that cannot be explained by a difference in the referents of 'Superman' and 'Clark Kent' (they have the same referents). Well, perhaps you don't agree that these sentences do differ in truth value, so here is another reason: when Lois hears the sentence 'Superman is strong' she is disposed to say 'true', but when she hears the sentence 'Clark Kent is strong' she is not disposed to say 'true'. Again, this difference cannot be explained by a difference in the referents of 'Superman' and 'Clark Kent'. Suppose we accept, for whatever reason, that proper names have such things as senses. What kinds of things are they? How do they get associated with a proper name? How can they explain the phenomena that I just described? It is very common to take senses to be ways of one kind or another—ways of determining a referent, ways of presenting a referent, ways of thinking—but also common not to say much about what they are. I will take up the idea that senses are ways of thinking, and put more flesh on the bones of this idea. I will propose an account of what ways of thinking are, of how they might get associated with a proper name, and of how they might explain the phenomena above.

Tama Coutts

What Kant Would Say to Vann McGee

McGee claims there are counterexamples to modus ponens. If Kant were to have investigated these same issues, he would have begun by asking the following question: what would it be like for there to be a counterexample to modus ponens? McGee tacitly gives an answer to this question, and his answer is a natural one. It is however, wrong. In this paper I will show this, drawing inspiration from intuitionistic relevant logic. We will also see that intuitionistic relevant logic also gives a quite natural explanation of what is going on in McGee's most well known putative counterexamples.

Rohan French

Kaplan's Monsters The Case of 'fixedly'

In 'Demonstratives' Kaplan pronounced a ban on operators which alter features of the context, calling them "monsters" and claiming (with some provisos) that such operators are not expressible in English. We will show that for a plausible notion of what it is for something to be expressible in a formal language, that at least some monsters are expressible in a class of formal languages which use resources which are needed to give a formal semantics for English. In particular we will focus on the case of the 'fixedly' operator from Davies and Humberstone's 'Two Notions of Necessity', and show how it can be expressed using quantification over sets.

Tristan Haze

Modelling with the Propositional Calculus

A new answer is given to the question 'How can formulae of the propositional calculus be brought into a representational relation to the world?'. Formulae, together with either valuation- or proof-theory, are regarded as an abstract structure capable of bearing (via stipulation) a representational relation to the world. This 'modelling approach' differs in philosophically interesting ways from the three widely known approaches: (1) the denotational approach, on which formulae are taken to denote objects, (2) the abbreviational approach, on which formulae and connectives are taken to abbreviate natural-language expressions, and (3) the truth-conditional approach, on which truth-conditions are stipulated for formulae.

The simple technique used for the proof-theoretic version of the modelling approach is then applied to two issues in the philosophy of logic. Firstly, I demonstrate a corollary or converse to Carnap's result that certain 'non-normal' valuation-functions can be added to the set of admissible valuations of formulae without destroying the soundness and completeness of standard proof-theories. This sheds considerable light on a recent thread of the inferentialism debate involving dialectical use of Carnap's result. Secondly, I show how the technique can be extended to quantification theory, by defining a model-theoretic notion of validity equivalent to the usual one, but making use of a proof-theoretic apparatus in place of the device of assigning values to formulae. This sheds light on the close relationship between proof- and valuation-theory.

Dave Ripley

Logics of confusion

Sometimes we treat two or more things as one, ignoring the difference between them. Call this "confusion". Sometimes we're confused because we don't realize at all that there are distinct things involved, as when I thought that Sam Neill and Sam Rockwell were the same actor, and just thought of him as something like "that Sam actor guy". Other times, we do realize there's a difference but we don't bother ourselves about it, as when we are familiar with the distinction between relativistic and proper mass, but still measure out 200 grams of flour without a thought in the world about which sort of mass it's 200 grams of.

Whatever the reason for our confusing distinct things, though, it poses some difficulties for the logical reconstruction of our reasoning and action. Different authors have offered different ways of proceeding with the task; Field, in a number of articles, suggests a supervaluational approach, and Camp, in his book *Confusion*, suggests a particular epistemic interpretation of the logic FDE. In this talk, I will argue that both of these approaches fail to grapple with important aspects of confusion. Instead, I will follow up some imprecise but suggestive remarks made by Millikan, pulling them out of context and providing them with a logical framework. I'll argue that this framework is considerably truer to the phenomena than either Field's or Camp's, and apply it to the more familiar case of vagueness. There will be roughly two punch lines: that when confusion is around we should expect consequence to behave nontransitively, and that vagueness is a kind of confusion.

Peter Roeper

A Vindication of Logicism

I take logicism to be the thesis that the truths of arithmetic can be transformed into logical truths by means of definitions. The idea is Frege's, who set out to establish logicism for the arithmetic of the natural numbers. This involved giving definitions of the natural numbers and the basic mathematical operations, and of proving, in effect, the Peano axioms within his system of logic.

In order to establish this thesis Frege first turns to the analysis of ordinary number statements, which leads him to a principle which he regards as central: 'The number of Fs = the number of Gs iff there are as many Fs as Gs'. Called *Hume's Principle* by Frege, it connects the notion of number with equinumerosity.

Frege insists that Hume's Principle cannot serve as a definition of numbers. An explicit identification of the numbers is required. Hume's Principle serves as a test; any proposed identification must satisfy Hume's Principle. Frege then proceeds to identify certain sets, essentially the extensions of numerical predicates, as the numbers.

I claim that the failure of Frege's attempt to prove logicism is due to two things: (i) for Frege numbers are objects, something radically different from concepts/properties; (ii) his solution is extensional. Instead I suggest that (ii) numbers are properties, not objects in Frege's strong sense, but (i) they can be treated as objects.

Following Frege's general strategy I take Hume's Principle as the starting point. By extracting the relevant information from it I arrive at the conclusion that numbers are certain logical properties, namely the number properties of pluralities, i.e. the properties expressed by numerical quantifiers. E.g. in the number statement 'there are two Dioscuri' or, more transparently, 'the Dioscuri are two' the property of there being two of them is attributed to the Dioscuri. The property can be expressed by the numerical quantifier $\exists_2(X)$:

$$(\exists x \in D)(\exists y \in D)[x \neq y \,\&\, (\forall z \in D)(z = x \vee z = y)]$$

When we do mathematics these properties need to be treated as objects, we need a systematic means of referring to them. The familiar λ-notation can be used to transform predicates into referring expressions. The nominalisation of the numerical quantifier $\exists_2(X)$ is the singular term $\lambda_X \exists_2(X)$, which refers to the number 2.

Nominalisation by means of the λ-functor is a grammatical device that has no deep significance. To ensure consistency different categories of objects need to be distinguished. Individuals are those whose primary category is that of an object. Numbers are not individuals; their primary category is *property of pluralities*. Formation rules have to respect the categorial distinctions and to guarantee that no sentences can be constructed that do not have definite truth conditions.

Using a system of modal plural logic, enriched by λ-nominalisation, I show that the Peano Axioms can be derived with the help of definitions.

Hartley Slater

Getting the Relata Right

Increased attention to 'that'-clauses leads to a realization of the necessity and prevalence of indexicality in natural language, a point that Bradley Armour-Garb, amongst many others, has missed. I first trace in more detail the chain of thoughts that connects 'that'-clauses so intimately with indexicality, before applying the result to some examples from Armour-Garb's work. He is taking it that the truth predicate attaches to sentences, whereas it attaches to 'that'-clauses, and the paradoxes that he finds immediately dissolve, once this is respected.

Nicholas J.J. Smith

Propositions and Well-Formed Formulae

In formal semantics, model theory for formal languages is used to shed light on natural language semantics. A model involves an assignment of values (e.g. extensions, or intensions) to basic symbols, together with rules that determine the values of non-basic expressions, based on their syntactic structure and the values assigned to their components. The standard analogy in formal semantics is this: a formula of the formal language corresponds to a sentence of natural language; the values assigned to the components of the formula correspond to the meanings (semantic values) of the words and expressions that make up the sentence; a proposition is the meaning (semantic value) of an entire sentence (or perhaps a structured entity, whose structure matches that of the sentence, and whose components are the meanings of the expressions that make up the sentence). In this paper I argue for a different analogy: a formula of the formal language corresponds to (part of) the proposition expressed by a sentence of natural language (uttered in some context); the values assigned to the components of the formula correspond to the (remainder of) that proposition. Thus, the proposition expressed by a sentence of natural language is a well-formed formula of a certain formal language together with an assignment of values to the components of that formula.

Dustin Tucker

Paradoxical Constraints on Theories of Propositional Attitudes

Propositions are more than the bearers of truth and the meanings of sentences: we also use them in our theorizing about an array of attitudes including belief, desire, hope, fear, knowledge, and understanding. This variety of roles leads to a variety of paradoxes, most of which have been sorely neglected. I focus on one family of these paradoxes and survey several possible responses. Each response makes concessions somewhere, either in our theory of truth, our theory of generality, or our theory of attitudes. But my goal here is not to weigh these concessions against each other. Each response is, in effect, a skeleton of a theory of propositions, and I argue that with only one exception, these theories of propositions place hard limits on our ability to know, or at least our ability to theorize satisfactorily, about the connection between our mental lives and the world.

Simon Varey

Reasonable Inference and the Hard Problem of Existential Import

I want to suggest that there are in fact two problems of existential import. One problem is the fact that term logic appears to be inconsistent. A second, more interesting problem is the question of why this inconsistency went unnoticed for so long, and why, despite its inconsistency, the system still seems to have a certain intuitive appeal. By understanding P. F. Strawson's interpretation of term logic in terms of Robert Stalnaker's notion of reasonable inference, I will argue that we can explain the intuitive appeal of traditional term logic as a system of inferences under presupposition, and thus answer this second question.

Andrew Withy

A Pictorial Semantics for Boethius' De Hypotheticis Syllogismis

Boethius set out a form of categorical reasoning in his De Hypotheticis Syllogismis around 520CE. This work has been almost universally ignored, despite his other logic works, such as translations of Aristotle's Categories and On Interpretation, and Porphyry's Isagoge, being the only source of classical logic for western philosophers until the Islamic translations and developments of the rest of Aristotle's Organon became available.

I provide a formal compositional semantics for the most complex part of his system of hypothetical reasoning, using only four simple principles that were available to Boethius, and Venn diagrams. The resulting system produces every inference he claims and fails to produce those he decries, for each of the forty different cases of argument forms he analyses. The underlying principles also explain why he chooses to enumerate 4, 8, or 16 different cases for each argument form where the only difference between cases is whether predicates are negated, and why some combinations of positive and negative predicates allow an argument form to produce a wider range of inferences than others. It also leads to a natural interpretation of the system as a form of categorical reasoning.

Logic and Logic

Ross T. Brady

Simple Semantics for Relevant Logics

This paper will simplify the Routley-Meyer semantics, especially for the stronger logics, by adhering to the systemic restrictions of natural deduction in the presentation of the semantics, in the process yielding a semantics that is much closer to the proof theory than standard model-theoretic semantics. The main effect will be the removal of the requirement that disjunctions $A \vee B$ must have either A or B as a witness, instead requiring that A and B be assumed so as to prove something in common, as happens in natural deduction. Similarly, an existential statement $\exists x A$ does not require an instantiation $A^{a/x}$ with a particular a as a witness, but instead $A^{a/x}$ is assumed so that a can be ultimately eliminated. We also thankfully lose the one-one correspondence between a set of additional axioms and the Routley-Meyer semantic postulates, replacing it by a single systemic condition in the $\rightarrow$-"truth"-conditions.

Previously, we have restricted consideration to the entailment-conjunction fragments of relevant logics from R down to DW, where one can maintain the standard model-theoretic presentation of the semantics. Indeed, the case of R is essentially Urquhart's semi-lattice semantics. We then added universal quantifiers and necessity. Here, we expand the simple semantics to include disjunction, existential quantification and possibility along proof-theoretic lines. Unlike in model-theory, we can either leave distribution in or out. Finally, we add negation by simply prefixing each formula with a 'T' or an 'F', giving T- and F-versions of the natural deduction rules and semantic truth-conditions.

We are left with the question: What logics are best captured by this approach? Given that the contracted negation principle, $A \rightarrow \sim A \rightarrow \sim A$, requires a special Anderson and Belnap natural deduction rule, it would be left out of this approach. So, the logics are likely to be metacomplete, either with or without distribution.

Martin Bunder

How I got into Logic via Measure Theory

This paper discusses some work, started in 1961, that led to the development of a simple system of infinite and infinitesimal numbers, that help to explain the Cantor Ternary and nonmeasurable sets. This work soon needed some basic set theory and logic and led to me joining the first MA (Hons) course in Logic at UNE in 1965.

Jacques Duparc

A Game Theoretical Proof of the Baire Grand Theorem

Inside the Baire space, we provide a new proof for the Baire lemma on pointwise convergence. This result known as Baire "grand theorem" is a representation theorem for the Baire class 1 functions. It asserts that a function f is the pointwise limit of a countable sequence of continuous functions if and only if on every non-empty closed set, f admits a point of continuity. By working with the right game theoretical setting for such functions, and using Borel determinacy, we obtain a new way of proving this result that also sheds light on possible extensions of this theorem to other Borel functions of higher complexity.

Adrian Heathcote

The Mirror Cracked: Logic and Quantum Logic

[Abstract to come]

Farida Kachapova

A Beth model for intuitionistic functionals with types

A Beth model for intuitionistic analysis was introduced by van Dalen. It is based on a tree of all finite sequences of natural numbers. A sequence is interpreted as a partial function at each node that makes a total function along each path in the tree. Lawless sequences and the theory of the "creative subject" were also interpreted in this model.

Here we generalise van Dalen's model to functionals with types using a recursive definition: a functional f of type k+1 is interpreted as a partial function from a(k)*x N to a(k) where a(k) is the set of all functionals of type k and a(k)* is the set of all finite sequences of such functionals; it is also required that f is a total function along each path in a(k)*. Starting from this definition we construct a Beth model for an intuitionistic theory LP with lawless functionals of high types and the "creative subject".

The model is constructed within a type theory I with classical logic and "almost predicative" comprehension axiom. This proves the consistency of LP with respect to I. We also construct an interpretation of I in LP, which shows the equiconsistency of the classical theory I and the intuitionistic theory LP. This was done with the purpose to contribute to the program of justifying classical mathematics from the intuitionistic point of view.