Editorial 3

The Law of Evidence and Labelled Deduction: A Position Paper 5

Funny Fragments 47

Social Software 49

Announcements 52

- Conferences 52
- New Publications 2003 58
- AiML – Advances in Modal Logic 68
- ASL – Association for Symbolic Logic 73
- FoLLI – Foundation of Logic, Language and Information 76

Conference Booklet: The Logic of Time and Modality 77

Conference Booklet: 50 Years of *Studia Logica* 89

ΦNEWS 101

Index of Names 105

ΦNEWS • Volume 4 • October 2003

Published by ΦLOG and Kluwer Academic Publishers

Edited by Vincent F. Hendricks, Stig Andur Pedersen and Dov M. Gabbay

is published by

ΦLOG
The Danish Network for Philosophical Logic and Its Applications

Department of Philosophy and Science Studies
Roskilde University, P6
P.O. Box 260
DK4000 Roskilde, Denmark
Phone: (+45) 4674 2343 Fax: (+45) 4674 3012
Website: http://www.phinews.ruc.dk
Website: http://www.philog.ruc.dk

and

Kluwer Academic Publishers

P.O. Box 17
3300 AA Dordrecht, The Netherlands
Website: http://www.wkap.nl

Edited by
Vincent F. Hendricks (Editor-in-chief, vincent@ruc.dk)
Stig Andur Pedersen (Editor-in-chief, sap@ruc.dk)
Dov M. Gabbay (Editor-in-chief, dg@dcs.kgs.ac.uk)

Managing editor: Pelle Guldborg Hansen (pgh@ruc.dk)

Volume 4, October 2003

Visit

http://www.phinews.ruc.dk

for a free subscription

Concept, LaTeX 2ε-Layout, Graphics and Sleeve Designs by Vincent F. Hendricks
Backcover illustration by Henrik Capetillo
Typeset in LaTeX 2ε
Printed by Roskilde University Press, Denmark 2003
Sleeve printed by Grønager's – Grafisk Produktion AS, Denmark 2003
ISSN 1602-1444
© 2003 by Vincent F. Hendricks, Stig Andur Pedersen, Dov M. Gabbay, ΦLOG and Kluwer Academic Publishers
ΦLOG is sponsored by The Danish Research Council for the Humanities

EDITORIAL

Welcome to the fourth volume of ΦNEWS—The Free Newsletter for Philosophical Logic and Its Applications, published jointly by ΦLOG—The Danish Network for Philosophical Logic and Its Applications and Kluwer Academic Publishers. ΦLOG is sponsored by The Danish Research Council for the Humanities.

ΦNEWS is published biannually. The newsletter is freely distributed to subscribers and an on-line copy may be obtained from the ΦNEWS website at

`http://www.phinews.ruc.dk`

It is first of all with great pleasure that we welcome Prof. Dov M. Gabbay (King's College, London) as one of the editors of ΦNEWS.

Volume 4 includes a position paper entitled 'The Law of Evidence and Labelled Deduction', announcements of upcoming conferences held under the ΦLOG auspieces – in particular the conference entitled *Social Software*, scheduled for the spring 2004, new and forthcoming publications, upcoming conferences in general, and announcements from AiML – Advances in Modal Logic, ASL – Association for Symbolic Logic, and FoLLI – Foundation of Logic, Language and Information.

This volume finally holds two conference booklets for respectively *The Logic of Time and Modality*, Roskilde University, October 31–November 1, 2003, and *Trends in Logic: 50 Years of Studia Logica*, The Carlsberg Academy, November 20–22, 2003. Be sure to keep this volume of ΦNEWS as your conference navigator if you are attending any of these ΦLOG events.

The next volume of ΦNEWS is scheduled for April 2004. ΦNEWS publishes contributions in terms of expositional papers, announcements of workshops, seminars, conferences, forthcoming publications, new initiatives and other material within the aim and scope of the newsletter. Send your written contribution (preferably in TEX, LATEX, LATEX 2_ε) to either one of the ΦNEWS editors. Contact information, and additional information on how to submit material, is available on page 101.

October, 2003
Vincent F. Hendricks
Stig Andur Pedersen
Dov M. Gabbay
Editors

BOOK SERIES:
TRENDS IN LOGIC 18

Hardbound
ISBN 1-4020-1270-5
May 2003, 308 pp.
€ 104.00 / $ 100.00 / £ 67.00

Sign up to Kluwer Alert by sending your details to Jasper.deVaal@wkap.nl and you will get a 50% DISCOUNT on:

Logic for Concurrency and Synchronisation

Edited by
Ruy J.G.B. de Queiroz *Universidade Federal de Pernambuco, Recife, Brazil*

This book is for researchers in computer science, mathematical logic, and philosophical logic.

Sign up to Kluwer Alert and get a 50% discount! Contact: Jasper.deVaal@wkap.nl

The study of information-based actions and processes has been a vibrant interface between logic and computer science for decades now. The individual chapters of this book show the state of the art in current investigations of process calculi with mainly two major paradigms at work: linear logic and modal logic. Viewed together, the chapters also offer exciting glimpses of future integration with obvious links including modal logics for proof graphs, labelled deduction merging modal and linear logic, Chu spaces linking proof theory and model theory and bisimulation-style equivalences for analysing proof processes.

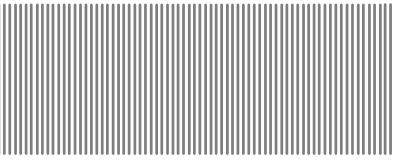
The combination of approaches and pointers for further integration also suggests a grander vision for the field. In classical computation theory, Church's Thesis provided a unifying and driving force. Likewise, modern process theory would benefit immensely from a synthesis bringing together paradigms like modal logic, process algebra, and linear logic.

If this Grand Synthesis is ever going to happen, books like this are needed!

Contact information:
Charles Erkelens
PHILOSOPHY OF SCIENCE AND LOGIC
E charles.erkelens@wkap.nl
T +31 78 65 76 387

Floor Oosting
PHILOSOPHY AND RELIGIOUS STUDIES
E floor.oosting@wkap.nl
T +31 78 65 76 205

Visit www.wkap.nl/prod/b/1-4020-1270-5 for more information



kluwer
the language of science

THE LAW OF EVIDENCE AND LABELLED DEDUCTION: A POSITION PAPER

DOV M. GABBAY
Department of Computer Science
King's College London – Strand, UK
dg@dcs.kcl.ac.uk

JOHN WOODS
Department of Philosophy
University of British Columbia, Vancouver, BC, Canada
jhwoods@interchange.ubc.ca
&
Department of Computer Science
King's College London – Strand, UK
woodsj@dcs.kcl.ac.uk

ΦNEWS

ABSTRACT

The purpose of this position paper is to reveal, through examples, the potential for collaboration between the theory of legal reasoning on the one hand, and some recently developed instruments of formal logic. Three zones of contact are highlighted.

1. The law of evidence, in the light of labelled deductive systems (LDSs), discussed through the example of the admissibility of hearsay evidence.
2. The give and take of legal debate in general, and regarding the acceptability of evidence in particular, represented using the abstract systems of argumentation developed in logic, notably the coloured graphs of Bench-Capon. This is considered through an imaginary example.
3. The use of Bayesian networks as tools for analysing the effects of uncertainty on the legal status of actions, illustrated via the same example

These three kinds of technique do not exclude each other. On the contrary, many cases of legal argument will need the combined resources of all three.

1 Background: Logic and Law

In the past thirty years major changes in logic have taken place. Whereas in the first half of the last century logic was mainly applied to mathematics and philosophy, the rise of computer science, artificial intelligence, computational and logical linguistics, logic in engineering, and quantum computation have given logic a big push and accelerated its evolution. All of this is well known and has been discussed in various places [19, 20, 38]. What has not been sufficiently discussed is the influence and interaction of these developments on the area of logic and law.

Consider, for example, the way logic has evolved in response to the needs of computer science, AI and theories of language. They have to do with daily human behaviour, reasoning and action. These areas deal with devices and artifacts that help and or replace the human in his daily activities.

Logic is needed partly as the underlying formal language and partly to model and analyse the human in these daily activities, with a view to producing better devices to serve, regulate or understand him.

The authors have already embarked on a multi-volume research effort entitled *A Practical Logic of Cognitive Systems*. The first volume, *Agenda Relevance: A Study in Formal Pragmatics* [21] has already been published. The second volume [22], on *The Reach of Abduction: Insight and Trial* is soon to follow. These books aim to model the human in his daily reasoning and action activities.

Once logic has evolved in this direction and has developed new logical tools for this purpose, these same kind of new logics and new tools can usefully be adapted to the consideration of similar issues in the law.

Here lies the connection between logic and law. We can say without serious exaggeration that the interface of logic and law is going to be central to the further advancement of logic in the next twenty years. If only we can bring the respective communities together and make them aware of their potential! This is the purpose of this position paper.

We envisage the following main benefits to the law community, in addition to the benefits from existing logical tools and aids available from Artificial Intelligence.

- The proper LDS logic tailored for law of evidence and other judicial arguments can help articulate and clarify (hidden) intuitive common sense principles behind existing practices.
- The LDS methdoology includes a system of labelling and stylised hierarchical movements which have logical content. This kind of hierarchy can be added to legal specification formats thus giving a better specification language for law without sacrificing the use of ambiguities and variety of interpretations.

It is astonishing to realize that very few people are aware of the true potential of the interaction of the new logics and law. There are many reasons for that, most of them social. The new developments in logic are slow to spread around even among logicians, and certainly among researchers in legal reasoning and legal theory, many of whom still think of "logic" as "Aristotlian syllogism".[1]

Some bridging work between law and logic has been done by C.H. Perelman [30], who kept in touch with both logicians and judges and lawyers, arguing that logic should play a different — more restricted — role. But when Perelman wrote, the new logical tools were not as available as they are now; and such as were available, Perelman made no use of.

The rise of Horn clause logic programming in the 1980s has helped turn some logicians in the direction of the law, but early attempts to apply logic to law, such as the formalisation of the British Nationality Act [34], has drawn a strong critical reaction from the law community on the ground that Horn clause logic is not rich enough to allow for the wealth of nuances and interpretations/explanation/ revision so common in legal reasoning. See also [1] by Judge Ruggero J. Aldisert.

This criticism may have been valid in 1980, it is no longer valid now, especially in view of many advances made in logics of practical reasoning and argumentation.

Logic programmers and deontic logicians have had a somewhat earlier interest in law, have their own conferences and journals [14]. But we doubt if they are aware as a community of all relevant developments in logic. They appear not to realize (or believe) that law is an area of potentially evolutionary significance to logic.

We recommend to the reader survey works by two key researchers in the area, Trevor Bench-Capon's [10] survey article for the *Encyclopaedia of Computer Science and Technology* and Henry Prakken's book [31], *Logical Tools for Modelling Legal Argument*. Prakken's book, especially, takes note of many of the new developments in logic, and argues very strongly in favour of the theoretical connectedness of logic and

[1] It is instructive to read the following passage on legal reasoning from the July 2003 edition of a basic textbook on legal philosophy, widely taught in the UK (J. W. Harris, *Legal Philosophies*, p 213): "It is far from easy to get a comprehensive view of the subject [of legal reasoning]. Most writers who have discussed legal reasoning have either concentrated on the form as distinct from the substance of justificatory arguments, or else dealt with only part of the subject. Two forms of argument, the deductive and the inductive, have generally been considered inapposite characterizations of legal argument. Some take the view that deductive argument – from major and minor premises to a logically necessary conclusion – is inappropriate even in clear cases. This may be asserted on the general ground that deductive arguments only hold true of factual propositions not of norms; or on the more specific ground that even the clearest rule may be held not to apply to a case where that would frustrate the purpose of the law or produce absurd consequences, and the decision whether this so or not cannot be dictated by logic. On the other hand, reasoning in clear cases seems very close to deductive reasoning – here is a speed-limit rule applying to all car drivers, I am a car driver, so it applies to me. Even in unclear cases, it can be contended that the form of the argument is deductive, since what is at issue is which of competing rulings should be adopted, granted that the winner will be applied deductively in all cases of the present type – although here our major concern will be with the substantive arguments which dictate choice among the rulings.

law. He especially highlights the new developments in defeasible and non-monotonic logics and reasoning from inconsistent data. However, he is unaware of the methodology of labelled deductive systems which subsumes the logic of legal reasoning, among many others, as a special case. More importantly, Prakken believes that 'logic should be regarded as a tool rather than as a model of reasoning', [31, Section 1.4]. Furthermore, the entire approach to date of the community to logic and law is further restricted by the view that [31, p. 6]:

> To understand the scope of the present investigations it is important to be aware of the fact that the information with which a knowldge-based system reasons, as well as the description of the problem, is the result of many activities which escape a formal treatment, but which are essential elements of what is called 'legal reasoning'. In sum, the only aspects of legal reasoning which can be formalised are those aspects which concern the following problem: *given* a particular interpretation of a body of information, and *given* a particular description of some legal problem, what are then the general rational patterns of reasoning with which a solution to the problem can be obtained? With respect to this question one remark should be made: I do not require that these general patterns are deductive; the only requirement is that they shold be formally definable.

Thus modelling the legal theory of evidence (which decides what 'body of information' we are 'given') is beyond the horizon of current research in logic and law. In what follows, on the contrary, we shall develop a case study that will show just how important this area is.

A recent key collection of papers by Marylin MacCrimmon and Peter Tillers [29] indicates very lively activity in law and logic. However, most of the papers take a fuzzy logic, uncertainty and probabilistic approach (in the sense of [35, 24]. See also [32] and the references there.

We must here add that the Bayesian reasoning community is actively involved in (Bayesian) logic and law. This is because of several high visibility court cases and evidence where probabilities are used. Part of the problem is that the probabilistic reasoning community is not so interactive with the ordinary logic communities (and so we also need to bring logic and probability together as part of our own ongoing work). The theory of Labelled Deductive Systems is fully compatible with probabilistic reasoning and networks.

We shall have a full discussion of [29] in the full version of this paper.

In the sections to come we examine some case studies to show how the new logics can play a role in the area of evidence and legal reasoning.

2 Legal Theory of Evidence and the New Logics

Our purpose here is to show how the new labelled logics, arising from research in computer science, can be applied to the legal theory of evidence. For a sample of Labelled Deductive Systems, see [18]. For the original monograph, see [15].

2.1 Some Labelled Logic

We start with logic. One of the most well known resource logics is linear logic [23]. In this logic, the databases are multisets of formulas and each item of data must be used *exactly once*. So, for example, we have

$$A, A \to B \vdash B$$

But

$$A, A \to (A \to B) \nvdash B$$

This is because two copies of A are needed here, and we have only one. The proof would run as follows:

1. $A \to (A \to B)$, assumption
2. A, assumption
3. $A \to B$, from 1 and 2 using the rule of modus ponens.
4. B, from 1 and 3, using the rule of modus ponens.

In this proof, 2. is used twice.
To make this example more concrete, let

- $A =$ having a drunken driving conviction
- $B =$ driving licence suspended.

Then $A \to (A \to B)$ means that two convictions entail suspension (and of course you cannot count the same conviction twice!).

Linear logic allows for the connective $!A$, which means that A can be used as many times as needed.

Thus

$$!A, A \to (A \to B) \vdash B.$$

Let us modify the logic a bit[2] and add the connective $\heartsuit A$: $\heartsuit A$ means that we can use A if we ask and get permission from some meta-level authority. So we can write

$$\heartsuit A, A \to (A \to B), \text{ permission given } \vdash B.$$

There is a mixing here of object level and meta-level features. Such logics are best expressed as labeled deductive systems (LDS) [15, 18]. A labelled system is

[2] See footnote 17 for an anagram example.

comprised of formulas and labels. The labels contain additional information relating to the formulas. For example an item of data (called a *declarative unit*) may have the form

$$\Delta : \text{ John has cancer.}$$

Δ can be a medical file with data confirming the fact that John has cancer. This fact can be used in certain situations of legal argument; e.g. to attempt to release John from prison. The reasoning governing Δ is medical, while the reasoning governing the release from prison is legal. Labelled logic is the methodology of how to use such mixed reasoning.

We have in LDS the following form of modus ponens:

$$\frac{t : X, s : X \to Y, \varphi(s,t)}{f(s,t) : Y}$$

Here t, s are labels (their nature and mode of handling are defined in the system), which can be themselves entire databases; φ is meta-predicate indicating that there is the permission to apply modus ponens (φ is called the compatibility predicate); and f is a function giving the new label of the result Y.

Going back to our example, we write

1. $s : (A \to (A \to B))$, where s represents here a body of legal background data on how the substantive law of
" two drunken driving convictions $\to$ licence suspended"
has been established.
2. $t : A$, where t is a file indicating the data establishing the facts of the drunken driving incident.
3. $\varphi(s,t)$ is a meta-level argument looking into s and t and arguing that, although we have here only *one* incident of drunken driving, the intention of law (see file s) and the severe circumstances of the incident (see file t) call for suspension (that is, permission to count as two incidents is granted).
4. $f(s,t) : A \to B$, by modus ponens from (1), (2), (3).
$f(s,t)$ is a file containing the arguments present in granting permission, i.e. $f(s,t) = t + s + \varphi$
5. $f(s,t) : B$, by modus ponens from (4) and (5).
So formally, we have $f(f(s,t),t) = f(s,t)$.

We now show a further connection with the law of evidence.

One important feature of LDS is that it regulates the admissibility of data into the database together with the label it is permitted to have. In fact, using φ we can diplomatically admit a datum D into the database with a label "don't touch", with the effect that φ will never give permission to use it.

These kinds of logics were developed to accommodate the needs of artificial intelligence and the logic ofin language. It is surprising how well these logics fit the needs of theories of evidence.

Imagine a database (Barclays Bank) containing data about a customer. One kind of data includes home telephone number, mobile telephone number, etc. Assume hat a security protocol will allow only certain individuals at the Bank to enter such data and it is up to them to decide whether to 'admit' an additional number. Suppose I call Barclays bank, identify myself and ask the represenative to add my mobile number to the database. The representative will ask me some questions (usually mother's maiden name). If correct answers are given, he will add (admit) the additional telephone number. If he is still uncomfortable with my identity (for whatever reasons) he can refuse to do so. We doubt, however, that he has the authority to decide to accept the phone number even if we fail to answer the questions correctly. In other words, security protocols allow the representative to refuse admissible data but do not allow him to overrule and accept non-admissible data!

2.2 What Some Books on Evidence Say

Let us go to the website and to the book of Professor Steve Uglow. He teaches evidence at the University of Kent (www.kent.ac.uk/law/spu/), established the law school there, and is actively involved with the community and its problems.

In his web course notes, right at the beginning, he says:

"Evidence is about regulating the information produced at a trial.

- What are the general principles regarding this?
- What are exclusionary rules?
- What logical processes are involved?"

In our labelled logic we can phrase these points as

- With what label do we insert the new data (evidence) in our database?

The challenge of this area to the research community is made clear at the very first paragraph of Uglow's 725-page book on evidence [36] (*Textbook on Evidence*, 1997)

> "The law relating to evidence is a strange and unruly beast. It is unruly because, first, it refuses to fit into any easy structure for analysis and exposition and, second, it often adopts the characteristics of an uncharged minefield, by which is meant that any set of facts has the potential of throwing up evidential problems, not just of one but of several types, often unforeseen. It is strange because it fulfils different functions than the familiar areas of substantive law. It is in such areas that we see legal rules at their most visible, dealing with the *consequences* of facts – if a contract is broken, damages are paid; if a theft is committed, punishment is imposed. Damages, imprisonment and other civil

and criminal remedies are the sanctions accompanying rules which require or prohibit certain types of conduct or which lay down conditions under which that conduct can take place. These rules are often referred to as the substantive law. Within most contested trials, such rules form the background to the case but play little part since there is no conflict over the substance of the rule. We know what the rule says and what the consequences of a breach will be: if there has been a road accident and a driver has been negligent, damages for personal injuries will be paid to any plaintiff; if a sane defendant intentionally kills another person, he or she will be prosecuted and generally receive a life sentence.

But the real conflict in a court, before any substantive rule is brought to bear, is about establishing the facts: was the driver negligent? Did the defendant cause the victim's death? What happened? The law of evidence is not about determining the consequences of facts but about establishing those facts. In a contested trial, under the common law system of justice, the opposing parties will present differing, sometimes diametrically opposed, views of the same event. Having listened to these accounts, the trier of fact must decide what the facts are. It is this problem as to how 'facts' are established with which the law of evidence is concerned: what information can be presented to the court' through what means; how does a court decide whether that information proves whether an event happened in a particular way or not? Such rules, alongside the rules of civil and criminal procedure, can be described, not as *substantive*, but as *adjectival* law.[3] This means that these rules attach themselves to and qualify the operation of a substantive rule but never, by themselves, directly decide the rights and wrongs of any issue. The law of evidence qualifies the operation of a substantive rule because it controls the flow and nature of the information which can be presented to the court. Indirectly, of course, the law of evidence can be decisive since the outcome of a case can depend on whether a particular item of evidence is allowed to be presented to the court or not. For

[3] This is our footnote. Note that a substantive law in labelled logic looks like $s : A \to (A \to B)$. Facts look like $t : A$. We can also have other testimony allowing for $t' : \neg A$. The rule that decides in *LDS*, whether to deduce A or $\neg A$ given say, $t_1 : A, t_2 : A, t_3 : \neg A$ is called a *flattening rule*. More precisely, a flattening rule tells us, given $t_i : A$ and $s_j : \neg A$, what is the resultant labels $t : A$ and $s : \neg A$. So, for example, if t_i, s_j are reliability measures of various sources supporting A and $\neg A$ respectively, t and s might be some averages. What Professor Uglow calls here *Adjectival Law*, means in LDS the logic for reasoning *inside* the label t. For example, t may contain medical evidence and a lawyer may attack that! If we take our example; Δ : John has cancer, Δ may be a medical file about John. Δ may contain among other things an expert opinion of a certain Dr. Smith, giving a statement $\Gamma : X$, there X is the Doctor's statement and Γ is another file showing Dr.Smith is a world expert on this kind of cancer. A lawyer wishing to attack Δ might choose to attack Γ (i.e. Dr. Smith's credentials are false), thus weakening the value of X and overall weakening Δ. So we have a structure like

example, a guilty verdict or an acquittal can hang on whether the prosecution can meet the preconditions for the admissibility of a confession in a criminal trial; in a civil case where the weight of the evidence is evenly balanced, the decision may hinge on the question as to where the burden of proof rests.
Many of these evidential issues seem very technical to a layperson and, especially in criminal trials, to exclude relevant and important information from the proceedings. Examples might be given of the rule against the admission of hearsay evidence – a witness would be usually prevented from testifying that the victim, now dead, had identified the accused as the assailant; similarly the jury would rarely be allowed to hear about any previous convictions of the defendant. But these are not technicalities for their own sake and reflect the nature and characteristics of the common law trial."

Put in the language our own LDS, what Uglow is saying right at the beginning of his textbook is that:
Given the situation

$$t : A, s : A \to B$$

he calls $A \to B$ "substantive law", (in logic it is called a "rule" or a "ticket"), and calls A the facts (called minor premises in logic), then the main part of the theory of evidence is whether to admit A into the database (i.e. establish A as a fact) and with what label t? t may be a label supporting A and what the book calls "adjectival law" is the theory (logic) of evidence.

There is no doubt that the new labelled logics have a role to play in taming this "strange and unruly beast".

Here now is another basic textbook on evidence [13], I. H. Dennis, *Law of Evidence*, 1999.[4] He says (pages 4–6)

B. Concepts and Terminology

The law of evidence uses a number of concepts which are fundamental to an understanding of the subject. This section attempts to introduce these concepts

$$\Delta = \boxed{\equiv \quad \Gamma = \boxed{\equiv} : X \quad \equiv} : \text{John has cancer}$$

[4] Professor Dennis teaches at University College London. He also says in his introduction "Evidence is a notoriously difficult subject to organize in any logical basis".

by stating a number of general propositions about them and about their relationships. The propositions are stated in summary form, with more detailed explanation given later.

1. Evidence must be *relevant* in order for a court to receive it. This means that it must relate to some fact which is a proper object of proof in the proceedings.[5] The evidence must relate to the fact to be proved in the sense that it tends to make the existence (or non-existence) of the fact more probable, or less probable, than it would be without the evidence. A simple example is a case where a fact to be proved is the identity of the accused as the person who stole certain goods. Evidence that the goods were found in the accused's house is relevant because it makes the existence of the fact that he is the thief more probable.

2. Evidence must also be *admissible*, meaning that it can properly be received by a court as a matter of law. The most important rule of admissibiltiy is that the evidence must be relevant; irrelevant evidence is always inadmissible. Generally speaking evidence that is relevant is also admissible, but certain rules of law prohibit the reception of certain types of evidence, even though the evidence is relevant. An example is the rule against hearsay evidence, which, broadly speaking, forbids the reception of evidence of a statement made by a person on another occasion when the purpose of adducing[6] the evidence is to ask the court to accept that the statement was true. These rules are often called the *exclusionary rules*, to indicate their function of excluding certain evidence from the court's consideration. The rules are complex because they are often accompanied by exceptions, some of which may be narrow and precisely defined, others may be in broad and flexible terms.

3. In criminal cases, in addition to exclusionary rules, there is also *exclusionary discretion*. A trial judge may exclude prosecution evidence that is relevant and admissible (in the sense that it is not excluded by an exclusionary rule) in the exercise of a discretion conferred on him by the common law or by section 78 of the Police and Criminal Evidence Act 1984 (PACE). The statutory discretion is to prevent the admission of the evidence from adversely affecting the fairness of the proceedings. The main application of the common law discretion is to exclude evidence the prejudicial effect of which outweighs its probative value. Probative value refers to the potential weight of the evidence (see next paragraph), whereas prejudicial effect refers to the tendency of evidence to prejudice the court against the accused, so as to lead the court to

[5] The facts which are proper objects of proof are sometimes called material facts, but materiality is a slippery term which can be used with more than one meaning. See the discussion in the text below.

[6] "Adducing" evidence is a term often used to denote the process of presenting evidence to a court in one of the approved forms, most commonly in the form of the testimony of a witness.

make findings of fact against him for reasons not related to the true probative value of the evidence.

4. At the end of a contested trial the court will have to evaluate the relevant and admissible evidence that it received. The *weight* of the evidence is the strength of the tendency of the evidence to prove the fact or facts that it was adduced to prove. This is a matter for the tribunal of fact to decide. In civil cases the judge who tries the case is generally the judge of issues of both law and fact. In criminal cases the tribunal of fact is different according to whether the case is tried on indictment or summarily. The jury is the tribunal of fact for cases tried on indictment. In summary trial the magistrates (justices) deal with issues of both law and fact; lay magistrates have the guidance of their clerk on questions of law. This book uses the term "factfinder" to refer generally to a tribunal of fact, unless the context requires a specific reference to a judge, jury or magistrate. When a factfinder has to determine the weight of evidence it will examine carefully, amongst other things, the *credibility* and *reliability* of the evidence. These terms are not always used with a consistent meaning. Credibility is most commonly used in connection with the testimony of a witness and refers to the extent to which the witness can be accepted as giving truthful evidence in the sense of honest or sincere testimony. Reliability refers most commonly to the truthfulness of testimony in the sense of its accuracy. Honest witnesses may sometimes give evidence that is inaccurate; mistaken evidence of identification by eyewitnesses is a classic example.

Note here the central role played by the notion of *relevance*. This is also an AI and natural language concept. It is no accident that the first book of our series of books on cognitive systems is a book on relevance [21].

3 Case Study: Hearsay Case, *Myers v DPP*

We begin by quoting from [2, p. 133].

A good statement of the hearsay rule was given originally in *Cross on Evidence*, [12]: "An assertion other than one made by a person while giving oral evidence in the proceedings is inadmissible as evidence of any fact asserted". Allen continued on page 135:

> "Hearsay law has been described as 'exceptionally complex and difficult to interpret' [33]. What we need is a method of approach to the subject which will enable us to understand why some cases were decided as they were and why others are open to criticism. Above all, we need a technique [our comment: i.e. logic] for thinking about hearsay, ...'.

We now examine a key case, which seems to be quoted in every textbook on Evidence (and hearsay). This is a case of *written statements*, which may fall under hearsay law.

We quote two descriptions of this case, one from [28] and one from [36], and then we model the arguments as quoted in [36].

We begin with [28, pp. 250–252]

> *(b) Written statements*
> The leading case on written hearsay is *Myers v DPP* ([1965] AC 1001). The appellant was convicted of offences relating to the theft of motor cars. He would buy a wrecked car, steal a car resembling it, disguise the stolen car so that it corresponded with the particulars of the wrecked car as noted in its log book, and then sell the stolen car with the log book of the wrecked one. The prosecution case involved proving that the disguised cars were stolen by reference to the cylinder-block numbers indelibly stamped on their engines. In the case of some cars, therefore, they sought to adduce evidence derived from records kept by a motor manufacturer. An officer in charge of these records was called to produce microfilms which were prepared from cards filled in by workmen on the assembly line and which contained the cylinder-block numbers of the cars manufactured. The Court of Criminal Appeal held that the trial judge had properly allowed the evidence to be admitted because of the circumstances in which the record was maintained and the inherent probability that it was correct rather than incorrect. The House of Lords held that the records constituted inadmissible hearsay evidence. The entries on the cards and contained in the microfilms were out-of-court assertions by unidentifiable workmen that certain cars bore certain cylinder-block numbers. The officer called could not prove that the records were correct and that the numbers they contained were in fact the numbers on the cars in question. Their Lordships, however, were divided as to whether the evidence should be admitted by the creation of a new exception to the hearsay rule.[7] Lords Pearce and Donovan were in favour of such a course, but the majority, comprising Lords Reid, Morris and Hodson, declined to do so, being of the opinion that it was for the legislature and not the judiciary to add to the classes of admissible hearsay.[8] It was argued before the House that the trial judge has a discretion to admit a record in a particular case if satisfied that it is trustworthy and that justice requires its admission. Lord Reid, while acknowledging that the hearsay rule

[7] The Lords were unanimous in dismissing the appeal on the grounds that the other evidence of guilt being overwhelming, there had been no substantial miscarriage of justice.

[8] The minority view, that it was within the provenance of the judiciary to restate the exceptions to the hearsay rule, was adopted by the Supreme Court of Canada in *Ares v Venner* [1970] SCR 608. See also per Lord Griffiths in *R v Kearley* [1992] 2 All ER 345, HL at 348.

was 'absurdly technical', held that 'no matter how cogent particular evidence may seem to be, unless it comes within a class which is admissible, it is excluded . . . '

The actual decision in *Myers v DPP* was reversed by the Criminal Evidence Act 1965, which provided for the admissibility of certain hearsay statements contained in trade or business records. Although the 1965 Act was repealed by the Police and Criminal Evidence Act 1984, ss 23 and 24 of the Criminal Justice Act 1988 are wider in scope than the provisions of the 1965 Act and provide for the admissibility of first-hand hearsay statements in documents generally as well as hearsay statements contained in documents created or received by a person in the course of, inter alia, a trade or business. The principles enunciated in *Myers v DPP*, however, remain of importance in relation to hearsay statements falling outside the statutory exceptions. Over 25 years later, another majority of the House of Lords, in *R v Kearley*,[9] although of the opinion that there may be a case for a general relaxation of the hearsay rule, affirmed the majority view in *Myers v DPP* that the only satisfactory solution is legislation following on a wide survey of the whole field.

Patel v Comptroller of Customs[10] also illustrates the application of the hearsay rule to written statements. The appellant was convicted of making a false declaration in an import entry form concerning certain bags of seed. Evidence was admitted that the bags of seed bore the words 'Produce of Morocco'. The Privy Council held that the evidence was inadmissible hearsay and advised that the conviction be quashed. The decision may be usefully compared with that in *R v Lydon*.[11] The appellant, Sean Lydon, was convicted of robbery. His defence was one of alibi. About one mile from the scene of the robbery, on the verge of the road which the getaway car had followed, were found a gun and, nearby, two pieces of rolled paper on which someone had written 'Sean rules' and 'Sean rules 85'. Ink of similar appearance and composition to that on the paper was found on the gun barrel. The Court of Appeal held that evidence relating to the pieces of paper had been properly admitted as circumstantial evidence: if the jury were satisfied that the gun was used in the robbery and that the pieces of paper were linked to the gun, the references to Sean could be a fact which would fit in with the appellant having commited the offence. The references were not hearsay because they involved no assertion as to the truth of the contents of the pieces of paper: they were not tendered to show

[9] [1992] 2 All ER 345, HL, per Lords Bridge, Ackner and Oliver at 360–361, 366 and 382–383 respectively.

[10] [1966] AC 356, PC. See also *R v Sealby* [1965] 1 All ER 701 and *R v Brown* [1991] Crim LR835, CA (evidence of a name on an appliance inadmissible to establish its ownership); and cf *R v Rice* [1963] 1 QB 857, below.

[11] [1987] Crim LR 407, CA.

that Sean ruled anything.[12]

If we go 480 pages into Steven Uglow's book [36], we find his account of the same case.

> "*written statements*: the classic case here is *Myers v DPP* ([1964] 2 All E.R. 877) where the defendant bought wrecked cars for their registration certificates. He would then steal a similar car and alter it to fit the details in the document. He would sell the disguised stolen car along with the genuine log book of the wrecked car. The prosecution sought to show that the cars and registration documents did not match up by reference to the engine block numbers and introduced microfilm evidence kept by the manufacturer, showing that this block number did not belong in a car of this registration date. The microfilm was prepared from cards which were themselves prepared by workers on the assembly line. Lord Reid in the House of Lords held that the microfilm was inadmissible since it contained the out-of-court assertions by unidentified workers."

The labelled structure of the above is as follows.

Let

- $t : C$ The numbers assigned to the cars by the manufacturers are $x_1, x_2, \ldots$
- $t' : C'$ The numbers in the cars' logbook are $y_1, y_2, \ldots$.

If $x_i \neq y_i$, then we get:

- $t + t' : C'' =$ the numbers on the cars and numbers on the registration documents do not match

where

- $t =$ description of how the microfilm supporting C was obtained and compiled.
- $t' =$ the cars' logbooks.

[12] See also *R v McIntosh* [1992] Crim LR 651, CA (calculations as to the purchase and sale prices of 12 oz of an unnamed commodity, not in M's handwriting but found concealed in the chimney of a house where he had been living, admissible as circumstantial evidence tending to connect him with drug-related offences); and cf *R v Horne* [1992] Crim LR 304, CA (documents of unknown authorship, referring to H, containing calculations possibly relating to the cost of importing drugs, and found in the flat of a co-accused to which H was supposed to deliver the drugs, inadmissible against H). *R v McIntosh* was applied in *Roberts v DP* [1994] Crim LR 926, DC: documents found at R's offices and home, including repair and gas bills and other accounts relating to certain premises, were admissible as circumstantial evidence linking R with those premises, on charges of assisting in the management of a brothel and running a massage parlour without a licence.

The candidate item of data for admissibility is

- $t : C$.

The following passage is Lord Reid's argument that $t : C$ should be inadmissible, i.e. Lord Reid wants to argue that t should also contain the phrase "do not use me".

This is done in the logic of the labels. In other words, Lord Reid's argument has to do with the data inside t.

Here is Lord Reid's argument (technically it is part of t). It also quotes the arguments given in favour of admitting $t : C$.

> ***Myers v DPP*** **[1964] 2 All E.R. 877 at 886b–887h, *per* Lord Reid**
>
> It is not disputed before your Lordships that to admit these records is to admit hearsay. They only tend to prove that a particular car bore a particular number when it was assembled if the jury were entitled to infer that the entries were accurate, at least in the main; and the entries on the cards were assertions by the unidentifiable men who made them that they had entered numbers which they had seen on the cars. Counsel for the respondents were unable to adduce any reported case or any textbook as direct authority for their submission. Only four reasons for their submission were put forward. It was said that evidence of this kind is in practice admitted at least at the Central Criminal Court. Then it was argued that a judge has a discretion to admit such evidence. Then the reasons given in the Court of Criminal Appeal were relied on. And lastly it was said with truth that common sense rebels against the rejection of this evidence.
>
> At the trial counsel for the prosecution sought to support the existing practice of admitting such records, if produced by the persons in charge of them, by arguing that they were not adduced to prove the truth of the recorded particulars but only to prove that they were records kept in the normal course of business. Counsel for the accused then asked the very pertinent question — if they were not intended to prove the truth of the entries, what were they intended to prove? I ask what the jury would infer from them: obviously that they were probably true records. If they were not capable of supporting an inference that they were probably true records, then I do not see what probative value they could have, and their admission was bound to mislead the jury.
>
> The first reason given by the Court of Criminal Appeal for sustaining the admission of the records was that, although the records might not be evidence standing by themselves, they could be used to corroborate the evidence of other witnesses.[13] I regret to say that I have great difficulty in understanding that

[13] This is our footnote. "corroborate evidence of other witnesses" means in our LDS language "help with the flattening process".

. . . Unless the jury were entitled to regard them, I can see no reason why they should only become admissible evidence after some witnesses have identified the cars for different reasons . . .[14]

At the end of their judgement, the Court of Criminal Appeal gave a different reason. 'In our view the admission of such evidence does not infringe the hearsay rule because its probative value does not depend upon the credit of an unidentified person but rather on the circumstances in which the record is maintaned and the inherent probability that it will be correct rather than incorrect.' That, if I may say so, is undeniable as a matter of common sense. But can it be reconciled with the existing law? I need not discuss the question on general lines because I think that this ground is quite inconsistent with the established rule regarding public records. Public records are prima facie evidence of the fact which they contain but it is quite clear that a record is not a public record within the scope of that rule unless it is open to inspection by at least a section of the public. Unless we are to alter that rule how can we possibly say that a private record not open to public inspection can be prima facie evidence of the truth of its contents? I would agree that it is quite unreasonable to refuse to accept as prima facie evidence a record obviously well kept by public officers and proved never to have been discovered to contain a wrong entry though frequently consulted by officials, merely because it is not open to inspection. But that is settled law. This seems to me to be a good example of the wide repercussions which would follow if we accepted the judgement of the Court of Criminal Appeal. I must therefore regretfully decline to accept this reason as correct in law.

In argument, the Solicitor-General maintained that, although the general rule may be against the admission of private records to prove the truth of entries in them, the trial judge has a discretion to admit a record in a particular case if satisfied that it is trustworthy and that justice requires its admission. That appears to me to be contrary to the whole framework of the existing law. It is true that a judge has a discretion to exclude legally admissible evidence if justice so requires, but it is a very different thing to say that he has a discretion to admit legally inadmissible evidence. The whole development of the exceptions to the hearsay rule is based on the determination of certain classes of evidence as admissible or inadmissible and not on the apparent credibility of particular evidence tendered. No matter how cogent particular evidence may seem to be, unless it comes within a class which is admissible, it is excluded. Half a dozen witnesses may offer to prove that they heard two men of high character who

[14] Our footnote: i.e. $u_1 : X$ is admissible only if some other $u_2 : X$ is already admissible. See objection $s_{3,2}$ below. LDS allows formally for putting item $u_1 : X$ in the database in such a way that it can be used only in the flattening process to support other items but not in deduction.

cannot now be found discuss in detail the fact now in issue and agree on a credible account of it, but that evidence would not be admitted although it might be by far the best evidence available.
It was admitted in argument before your Lordships that not every private record would be admissible. If challenged it would be necessary to prove in some way that it had proved to be reliable, before the judge would allow it to be put before the jury. And I think that some such limitation must be implicit in the last reason given by the Court of Criminal Appeal. I see no objection to a judge having a discretion of this kind though it might be awkward in a civil case; but it appears to me to be an innovation on the existing law which decides inadmissibility by categories and not by apparent trustworthiness ...

Structure of Lord Reid's argument

$\Delta_1 : N$	=	number on car A is a (when assembled), and Δ_1 is the support of the claim
Δ_1	=	description of procedures of entering numbers during assembly

We also have a common sense metalevel persistence principle: numbers on cars persist (don't fade away or change).

$$N \rightarrow \textbf{ Always } N.$$

Thus, according to Lord Reid, t is equal to:

$$t = \{\Delta_1 : N, N \rightarrow \textbf{ Always } N\}.$$

He wants to block the use of t by attacking the admissibility of Δ_1.

Four reasons were quoted for the admissibility of Δ_1 and three reasons for non-admissibility:

r_1: Evidence of this kind is admitted in Central Criminal Court.

r_2: Judge has discretion to admit such evidence.

r_3: This is a list of reasons given in Court of Criminal Appeal, namely:

- $r_{3,1}$: The records were produced to show that the records were kept in the normal course of business (but not to prove the truth of the recorded particulars).
- $r_{3,2}$: Although the record may not be evidence by themselves, they may be used to corroborate other evidence.
- $r_{3,3}$: We do not have dependency on the credit of an unidentified person but rather on a probably reliable process of record maintenance, and can therefore admit them.

r_4: Common sense rebels against rejection of such evidence.

s_0: No reported case or any textbook as direct authority for admission.

It seems at this point that r_1–r_4 are stronger than s_0.[15] So Lord Reid is trying to weaken the force of r_3 and r_2 by attacking them logically with s_3 and s_2:

s_2: Judges do not have the discretion to admit legally inadmissible evidence.

s_3: Counter argument to r_3 comprising of:

- $s_{3,1}$; If the records are not intended to prove the truth of their entries, what are they intended to prove? (I.e. they are irrelevant!)
- $s_{3,2}$: Either the records are admissible or not. There is no sense in which they can become admissible only after some other evidence to the same conclusion becomes admissible (see Footnote 14).
- $s_{3,3}$: Such records are not public records which are admissible for reasons that they are open to the public for inspection and correction. The current law therefore does not support their admissibility.

Figure 1 shows the form of t, where E = admit evidence or 'use me'.

To strengthen his case (i.e. strengthen the overall labels for $\neg E$, Lord Reid is attacking the label r_3 by putting forward $s_{3,1}, s_{3,2}$ and $s_{3,3}$. Note that the reasoning in the different boxes can be of different kinds!

Note that one of the points Lord Reid is making is s_2, namely that trial judges do not have discretion to 'admit legally inadmissible evidence'.

Compare this with the Barclays Bank example. So the force of the argument is to influence the flattening process: we have r_1–$r_4 : E$ and $s_0, s_2, s_3 : \neg E$, which one wins?

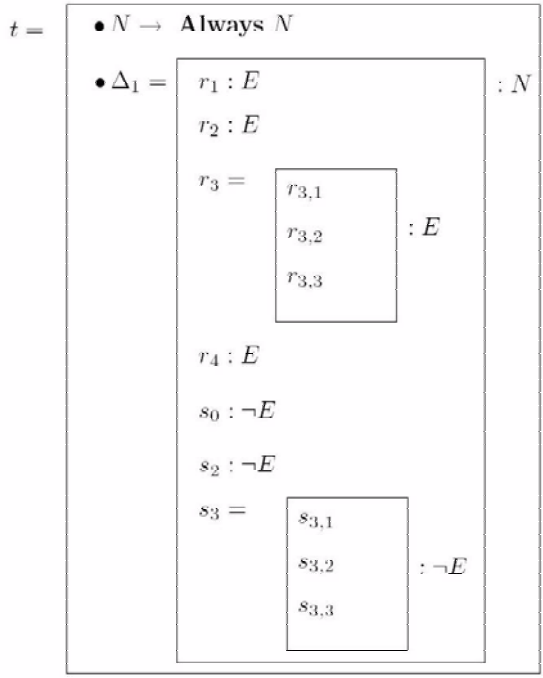
In this case the evidence was not admitted.[16]

Uglow continues:

> The House of Lords recognized the absurdity of their position but felt strongly that it was for the legislature to reform the law and create new exceptions. Parliament dealt with the problem of documentary hearsay with the Criminal

[15] In other words, it seems that a reasonable flattening process, weighing $\{r_1, r_2, r_3, r_4\}$ against $\{s_0\}$ will decide in favour of the former and thus admit the records. Note that no rules are given at this stage of how the decision is made. In some logics, where labels are confidence numbers, we can give a rule; e.g. admit iff $r_1 + r_2 + r_3 + r_4 > s_0$, but not here.

[16] This decision was made by vote as described in the quote from [28] on our page 16.



1.

Evidence Act 1965 which created an exception for trade and business records This was later extended by section 68 of the Police and Criminal Evidence Act 1984 and now by sections 23 and 24 of the Criminal Justice Act 1988. Such records have all been admissible in civil proceedings since the Civil Evidence Act 1968.

Myers has been regularly followed in such cases as *Patel v Comptroller of Customs* ([1965] 3 All E.R. 593) where the appellant was convicted of making a false declaration to customs, having stated that the bags of seed were originally from India. The prosecution sought to prove that the seed originated in Morocco and adduced evidence that the bags were stamped with 'Produce of Morocco'. The Privy Council, following *Myers* held that these words were hearsay and inadmissible. Unlike *Myers*, there was no evidence that the writing was at all reliable, there being no testimony as to how or by whom the bags

were marked."

The reader should note that the main thrust of the argument and logic of the Lord Reid example is in weakening and strengthening labels. Put schematically we have a master argument, say E which can prove a conclusion on D. E is a labelled argument containing various labels within labels. Among this maze of labels there is a label t containing another argument, say Δ. To attack E we can attack Δ. Our argument attacking Δ can itself be attacked by attacking some label s in it and so on. This is reminiscent of systems of abstract argumentation theory. Bench-Capon [7] has a paper on graphs of arguments and counterargunents, but his model is schematic. We can give actual proof rules and labelling disciplines so that questions like export from one label to another can also be considered. For example:

"If you weaken t then D will not follow from E, and that would be a bad precedent."

One cannot argue in this way unless a specific labelled model is available. We shall examine the Bench-Capon paper in the next section. For the time being, we think that we have seen enough to be convinced that labelling logics can play a central role here, though we would understand if the cautious reader would prefer to reserve judgement until more case studies are presented.

4 Value-based Argument Framework

The purpose of this section is to compare our approach with that outlined in Bench-Capon [7] and to show how labels can be used more effectively. We also give a Bayesian approach and a neural nets approach. In the full paper we hope to offer an LDS mix of all approaches. We believe any realistic model needs to do that!

We can indicate at this stage how the abstract argumentation model can relate to LDS. Consider the Lord Reid argument as presented in Figure 1. It has arguments $r_1, \ldots, r_4$ in favour of E and counter arguments $s_0, \ldots, s_3$ in favour of $\neg E$, esssentially attacking $r_1, \ldots, r_4$. LDS requires in this case a flattening function (or a process) to tell us which arguments win and at what strength we can use E or $\neg E$.

This flattening process can make use of abstract argumentation theory, either in its Bench-Capon form, or modified with probability or implemented in neural nets. A taste of these options is given in this section.

4.1 The Framework

We begin by discussing and highlighting our method of modelling. The first principle is to work bottom up from the application area into the formal model, trying to reflect in the formal model more and more key properties of the application area. In the case of evidence this means we need to see and study many examples/case studies/debates about evidence and then try to construct a suitable logic for it. Chances are that

existing logics, constructed for some other purpose, may not be the most suitable. Our starting formal system for this purpose is LDS. The theory of LDS was developed from the bottom up point of view, especially to model aspects of human behaviour, reasoning and action, and is very comprehensive, adaptable and incremental. It contains a large variety of existing logical systems as special cases. What is more important is that LDS is not a single system but a methodology for building *families* of systems, ready to be adapted to the needs of various application areas, in our case to the theory of evidence.

One very important side effect of this approach is that the logic can be worked up directly from the day-to-day activity of the practitioner of the laws of evidence, without necessarily forcing him to study logic. The 'logic' will be hidden in the stylised movements he will be asked to make, and the interplay between the labels and comments and arguments he will be using.[17]

In contrast to our approach, in a good deal of applicational work in logic, a logic is applied to various areas and tend to force the application area into a form suitable for its existing formalism. This tends to produce results intelligible mainly to the logician, ignoring that the ordinary human/lawyer/judge already knows intuitively how to handle his daily life, and that all he needs is some bottom up additional organisation of his activities which will enable him to understand it better and possibly solve some of his outstanding puzzles.[18]

The difference in this point of view is apparent when we look again at Prakken's book. The book does realise the potential in the interaction of logic and law. It also recognises some of the kinds of logics needed to model some aspects of the law. But having made and argued all of these points, the main part of the book gives an exposition of the relevant parts of the logic in a way that only a logician can understand. This is also true at the moment of this version of our paper, but we hope in the full version to be able to do logic directly in the legal evidence application area.

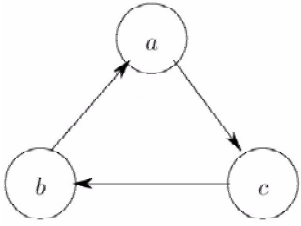
---

[17] Consider the widespread use of anagrams. Take as an example the pair of words 'read on'. We can rearrange the letters (including the space between the words) into 'no dear'. Let us write this as 'read on $\vdash$ no dear'. We can also write equivalently 'space, a, d, e, n, o, r $\vdash$ read' on 'space, a, d, e, n, o, r $\vdash$ no dear' where on the left we just listed the basic blocks we can use, including the space. Now suppose we allow you some 'wildcard' of the form 'space $\mapsto$ any other already listed letter' Then we get 'space, a, d, e, n, o, r, (space $\mapsto$ any other already listed letter) $\vdash$ adorned'. We chose here space $\mapsto$ d. What we have been doing here was linear logic! So anagrams with wildcards is linear logic. The idea that logic can be 'translated' into stylised proof movements was put forward in the Gabbay 1984 logic lectures at Imperial College, London. See the first chapter of [15] and see [17]. Peter Tillers says similar things in his paper in [29, pp. 2–11]. We assume the word 'dynamics' in the title of [29] is significant.

[18] The modelling practices of the social sciences generally are adaptations of the modelling paradigms of physics (rather than, say, biology), and are a reflection of the primacy of logical positivism as the social sciences were in process of articularing its philosophical presumptions. But it is almost never satisfactory to abstract from the data of human interactions in the same way that one abstracts from the interactions of physical particles.

See Footnote 17.

Having said all that, we can now look at some specific model, namely that of abstract argumentation systems. These were put forward as a response to the realisation that no argument or proof is conclusive in real life, and that arguments have counter-arguments. The argument framework has the form $AF = (AR, Attacks)$ where AR is a set of objects called arguments and $Attacks$ is a binary relation (usually irreflexive), saying which arguments x attacks which argument y. The following Figure 2 is an example



2.

a attacks c, c attacks b and b attacks a.

There are no winning arguments here. This framework is too abstract to be of specific use. It equally applies to circuits and impending circuits, credits and debits, neural nets and couterweights or any system involving x and anti-x, whatever x is.

To apply such a system successfully we need to go into the structure of the arguments and analyse the mechanics of one argument attacking another.

Bench-Capon tried to improve upon such systems by introducing a clever idea; the value-based argumentation framework. In this framework we are given a set of colours (values) and a colouring of the arguments. The values are partially ordered and an argument of strictly lesser value cannot now attack an argument of stronger value.

So following Bench-Capon in the previous figure, if we make b red and a and c blue then

1. If blue is stronger than red, then b cannot attack and defeat a, a can attack c and the winning arguments are $\{a, b\}$, because c is out.
2. If red is stronger than blue then the winning arguments are $\{b, c\}$.

Certainly this colouring with values is an intuitively welcome improvement. However, this model is still too abstract. Real life has arguments within arguments in different levels and interconnections between the levels. We can extend the Bench-

Capon model by using our technique of self-fibring of networks [5]–[16]. This method allows for the recursive substitution of networks inside nodes of other networks. We will work out the details in a later section. Still, we think using LDS is a much better option.

In LDS, this situation will arise if we have a labelled database which includes items such as $t : a, s : b$ and $r : c$ and some additional data, say $u_i : X_i$, such that the following can be proved, among others:[19]

- $\gamma(t) : \neg c$
- $\beta(r) : \neg b$
- $\alpha(s) : \neg a$.

α, β, γ are the labels of $\neg a, \neg b$ and $\neg c$ respectively and t, r, s are mentioned in the respective labels to indicate that e.g. $t : a$ is used in the proof of $\gamma(t) : \neg c$ (a with label t attacks c, by proving $\neg c$ with label $\gamma(t)$). The label $\gamma(t)$ shows exactly what role a plays in this attack.

The flattening process acts here as value judgement of what can win, $r : c$ or $\gamma(t) : \neg c$, by comparing r and $\gamma(t)$.

Obviously the value based argumentation machinery can be utilised as part of our flattening mechanism.

The following LDS model will reflect the Bench-Capon coloured diagram:

red:	b
blue:	a
blue:	c
red to blue:	$b \rightarrow \neg a$
blue to blue:	$a \rightarrow \neg c$
blue to red:	$c \rightarrow \neg b$

Using modus ponens in the form

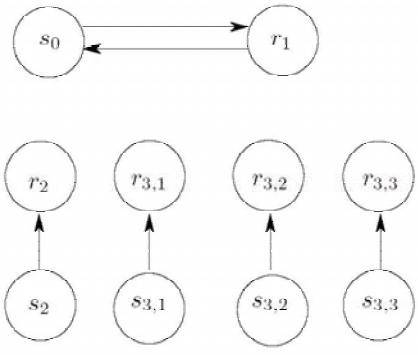
$$\frac{\alpha : X, \beta : X \rightarrow Y, \varphi(\beta, \alpha)}{\alpha \cup \beta : Y}$$

We can prove:

red:$\neg a$	if red to blue is allowed
blue:$\neg c$	if blue to red is allowed
blue:$\neg b$	if blue to blue is allowed.

The flattening function has to flatten:

[19] Note that we are assuming here that to defeat x we must put forward an argument for $\neg x$. This is only a simplifying assumption. In LDS, x comes with a label t and so to weaken $t : x$ we can attack t.



3.

{red: b, blue: $\neg b$}
{blue: a, red: $\neg a$}
{blue: c, (blue: $\neg c$ is not allowed!)}

Case 1.
red stronger than blue i.e. *blue to red* not allowed.

We get b and $\neg a$ and c.

Case 2.
Blue stronger than red (*red to blue* not allowed)

We get
{blue: a, (red: $\neg a$ not allowed)}
{blue: c, blue: $\neg c$}
{red: b, blue: $\neg b$ if c is available}

We cannot decide between c and $\neg c$ since both are blue. If we leave them both out or take $\neg c$ then $\neg b$ will not be obtainable and hence we will have $\{a, b\}$.

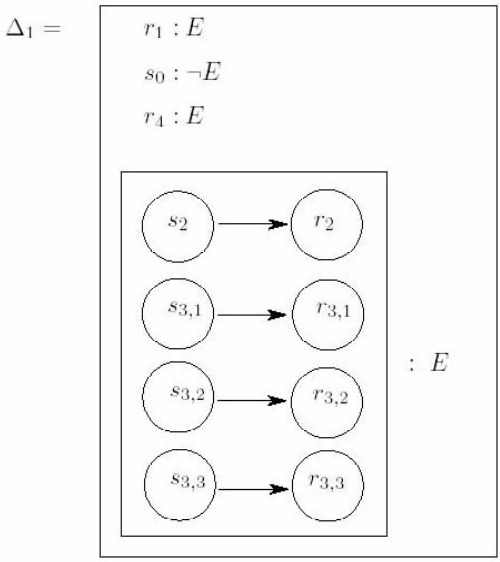
We see that in the labelled formulation we have more options

1. We can have $X, \neg X$ or neither as choices
2. The label colour (value) can itself be a whole database and so arguments about the values and their strengths can also be part of the system.

The Bench-Capon system is only one level.

The following Figure 3 shows the abstract argumenation structure of Lord Reid's arguments.

Accordingly, Δ_1 in Figure 1 can be better rewritten as Figure 4 below



4.

Assuming that the attack of Lord Reid is successful, then Figure 4 reduces to $\{r_1 : E, r_4 : E$ and $s_0 : \neg E\}$. The Lords indeed decided that s_0 was stronger, but they were uncomfortable about it and decided to recommend new legislation.

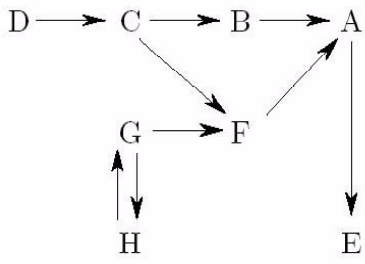
Note Lord Reid's argument $s_{3,2}$. This is a metalevel value argument like "you cannot colour something red".

Also note that s_0 and s_2 can be further counter-argued if possible by other Lords. The formal labelling of these additional arguments may require self-fibring. See section 2.4.5.

4.2 Moral Debate Example

This section also follows Bench-Capon [7, p. 442]. We consider an example cited by Bench-Capon, attributed to Coleman in [11] and Christie [9].

> "Hal, a diabetic, loses his insulin in an accident through no fault of his own. Before collapsing into a coma, he rushes to the house of Carla, another diabetic. She is not at home but Hal enters her house and uses some of her insulin. Was



5.

Hal justified, and does Carla have a right to compensation?"

The following are the arguments involved as presented in the Bench-Capon paper:

A = Hal is justified, since a person has a privelege to use the property of others to save their life - the case of necessity.

B = It is wrong to infringe the property rights of another.

C = Hal compensates Carla.

Bench-Capon [7] quotes that Christie [9] adds:

D_1 = If Hal is too poor to compensate Carla, he should nonetheless be allowed to take the insulin, as no one should die because they are poor.

D_2 = Moreover, since Hal would not pay compensation if too poor, neither should he be obliged to do so even if he can.[20]

Bench-Capon further suggests:

E = Poverty is no defence for theft.

F = Hal is endangering Carla's life.

G = Fact: Carla has abundant insulin.

H = Fact: Carla does not have ample insulin.

Figure 5 now represents the situation. Note that $H = \neg G$.

[20] Christie puts $D_1 + D_2 = D$ together as D. The division into D_1 and D_2 is ours, for later discussion.

Bench-Capon gives the following value properties to the arguments:

Life:	A, D, F
Property:	B, C, E
Fact:	G, H

He says one might argue whether life is stronger than property or not but facts are always the strongest.

Since H = ¬G, and since we cannot have both facts, he regards that part of Figure 5 as a case of uncertainty.

We cite this example because we want to analyse what is needed for a better representation of it.

We begin by listing the points:

1. The model needed for a proper analysis of this kind of problem in general (though maybe not necessarily the Hal problem) is a time/action model. There is a difference of values depending at what stage of the action sequence we are at. Has Hal entered Carla's house? Has he checked for insulin? Is it all over and Carla is dead? Each of these cases may have a different argument diagram, possibly with values depending on the previous one! We might add at this point that the need for time/action models has already been strongly emphasised in Gabbay [17] in connection with puzzles involved in the logical analysis of conditionals. This is factors of connected to contrary-to-duty models[21] and also needed to incorporate uncertainty. We can get a quite complicated (but highly intuitive) model.[22]
2. We require a better metalevel hierarchy of values and rules, as are available in Labelled Deduction. Possibly such options can also be made adequately available to the abstract argumentation model via self-fibring.
3. The links ($X \to Y$) should be given strength labels to help us model more realistic

[21] See the authoritative survey [27] of A. Jones and J Carmo in the *Handbook of Philosophical Logic*, 2nd edition.

[22] We take this opportunity to reinforce our methodological remark of footnote 18. In modelling human practical reasoning, actions and general behaviour it is often a disadvantage and a deficiency to try and use a stylised model and abstract too much from the actual reality (in contrast possibly with modelling physical nature). Often the details of the reality to be modelled suggests the solution to what otherwise is a puzzle. Let us look at the story and focus on the part which assumes Hal is too poor to replace Carla's insulin. We can ask how is he getting his insulin? Is he getting it on National Health Service? If yes, can't he call the NHS and try to get a replacement? So surely the question of replacement is not 'whether' but 'when', i.e. can he get a replacement in time before Carla runs out of insulin? If life is more important than property this is a good question. If property is more important, then we know he can replace it! Another question, if Hal steals the insulin from Carla and then calls for a replacement, would it not be more difficult to get a replacement (as opposed to calling the NHS first)? We need more details. We are *not* transforming the problem to one more suited to our framework. There are many other examples in other areas which need more details.

cases where an argument X is attacked by arguments $Y_1, \ldots, Y_k$ with strength measuring $m_1, \ldots, m_k$.

This is an essential generalisation. One of the quotes we cited from the car case study was (see footnote 7) had the Lords rejecting the written evidence because there was other ample evidence to the same effect (and they didn't want to create a precedent by admitting it).[23]

4. We can read the link $X \to Y$ as preventative action of X to stop Y and thus by giving probability of success turn any acyclic network into a Bayesian one. This will introduce uncertainty into the framework. Actually the probability of success is inversely proportional to the conditional probability of Y on X.

4.3 Bayesian aspects of the moral debate example

We begin this section with a closer look at Figure 5. We require a time/action model and contrary-to-duty considerations. We shall explain these features as we model the example.

We imagine an agent, such as Hal, who has available a stock of optional actions. These actions have the form $\mathbf{a} = (A, (B^+, B^-))$ where A is the precondition of the action and B^+, B^- are the post-conditions. A must hold in order for Hal to be allowed to perform the action, in which case the resulting state is guaranteed to satisfy B^+. However, the agent may take the action anyway, without permission (i.e. A does not hold), in which case the post-condition is B^-. Note that in most cases $B^- = B^+$.

We imagine we are at a state (or time) T_0, described by a logical theory Δ. The actions available to us to perform are $\mathbf{a}_1, \mathbf{a}_2, \ldots \mathbf{a}_i = (A_i, (B_i^+, B_i^-)), \ldots$. If $\Delta \vdash A_i$, then action $\mathbf{a}_i$ is allowalbe at time (state) T_0, otherwise not. If we perform the action $\mathbf{a}$, with post-condition B (B is either B^+ or B^-) then we move to time T_1, with state $\Delta_{\mathbf{a}} = \Delta \circ B$ where $\Delta \circ B$ is the revision of Δ by B. We have $\Delta \circ B \vdash B$.

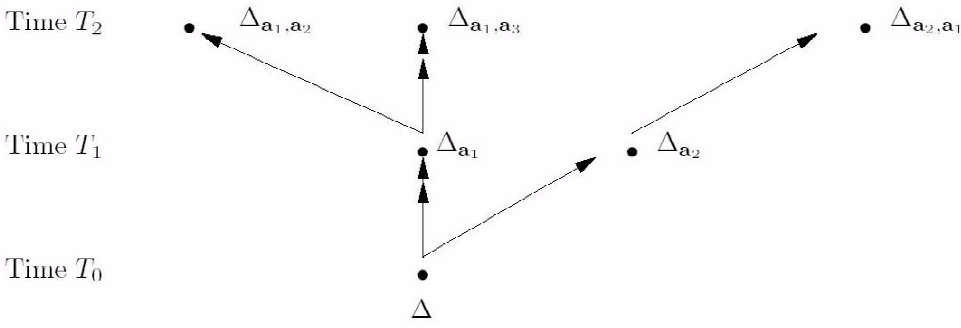
So to have time action model we need

1. A language for the theories Δ to describe states
2. A language for pre-condition and a language for post-conditions for actions
3. A logic or algorithm for determining when $\Delta \vdash A$ holds, where A is a pre-condition.
4. A revision algorithm giving for each Δ and post-condition B a new theory $\Delta' = \Delta \circ B$. This algorithm can satisfy some reasonable axioms.

Note that the languages for Δ, the pre-conditions and the post-conditions need not be the same!

The flow of time is future branching and is generated by the actions. So if for

[23] This is a mixture of metalevel/strength/proof argument that only LDS can model. We shall address this kind of argument later.



6.

example our agent can perform actions $\mathbf{a}_1, \ldots, \mathbf{a}_k$ as options then after two steps in which he performs say $\mathbf{a}_1$ first and then say $\mathbf{a}_3$, we may get a situation as in figure 6

The real history at time T_2 is $(\Delta, \Delta_{\mathbf{a}_1}, \Delta_{\mathbf{a}_1,\mathbf{a}_3})$. The states $\Delta_{\mathbf{a}_1,\mathbf{a}_2}$ and $(\Delta_{\mathbf{a}_2}, \Delta_{\mathbf{a}_2,\mathbf{a}_1})$ are hypotheticals.

At time T_0, our agent chose to take action $\mathbf{a}_1$ moving onto state $\Delta_{\mathbf{a}_1}$, but he could have chosen to take action $\mathbf{a}_2$ and done action $\mathbf{a}_1$ afterwards, ending up at state $\Delta_{\mathbf{a}_2,\mathbf{a}_1}$ at time T_2. In reality, however, he chose to perform $\mathbf{a}_1$ and then $\mathbf{a}_3$.

The pre-conditions of actions can talk about states and hypotheticals. They need not be in the same language as Δ or the same language as the post-conditions. What is important are the algorithms for '$\vdash$' and '$\circ$'.

We are now ready to analyse the moral debate example. First we tell the story in a more realistic way (see footnote 22!). Then we propose some probabilities as an example and we conclude by translating the Bench-Capon satements A–H (page 30) into our time/action set up.

Our story goes as follows. Hal needs insulin. So does Carla. Both are poor and get their insulin from the Health Service. They get it in batches, though not at the same time. So the question whether Carla has spare insulin (G) depends on the time, and is a matter of probability.

Hall loses all his insulin and would need to break into Carla's property to get hers. He has the option of calling the NHS and asking for replacement, which he can use either for himself if it arrives immediately or to replace Carla's if necessary. He might get some money from friends. One thing is clear to him. If he steals Carla's insulin, it will complicate matters; it might be more difficult to find a replacement. So the question of compensation C is also a matter of probability. The following are the

possible scenarios.

If property is valued more than life, then if Hal steals Carla's insulin, the probability of getting a replacement is lower in the case where Carla's life is not threatened.

If life is valued more than property, his chances of obtaining replacement is higher in case Carla's life is threatened.

We must clarify what 'getting a replacement' means. Hal will probably start a process for getting insulin for himself immediately at start time T_0. Since it might not arrive in time, he will break into Carla's home and use hers, and hope to use the insulin he 'ordered' to replace Carla's. If Carla has ample insulin, there is a higher chance or that the replacement will arrive in time before Carla's life is threatened. If Carla does not have ample insulin, Hal can use this as a further reason to rush the process of replacement. This further reason might be counterproductive if property is valued above life.

So the statement

C = Hal gets a replacement

should be taken as (see footnote 22):

Hal gets a replacement before Carla is in need of it.

We may then have the following scenarios (P stands for Probability $P(x)$ and it should be indexed by case and time, i.e. $P_{1,a}, P_{1,b}, P_{2,a}$ and $P_{2,b}$:

Case 1. Property stronger than life

(a) Time = Before Hal breaks into Carla's house.
$P(G) = \frac{2}{3}$
$P(\neg G) = \frac{1}{3}$
$P(C/G) = 0.9$
$P(\neg C/G) = 0.1$
(Since Carla does have ample insulin, Hal has more time to replace what he might take.)

$P(C/\neg G) = 0.5$
$P(\neg C/\neg G) = 0.5$
(Admittedly, Carla's life is in danger but there may not be enough time to get a replacement. On the other hand, this very fact might help get the insulin more quickly. Note that the event C means 'getting replacement in time'.)

(b) Time = After Hal breaks into Carla's house.
At this stage the value of G is known: either $G = 1$ or $G = 0$. We get
$P(C/G = 1) = 0.7$
$P(\neg C/G = 1) = 0.3$
(less than before breaking into the house, because Hal committed a serious crime. He may not be favourable with the authority.)

$P(C/G = 0) = 0,4$
$P(\neg C/\ G = 0) = 0.6$
Again, less than before.

Case 2. Property not stronger than life[24]

(a) Time = Before Hal breaks into Carla's house
$P(G) = \frac{2}{3}$
$P(\neg G) = \frac{1}{3}$
$P(C/G) = 0.9$
$P(\neg C/G) = 0.1$
$P(C/\neg G) = 0.9$
$P(\neg C/\neg G) = 0.1$

(b) Time = After Hal breaks into Carla's house
$P(G) = \frac{2}{3}$
$P(\neg G) = \frac{1}{3}$
$P(C/G = 1) = 0.9$
$P(\neg C/G = 1) = 0.1$
$P(C/G = 0) = 0.7$
$P(\neg C/G = 0) = 0.3.$

Let us now translate the arguments involved in the original moral debate example of Section 2.4.2.

When is Hal justified in breaking into Carla's home? The answer is yes only in the case that life is stronger than property and he can reasonably say he is not risking her life. That depends on finding a replacement. We therefore have to calculate the probability of C given all the data we have.

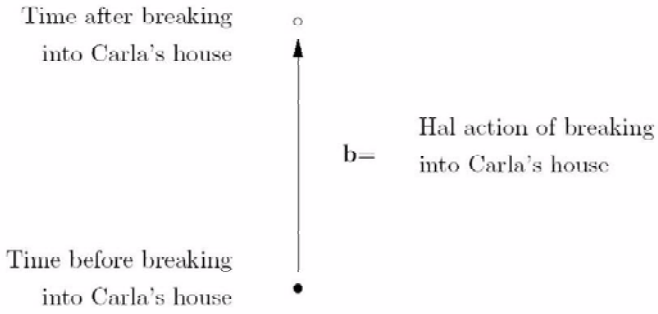
Thus our time/action axis has the form of Figure 7:
The actions available to Hal are:

1. **b** = breaking into Carla's house. The post-condition is breaking in and taking the insulin. The pre-condition of **b** is high probability of replacing Carla's insulin (in time before she needs it) in case *life is stronger than property* and $\perp$ (falsity i.e. no permission to do the action) in case *life is not stronger than property*.
2. **r** = actions having to do with getting a replacement of insulin. We assume he can perform these actions at any time but the post-conditions are not clear.[25]

We need also agree the value of the threshold probability, e.g. only if there is at

[24] Jon Willimanson reminded us that it is reasonable to assume that the legal process does not make general value judgements like this, nor can a legal argument appeal to such judgements. Instead much more specific 'mitigating circumstances' can be used to reduce the length of a sentence on conviction ('I did it to save my life, guv').

[25] We may need a temporal language for the post-conditions so that we can say something like 'insulin will be delivered in two days'.



7.

least 0.9 chance of replacement can Hal break into Carla's home to take the insulin. Consider now:

B = It is wrong to infringe the property of others.

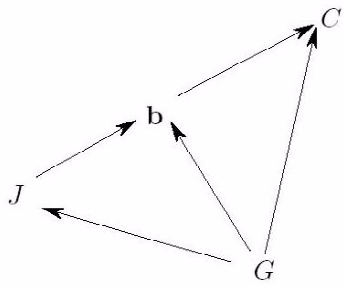
B is an argument reflected in the pre-condition of the action **b**, it can be done when B satisfied otherwise not. I would write it as

$$\mathbf{b} = (\text{Justification, Break in and taking insulin}).$$

Let us now model the chain of events as a Bayesian network. The story is clear. Depending on the probability $P(G)$, Hal decides whether he wants to break into Carla's house **b** (no use breaking into her house if she does not have enough insulin). He is justified J in breaking **b** into Carla's house if there is high probability of compensation C. Thus C depends both on **b** and G, and **b** also depends on G. We have the following network, Figure 8.

There are two problems with this representation.

1. The dependency of **b** on G is not on $G = 1$ or $G = 0$ but on $P(G)$. Say if $P(G) < 0.1$ then maybe $\mathbf{b} = 0$.
   This is OK because the probabilites can be made to take account of that. This is allowed in the theory of Bayesian nets.
2. The probabilities in Figure 8 depend on whether property is stronger than life or not. The best way to represent this is to have a Bayesian net with one variable only, *Case*.
   Case =1 means property stronger than life and *case* =*0* means property is not stronger than life.
   For each case we get a different copy of Figure 8 with different probabilities.
   So we get a substitution of the network of Figure 8 into a one point network:



8.

– *Case*. This operation is in accordance with the ideas in [37].

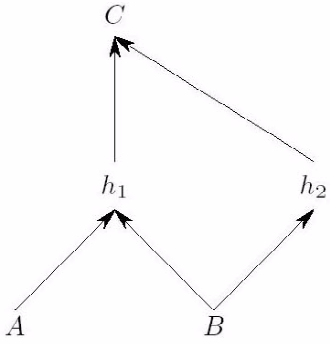
We can also allow for several justification variables to make it more realistic.

It is not difficult to work out the details of the rest of C–H, but the reader can already see that in the simple minded model there is lack of sensitivity to a variety of metalevels.

4.4 Neural Representation of Argumentation Frameworks

This subsection, based on [6] will outline how to represent (in neural nets) any value-based argumentation framework involving x and anti-x (i.e. arguments and counter-arguments). For instance, it can be implemented in neural networks with the use of Neural-Symbolic Learning Systems [3]. A neural network consists of interconnected neurons (or processing units) that compute a simple function according to the weights (real numbers) associated to the connections. Learning in this setting is the incremental adaptation of the weights [26]. The interesting characteristics of neural networks do not arise from the functionality of each neuron, but from their collective behaviour, thus being able to efficiently represent (and learn) multi-part, cumulative argumentation, as exemplified below.

Cumulative behaviour can be encoded in Neural-Symbolic Learning Systems with the use of a hidden layer of neurons in addition to an input and an output layer in a feedforward network. Rules of the form $A \wedge B \rightarrow C$ can be represented by connecting input neurons that represent concepts A and B to a hidden neuron, say h_1, and then connecting h_1 to an output neuron that represents C in such a way that output neuron C is activated (true) if input neurons A and B are both activated (true). If, in addition, a rule $B \rightarrow C$ is also to be represented, another hidden neuron h_2 can be added to the network to connect input neuron B to output neuron C in such a way



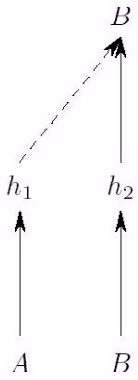
9. A simple example of the use of hidden neurons

that C is now activated also if B alone is activated.[26] This is illustrated in Figure 9. The network can be used to perform the computation of the rules in parallel such that C is true whenever B is true [3].

In a neural network, positive weights can represent the support for an argument, while negative weights can be seen as an attack on an argument. Hence, a negative weight from a neuron A to a neuron B can be used to implement the fact that A attacks B. Similarly, a positive weight from B to itself can be used to indicate that B supports itself. Since we concentrate on feedforward networks, neuron B will appear on both the input and the output layers of this network as shown in Figure 10, in which dotted lines are used to indicate negative weights.

In Figure 10, A attacks B via h_1, while B supports itself via h_2. Suppose now that, in addition, B attacks C. We need to connect input neuron B to output neuron C via a new hidden neuron h_3. Since B appears on both the network's input and output, we also need to add a feedback connection from output neuron B to input neuron B such that the activation of B can be computed by the network according to the chain 'A attacks B', 'B attacks C', etc. As a result, in Figure 11 (in which we do not represent B's feedback connection for the sake of clarity), if the attack from A on B is stronger (according to the network's weights) than B's support to itself, then A will block the activation of (output) B, and (input) B will not be able to block the

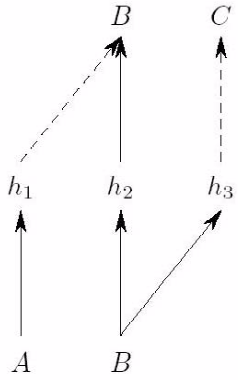
[26] In the general case, hidden neurons are necessary to implement the following conditions: (**C1**) The input potential of a hidden neuron (N_l) can only exceed N_l's threshold (θ_l), activating N_l, when all the positive antecedents of r_l are assigned the truth-value *true* while all the negative antecedents of r_l are assigned $false$; and (**C2**) The input potential of an output neuron (A) can only exceed A's threshold (θ_A), activating A, when at least one hidden neuron N_l that is connected to A is activated.



10. A simple example of the use of negative weights for counter-argumentation

activation of C. In this case, the network's final computation will include C and not B in a stable state. If, on the other hand, A is not strong enough to block B, then B will be activated and block C.

Let us take the example in which an argument A attacks an argument B, and B attacks an argument C, which in turn attacks A in a cycle. In order to implement this in a neural network, we need positive weights to explicitly represent the fact that A supports itself, B supports itself and so does C. In addition, we need negative weights from A to B, from B to C and from C to A (see Figure 12) to implement attacks. If all the weights are the same in absolute terms, no argument wins, as one would expect, and the network stabilises with none of $\{A, B, C\}$ activated. If, however, the value of A (i.e. the weight from h_1 to A) is stronger than the value of C (the weight from h_3 to C, which is expected to be the same in absolute terms as the weight from h_3 to A), C cannot attack and defeat A. As a result, A is activated. Since A and B have the same value (as e.g. in the previous case of an unspecified priority), B is not activated, since the weights from h_1 and h_2 to B will both have the same absolute value. Finally, if B is not activated then C will be activated, and a stable state $\{A, C\}$ will be reached in the network. In Bench-Capon's model [7], this is exactly the case in which colour blue is assigned to A and B, and colour red is assigned to C with blue being stronger than red. Note that the order in which we reason does not affect the final result (the stable state reached). For example, if we started from B successfully attacking C, C would not be able to attack A, but then A would successfully attack B, which would this time round not be able to successfully attack C, which in turn would be activated in the final stable state $\{A, C\}$. This



11. The computation of arguments and counter-arguments

indicates that a neural (parallel) implementation of this reasoning process could be advantageous also from a purely computational point of view.

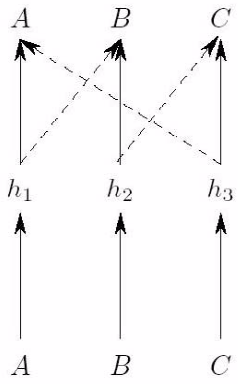
Note that (as in the general case of argumentation networks) in the case of neural networks, we can extend Bench-Capon's model with the use of self-fibring neural networks, which allow for the recursive substitution of neural networks inside nodes of other networks [5].

The implementation of the network's behaviour (weights and biases) must be such that, when we start form a number of positive arguments (input vector $\{1, 1, \ldots 1\}$), weights with the same absolute values cancel each other producing zero as the output neuron's input potential. A neuron with zero or less input potential is then deactivated, while a neuron with positive input potential is activated. This allows for the implementation of the argumentation framework in neural-symbolic learning systems, in the style of the translation algorithms developed at [4].

4.5 Self-fibring of Argumentation Networks

We will conclude this section by indicating how to do self-fibring of argument networks. The mechanics of it is simple. We begin with one network, say the one in Figure 2. We pick a node in it, say node a, and substitute another network for that node, say we substitute the network of Figure 5. We thus get the 'network' of figure 13.

The need of self-fibring may arise if additional arguments are available supporting the contents of the node.



12. The moral-debate example as a neural network

The self-fibring problem has three aspects:

Aspect 1: Intuitive Meaning
What is the intended interpretation/meaning of this substitution? This can be decided by the needs of the application area. Here are some options:

(1.1) a is supposed to be an argument, so Figure 5 can be viewed as delivering some winning argument (A of Figure 5) which can combine/support a.

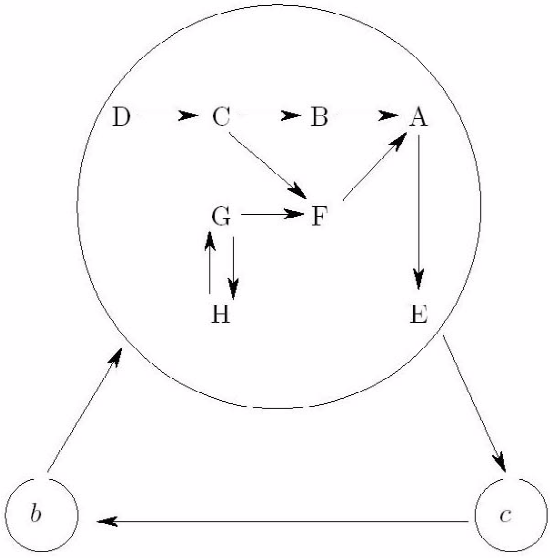
(1.2) Figure 5 is a network so b of Figure 2 can plug into it. We can connect b to all (or some) members of Figure 2 and similarly connect all (or some) members of Figure 5 into c of Figure 2.

For various options see [37, 5, 16].

Aspect 2: Formal aspect

(2.1) *Syntactical substitution*
Formally the node a is supposed to be an argument. So we need a fibring function (node, network) $= e$ yielding a node e and so we end up with Figure 14
might do, for example, the following: can use the colour of node a to modify the colours of the nodes in Figure 5 (the substituted network), and maybe also modify some connections in Figure 5, and then somehow emerge with some winning argument e and a colour to be substituted/combined with a and its colour.

(2.2) *Semantic substitution*
If the original network has an interpretation, then the node a can get several



13.

possible semantic values. We can make the definition of the substitution context sensitive to those values. We may even go to the extent of substituting different networks for different options of values.

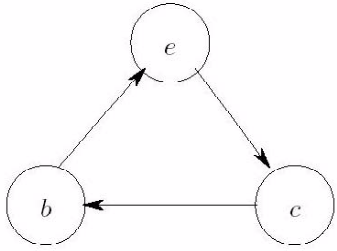
Aspect 3: Coherence
To enable successful repeated recursive substitution of networks within networks, we have to modify our definition of the original network. For example:

(3.1) Possibly extend the notion of network and allow arrows to either support or defeat arguments.

(3.2) Restrict the substitution of networks for nodes by compatibility/consistency conditions.

Example: Self-fibred argumentation network
We have a set of nodes and links of the form (a, b) meaning a attacks b. We also have valuation colours. A weaker colour cannot attack a stronger colour. So far this is the Bench-Capon definition.

Let a be a node. Define the notion of x is a supportive (resp. attacking) node for a as follows:



14.

- a is supportive of a
- if x is supportive (resp. attacking) node of a and y attacks x then y is an attacking (resp. supportive) node of a.

Now let a be a node in a network A and suppose we have another network N which we want to substitute for a. We must assume a appears in N with the same colour value as it is in A. We substitute N for a and make new connection as follows:

- Any node x of A which attacks a in A is now connected to any node y in N which supports a in N.
- Any node y in N which supports a in N is now made connected to any node x of A which a of A is attacking.

This definition is reasonable. a is an argument in network A. N is another network which is supposed to support a (a in N). Thus anything which attacks a in A will attack of all a supporters in N and these in turn will attack whatever nodes a attacks in A. Note that he may be attacking facts in N by this wholesale connection of arrows. However, Bench-Capon has already remarked that facts should get the strongest colour and so the colours will take care of that!

Acknowledgements

We are grateful to A. Garcez, L. Lamb, D. Makinson, G. Pigozzi and J. Williamson for valuable comments.

Bibliography

[1] Ruggero J. Aldisert. *Logic for Lawyers: A Guide to Clear Legal Thinking*, Clark Boardman, 1989.

[2] Christopher Allen. *Practical Guide to Evidence*, 2nd ed. Cavdndish Pub, 2001.

[3] A. S. d'Avila Garcez, K. Broda and D. M. Gabbay, *Neural-Symbolic Learning Systems*, Springer-Verlag, 2002.

[4] A. S. d'Avila Garcez, L. C. Lamb, D. M. Gabbay and K. Broda, Connectionist Modal Logics for Distributed Knowledge Representation, submitted, 2002.

[5] A. S. d'Avila Garcez and D. M. Gabbay, Fibring Neural Networks, Technical Report, 2003.

[6] A. S. D'Avila Garcez, D. M. Gabbay and L. Lamb. Value based argumentation frameworks as neural networks.

[7] T. J. M. Bench-Capon. Persuasion in practical argument using value-based argumentation frameworks. *Journal of Logic and Computation*, **13**, 429–448, 2003.
See also: http://www.csc.liv. ac.uk/ tbc/FTP/kings2.ppt

[8] T. Bench-Capon. Agreeing to differ: modelling persuasive dialogue between parties without a consensus about values. *Informal Logic*, forthcoming, 2003.

[9] G. C. Christie. *The Notion of an Ideal Audience in Legal Argument*. Kluwer, 2000.

[10] T. Bench-Capon. Knowledge based systems in the legal domain. A survey article in *Encyclopaedia of Computer Science and Technology*, available on the web at http://www.csc.liv.ac.uk/∼lial/lial/tut.html

[11] J. Coleman. *Risks and Wrongs*. Cambridge University Press, 1992.

[12] Sir Rupert Cross. *On Evidence*. Butterworth, 1999.

[13] H. Dennis. *Law of Evidence*, Sweet and Maxwell, 1992.

[14] Deon Conferences. Journals.
Please see: http://www.doc.ic.ac.uk/deon02/
http://www.cert.fr/deon00/

ARTIFICIAL INTELLIGENCE AND LAW
http://www.denniskennedy.com/ailaw.htm
http://www.iaail.org/

There are many useful Links to Evidence-Related Web Sites: at http://tillers.net

[15] D.M. Gabbay. *Labelled Deduction Systems*. Oxford University Press, 1996.

[16] D. Gabbay. *Fibring Logics*, Oxford University Press, 1998.

[17] D. M. Gabbay. Dynamics of practical reasoning, a position paper. In *Advances in Modal Logic 2, Proceedings of Conference October 1999*, K. Segerberg *et al.*, eds, pp. 179–224. CSLI Publications, Cambridge University Press, 2001.

[18] D. M. Gabbay. Sampling LDS. In *A Companion to Philosophical Logic*, D. Jacquertte,

ed., pp. 742–769. Blackwell, 2002.

[19] D. M. Gabbay. Editorial to *Handbook of Philosophical Logic*, 2nd edition. Kluwer, 2002–2004.

[20] D. M. Gabbay and J. Woods. Cooperate with your logic ancestors. *Journal of Logic, Language and Information*, **8**, iii–v, 1999.

[21] D. M. Gabbay and J. Woods. *Agenda Relevance: A Study in Formal Pragmatics*, Elsevier, 2003.

[22] D. M. Gabbay and J. Woods. *The Reach of Abduction: Insight and Trial*, Elsevier, to appear, 2004.

[23] J. Y. Girard, Y. Lafont and P. Taylor. *Proofs and Types*. Cambridge University Press, 1989.

[24] J. W. Guan and D. A. Bell. *Evidence Theory*, 2 volumes. Elsevier, 1991.

[25] J. W. Harris. *Legal Philosophies*, 2nd edition, 2003.

[26] S. Haykin, *Neural Networks: A Comprehensive Foundation*, 2nd edition, Prentice Hall, 1999.

[27] A. Jones and J. Carmo. Deontic logic and contrary-to-duties. *Handbook of Philosophical Logic*, Volume 8, 2nd edition, pp. 265–345, D. M. Gabbay and F. Guenthener, eds. Kluwer, 2002.

[28] A. Keane. *The Modern Law of Evidence*, Butterworth, 2000.

[29] M. MacCrimmon and P. Tillers, eds. *The Dynamics of Judicial Proof*. Physica-Verlag, 2002.

[30] Ch. Perelman. *Justice, Law and Argument*. Reider, 1980.

[31] H. Prakken. *Logical Tools for Modelling Legal Argument*, Kluwer, 1997.

[32] H. Prakken, C. Reed and D. Walton. Argumentation schemes and generalisation in reasoning about evidence. *ICAIL-03*, June 24–28, 2003.

[33] Report of the Royal Commission of Criminal Justice, M 2263, 1993. London: HMSO, Ch 8, para 26.

[34] M. J. Sergot, R. A. Kowalski *et al.*. British Nationality Act. *Communications of the ACM*, **29**, 370–386, 1986.

[35] G. Shafer. *A Mathematical Theory of Evidence*. Princeton University Press, 1976.

[36] S. Uglow. *Textbook on Evidence*, Sweet and Maxwell, 1997.

[37] J. Williamson and D. Gabbay. Recursive Bayesian Networks and self-fibring logics.

[38] J. Woods, R. H. Johnson, D. M. Gabbay and H. J. Ohlbach. Logic and the Practical turn. In *Handbook of the Logic of Argumentation and Inference: The Turn Towards the Practical*, D. M. Gabbay, R. H. Johnson and H. J. Ohlbach, eds. pp. 1–39. Volume 1 of *Studies in Logic and Practical Reasoning*, North-Holland, 2002.

BOOK SERIES: TRENDS IN LOGIC 19

Hardbound
ISBN 1-4020-1330-2
May2003, 384 pp.
€ 120.00 / $ 115.00 / £ 77.00

Paperback
ISBN 1-4020-1331-0
June 2003, 384 pp.
€ 50.00 / $ 48.00 / £ 32.00

A Guide to Classical and Modern Model Theory

By
Annalisa Marcja *University of Florence, Italy*
Carlo Toffalori *University of Camerino, Italy*

Since its birth, Model Theory has been developing a number of methods and concepts that have their intrinsic relevance, but also provide fruitful and notable applications in various fields of Mathematics. It is a lively and fertile research area which deserves the attention of the mathematical world.

This volume:
- is easily accessible to young people and mathematicians unfamiliar with logic;
- gives a terse historical picture of Model Theory;
- introduces the latest developments in the area;
- provides 'hands-on' proofs of elimination of quantifiers, elimination of imaginaries and other relevant matters.

A Guide to Classical and Modern Model Theory is for trainees and professional model theorists, mathematicians working in Algebra and Geometry and young people with a basic knowledge of logic.

Contact information:
Charles Erkelens
PHILOSOPHY OF SCIENCE AND LOGIC
E charles.erkelens@wkap.nl
T +31 78 65 76 387

Floor Oosting
PHILOSOPHY AND RELIGIOUS STUDIES
E floor.oosting@wkap.nl
T +31 78 65 76 205

for up-to-date information: www.wkap.nl/prod/b/1-4020-1330-2

kluwer
the language of science

FUNNY FRAGMENTS

Libby Copeland

Here's what's wild: Philosophy is hot nowadays, hot as, say, Ricky Martin in leather.

Oliver Edwards

I have tried too in my time to be a philosopher; but, I don't know how, cheerfulness was always breaking in.

Nelson Goodman

Any effort in philosophy to make the obscure obvious is likely to be unappealing, for the penalty of failure is confusion while the reward of success is banality. An answer, once found, is dull; and the only remaining interest lies in a further effort to render equally dull what is still obscure enough to be interesting.

Søren Aabye Kierkegaard

What philosophers say about Reality is often as disappointing as a sign you see in a shop window which reads: Pressing Done Here. If you brought your clothes to be pressed, you would be fooled; for only the sign is for sale.

Timothy Leary

In the information age, you don't teach philosophy as they did after feudalism. You perform it. If Aristotle were alive today he'd have a talk show.

Joy Larkin Luca

No sex in philosophy without knocking up the sciences.

David Papineau

I worry about the worth of philosophy done by philosophers who have been trained in nothing else.

Julius Robert Oppenheimer

Today, it is not only that our kings do not know mathematics, but our philosophers do not know mathematics and – to go a step further – our mathematicians do not know mathematics.

W. Winwood Reade

The philosophic spirit of inquiry may be traced to brute curiosity, and that to the habit of examining all things in search of food.

Bertrand Russell

Philosophy is an unusually ingenious attempt to think fallaciously.

Terrence Pratchett

His philosophy was a mixture of three famous schools: the Cynics, the Stoics and the Epicureans—and summed up all three of them in his famous phrase, 'You can't trust any bugger further than you can throw him, and there's nothing you can do about it, so let's have a drink.'

Steven Weinberg

From time to time since then I have tried to read current work on the philosophy of science. Some of it I found to be written in a jargon so impenetrable that I can only think that it aimed at impressing those who confound obscurity with profundity.

Soon Available! *Feisty Fragments — for Philosophy.* Vincent F. Hendricks. £15.00. King's College Publications; (December 2003); *Feisty Fragments* is a collection of more than 270 commented quotations from people from all the walks of life expressing their rather critical and often quite humorous takes on both philosophy and philosophers.

SOCIAL SOFTWARE

CONFERENCE
The Carlsberg Academy, Copenhagen (DK), May 27 – 29, 2004

The study of social interaction utilizing formal and/or systematic modelling techniques has in recent years seen a revival in the social sciences. This is due to a series of new developments and movements in particularly decision theory, game theory and the methodology of model construction. These new developments offer promising novel solutions to, and illuminating perspectives on, the problems and paradoxes associated with the systematic study of social interaction. The new trends in 'social software' have significant implications for the understanding of the systematic approaches to social interaction and the understanding of actual social phenomena. The conference brings together new foundational research as well as applications in social software from such diverse fields as philosophical logic, sociology, economics and computer science. The ambition is to assess the philosophical and sociological implications arising from the new movements, e.g.:

- How do systematic techniques relate to real world phenomena, such as morality, social norms and language?
- What are the consequences of the development of evolutionary game theory for game theoretical approaches to social interaction?
- What do various results in philosophical logic and probability theory reveal about rationality, agent interaction and common knowledge?

Lectures on these and related questions will be given by some of the most prominent researchers in this new interdisciplinary field. All presentations will be of such a nature that they may be followed by advanced students and scholars in philosophy, economics, sociology and computer science provided with general knowledge of foundational issues. See further

`http://www.philog.ruc.dk/phiconf4.html`

Speakers

- Ken Bimore / The ESRC ELSE Centre at University College London (UK)
- Wiebe van der Hoek / University of Liverpool (UK)
- Magnus Jiborn / Lund University (Sweden)
- Rohit Parikh / City University of New York (USA)
- Wlodek Rabinowicz / Lund University (Sweden)
- Robert van Rooij / ILLC – University of Amsterdam (The Netherlands)
- Hans Rott / University of Regensburg (Germany)
- Brian Skyrms / University of California, Irvine (USA)

Program Committee

- Pelle G. Hansen / Roskilde University / pgh@ruc.dk
- Vincent F. Hendricks / Roskilde University / vincent@ruc.dk
- Stig Andur Pedersen / Roskilde University / sap@ruc.dk

Registration

Please write Pelle Guldborg Hansen to register:

Department of Philosophy and Science Studies
Roskilde University, P6
P.O. Box 260
DK4000 Roskilde, Denmark
Phone: (+45) 4674 2540 Cell: (+45) 2334 2175
Fax: (+45) 4674 3012 Email: pgh@ruc.dk

A small conference fee is to be paid upon final registration (Thursday, May 27, 2004). The conference fee is 75,00 Danish kroner a day, thus participation for the entire duration of the conference (Thursday, May 27 – Saturday 29, 2004) is 225,00 Danish kroner. The conference fee covers the conference booklet, tea and coffee during the breaks.

If email is used include 'SOCIAL SOFTWARE—DK' in the subject entry. All questions pertaining to registration and accommodations should be directed to Pelle Guldborg Hansen. No individual notification upon registration will be forwarded to individual participants but the ΦLOG-website will keep a list of registered participants.

Organization

The conference is jointly organized by

- ΦLOG – The Danish Network for Philosophical Logic and Its Applications
- PHIS – The Danish Research School in Philosophy, The History of Ideas and the History of Science
- Department of Management, Politics and Philosophy, Copenhagen Business School
- Center for Philosophy and Theory of Science, Aalborg University
- Department of System Analysis, Risø National Research Laboratories

CONFERENCES

Fifth International Tbilisi Symposium on Language, Logic and Computation. Tbilisi, Georgia. October 6–10, 2003. The symposium is organized by the Center for Language, Logic and Speech of the Tbilisi State University in conjunction with the Institute for Logic, Language and Computation (ILLC) of the University of Amsterdam. Tutorials will be offered by: E. Engdahl (general linguistics), C. Gardent (computational linguistics), and W. Hodges (logic). Invited plenary speakers include: J. Allwood, J. Apresjan, M. Baaz, L. Beklemishev, C. Féry, J. Ginzburg, R. Iemhoff, F. Kamareddine, I. Melchuk, B. Partee, C. Stirling, H. de Swart, E. Vallduví, A. Voronkov, A. Zanardo, and E. Zimmermann. For further information, visit the website below. (courtesy of aslonline)

`http://www.illc.uva.nl/Tbilisi/`

New Zealand Mathematics Research Institute 2004 Summer Workshop. Nelson, New Zealand. January 3–10, 2004. The theme of this event is computational algebra, number theory, and geometry. The main focus of the NZMRI's activity has been the organisation of summer meetings on particular topics of contemporary significance in mathematics, to which some of the world's best mathematicians are invited for the purpose of giving short courses of lectures and interacting with local researchers and graduate students. This activity has been generously supported by the Marsden Fund (through 3-year grants 1995-98, 1998-2001 and 2002-04) and contributions by individuals (from NZ and overseas) and by mathematics and statistics departments at NZ universities. Its Directors (who serve on a voluntary (unpaid) basis) are Vaughan Jones (University of Auckland and University of California Berkeley), Marston Conder (University of Auckland), Rod Downey (Victoria University of Wellington), David Gauld (University of Auckland), and Gaven Martin (University of Auckland). For further information, visit the website below. (courtesy of aslonline)

`http://www.math.auckland.ac.nz/Conferences/2004/NZMRI/`

International Congress on Logic Programming and Nonmonotonic Reasoning (LPNMR-7). Ft. Lauderdale, Florida. January 6–8, 2004. This event is intended to facilitate interactions between researchers interested in the design and implementation of declarative logic programming languages and those who work in the areas

of knowledge representation and nonmonotonic reasoning. The Program Committee Co-chairs are V. Lifschitz and I. Niemela, Jose Alferes (New University of Lisbon, Portugal). Program Committee: Chitta Baral (Arizona State University, USA), Yannis Dimopoulos (University of Cyprus, Cyprus), Juergen Dix (University of Manchester, UK), Phan Minh Dung (Asian Institute of Technology), Esra Erdem (University of Toronto, Canada), Michael Gelfond (Texas Tech University, USA), Tomi Janhunen (Helsinki University of Technology, Finland), Jorge Lobo (Teltier Technologies, USA), Fangzhen Lin (Hong Kong University of Science and Technology), Ramon P. Otero (University of Corunna), Victor Marek (University of Kentucky, USA), Gerald Pfeifer (Vienna University of Technology, Austria), Enrico Pontelli (New Mexico State University, USA), Teodor Przymusinski (University of California, Riverside, USA), Chiaki Sakama (Wakayama University, Japan), Tran Cao Son (New Mexico State University, USA), Hudson Turner (University of Minnesota, Duluth, USA), David Warren (State University of New York at Stony Brook, USA), Jia-Huai You (University of Alberta, Canada) For further information, visit the website below. (courtesy of aslonline)

`http://www.tcs.hut.fi/Conf/lpnmr-7/`

NZIMA Logic and Computation Workshop. Nelson, New Zealand. January 11–16, 2004. Directly following the NZMRI 2004 Summer Workshop (see above), this event is part of the Logic and Computation Program funded by the New Zealand Institute of Mathematics and its Applications (NZIMA). Invited speakers include: S. Goncharov, I. Hodkinson, C. Jockusch, B. Khoussainov, D. Kozen, S. Lempp, and J. Miller. For further information, visit the website below. (courtesy of aslonline)

`http://www.cllc.vuw.ac.nz/LandC.shtml`

Australasian Computer Science Week. Dunedin, New Zealand. January 18–22, 2004. Australasian Computer Science Week is an international multi-conference event for computer science researchers. It is an annual event held in Australia and New Zealand that is sponsored by the Computer Science Association of Australasia. For further information, visit the website below. (courtesy of aslonline)

`http://www.cs.otago.ac.nz/acsw/`

Modality and Mentalism in Modern Epistemology. The Carlsberg Academy, Copenhagen, Denmark. January 29–31, 2004. *Modalism* in epistemology is the view that a satisfactory account of knowledge, evidence and cognate epistemic core notions involves reference to otherworldly state of affairs. Whether a certain belief for instance qualifies as knowledge is thus not something that can be settled merely on the basis of actual states of affairs. In addition, certain modal conditions – such as veracity through a specified range of possible scenarios – must be fulfilled. *Mentalism* is the view that knowledge is a *sui generis* mental state in which an epistemic agent is directly acquainted with the relevant subject matter. Knowledge ought thus not to be

considered as a true belief meeting certain further actual or modal conditions which secures an appropriate link between belief and truth. In particular, there is no such highest common factor (belief) which sometimes is and sometimes is not appropriately related to truth. Knowledge and belief are two distinct mental states and the former should be understood in adverbial rather than relational terms. The aim of the conference is to shed new light on these two dominant paradigms within contemporary epistemology and to investigate their interrelation (or lack of) when dealing with central epistemological themes such as transmission, internalism/externalism, naturalism, contextualism and scepticism. Finally, the conference will address the question where (if anywhere) modern epistemology ought to be placed on the philosophical map—in particular relative to philosophy of language, philosophy of mind, decision theory and cognitive science. Speakers: Keith DeRose (Yale University); Alvin Goldman (Rutger's University); Jaakko Hintikka (Boston University) John L. Pollock (University of Arizona); Robert Stalnaker (MIT); Timothy Williamson (University of Oxford); Michael Williams (Johns Hopkins); Crispin Wright (University of St. Andrews).
Introductory Seminar: An introductory seminar prior to the conference is scheduled for January 28–29, 2004. The seminar provides an introduction to the themes and issues to be addressed by the invited speakers during the conference. Lecturers for the seminar include Lars Bo Gundersen, Vincent F. Hendricks, and Duncan M. Pritchard. Program Committee: Lars Bo Gundersen (Aarhus University, DK), fillg@hum.au.dk; Vincent F. Hendricks (Roskilde University, DK), vincent@ruc.dk. The conference is organized by the research center Naturalized Mind – Cognisant Nature (NAMICONA), hosted by the Department of Philosophy, Aarhus University, Denmark and sponsored by NAMICONA and PHIS—The Danish Research School in Philosophy, History of Ideas and History of Science, Denmark. For more information refer to

`http://www.namicona.au.dk/pages/modalism.html`

Victoria International Conference 2004. Wellington, New Zealand. February 9–13, 2004. This event, hosted by Victoria University, is held in cooperation with the Israel Mathematical Union, the New Zealand Mathematical Society, and the New Zealand Institute of Mathematics and its Applications (NZIMA). The meeting will have several themes, but the program is being developed especially in conjunction with the six month Logic and Computation program of the NZIMA. Plenary speakers include: R. Downey, V. Jones, J. Makowsky, R. McLachlan, V. Palamodov, A. Nies, R. Raz, and H. Woodin. There also will be a special session in computational complexity. For further information, visit the website below. (courtesy of aslonline)

`http://www.mcs.vuw.ac.nz/~mathmeet`

Fifth International Workshop on Rewriting Logic and its Applications (WRLA 2004). Barcelona, Spain. March 27–28, 2004. Rewriting logic is a natural model of com-

putation and an expressive semantic framework for concurrency, parallelism, communication and interaction. It can be used for specifying a wide range of systems and languages in various application fields. It also has good properties as a metalogical framework for representing logics. The aim of the workshop is to bring together researchers with a common interest in RL and its applications. The deadline for submission of papers is November 24, 2003. The workshop will be held in conjunction with ETAPS 2004. Program Committee: David Basin (ETH Zurich), Manuel Clavel (Universidad Complutense de Madrid), Steven Eker (SRI International, Menlo Park), Kokichi Futatsugi (JAIST, Tatsunokuchi), Fabio Gadducci (Universita di Pisa), Alexander Knapp (LMU, Muenchen), Claude Kirchner (INRIA Lorraine & LORIA, Nancy), Salvador Lucas (Universidad Politecnica de Valencia), Narciso Marti-Oliet (Universidad Complutense de Madrid (Chair)), Jose Meseguer (University of Illinois at Urbana-Champaign), Ugo Montanari (Universita di Pisa), Pierre-Etienne Moreau (INRIA Lorraine & LORIA, Nancy), Grigore Rosu (University of Illinois at Urbana-Champaign), Carolyn Talcott (SRI International, Menlo Park). For further information, visit the website below. (courtesy of aslonline)

`http://www.fdi.ucm.es/wrla2004`

European Joint Conferences on Theory and Practice of Software (ETAPS 2004). Barcelona, Spain. March 29–April 2, 2004. (ETAPS) is the primary European forum for academic and industrial researchers working on topics relating to Software Science. The submission deadline for the main conferences and tutorials is October 17, 2003. The European Joint Conferences on Theory and Practice of Software (ETAPS) is the primary European forum for academic and industrial researchers working on topics relating to Software Science. ETAPS is a confederation of five main annual conferences, accompanied by satellite workshops and other events. After ETAPS 98 in Lisbon, ETAPS 99 in Amsterdam, ETAPS 2000 in Berlin, ETAPS 2001 in Genova, ETAPS 2002 in Grenoble, and ETAPS 2003 in Warsaw. ETAPS 2004 is the seventh joint conference in this series. The conference is organized by the Technical University of Catalonia (UPC). ETAPS Steering Committee: José Luiz Fiadeiro (Leicester, Chairman), Egidio Astesiano (Genova), Pierpaolo Degano (Pisa), Evelyn Duesterwald, Hartmut Ehrig (Berlin), Hubert Garavel (Montbonnot Saint-Martin), Marie-Claude Gaudel (Paris), Andy Gordon (Microsoft Research, Cambridge), Roberto Gorrieri (Bologna), Susanne Graf (Grenoble), R. Nigel Horspool (Victoria), Görel Hedin (Lund), Kurt Jensen (Aarhus), Paul Klint (Amsterdam), Tiziana Margaria (Dortmund), Ugo Montanari (Pisa), Mogens Nielsen (Aarhus), Hanne Riis Nielson (Copenhagen), Fernando Orejas (Barcelona), Mauro Pezzè (Milano), Andreas Podelski (Saarbrücken), Don Sannella (Edinburgh), Dave Schmitt (Kansas), Bernhard Steffen (Dortmund), Andrzej Tarlecki (Warszawa), Herbert Weber (Berlin), Igor Walukiewicz (Bordeaux). Organizing Committee: Jordi Cortadella (Satellite Events), Nikos Mylonakis, Robert Nieuwenhuis, Fernando Orejas (Chair), Edelmira Pasarella, Elvira Pino, Albert Ru-

bio. For further information, visit the website below. (courtesy of aslonline)

http://www.lsi.upc.es/etaps04

Seventh International Symposium on Functional and Logic Programming (FLOPS 2004). Nara, Japan. April 7–9, 2004. This event is a forum for research on all issues concerning functional programming and logic programming. In particular, it is intended to stimulate the cross-fertilization as well as integration of the two paradigms. Invited speakers include: M. Hagiya, C. Schuermann, and P. Selinger. The deadline for submission of papers is October 1, 2003. Program Co-Chairs: Yukiyoshi Kameyama (University of Tsukuba), Peter Stuckey (University of Melbourne). E-mail: flops@logic.is.tsukuba.ac.jp. Program Committee: Francois Fages (INRIA Rocquencourt), Herman Geuvers (Nijmegen University), Michael Hanus (University of Kiel), Martin Hofmann (LMU Munchen), Haruo Hosoya (University of Tokyo), Yukiyoshi Kameyama (University of Tsukuba), Naoki Kobayashi (Tokyo Institute of Technology), John Lloyd (Australian National University), Aart Middeldorp (University of Tsukuba), Atsushi Ohori (JAIST), German Puebla (Technical University of Madrid, Morten Rhiger (IT-University of Copenhagen), Amr Sabry (Indiana University), Peter Stuckey (University of Melbourne), Martin Sulzmann (National University of Singapore), Kazunori Ueda (Waseda University), Philip Wadler (Avaya Labs). Local Arrangements Chair: Jacques Garrigue (Kyoto University). For further information, visit the website below. (courtesy of aslonline)

http://logic.is.tsukuba.ac.jp/FLOPS2004/

Workshop on Combination of Logics: Theory and Applications (CombLog'04). Lisbon, Portugal. July 28–30, 2004. Combinations of logics include methods that have various applications in logics for software specification, logics for security, and logics for formal ethics (from the point of view of formal agents). For further information, visit the website below. (courtesy of aslonline)

http://www.cs.math.ist.utl.pt/comblog04/

BOOK SERIES:
APPLIED LOGIC SERIES 27

Hardbound
ISBN 1-4020-0763-9
July 2002, 408 pp.
€ 88.00 / $ 81.00 / £55.00

An Introduction to Mathematical Logic and Type Theory: To Truth Through Proof

Second Edition

By
Peter B. Andrews *Dept. of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA, USA*

FREE ONLINE SAMPLES AVAILABLE

This introduction to mathematical logic starts with propositional calculus and first-order logic. Topics covered include syntax, semantics, soundness, completeness, independence, normal forms, vertical paths through negation normal formulas, compactness, Smullyan's Unifying Principle, natural deduction, cut-elimination, semantic tableaux, Skolemization, Herbrand's Theorem, unification, duality, interpolation, and definability.

The last three chapters of the book provide an introduction to type theory (higher-order logic). It is shown how various mathematical concepts can be formalized in this very expressive formal language. This expressive notation facilitates proofs of the classical incompleteness and undecidability theorems which are very elegant and easy to understand. The discussion of semantics makes clear the important distinction between standard and nonstandard models which is so important in understanding puzzling phenomena such as the incompleteness theorems and Skolem's Paradox about countable models of set theory.

Some of the numerous exercises require giving formal proofs. A computer program called ETPS which is available from the web facilitates doing and checking such exercises.

Audience: This volume will be of interest to mathematicians, computer scientists, and philosophers in universities, as well as to computer scientists in industry who wish to use higher-order logic for hardware and software specification and verification.

for up-to-date information: www.wkap.nl/prod/b/1-4020-0763-9

Contact information:
Charles Erkelens
PHILOSOPHY OF SCIENCE AND LOGIC
E charles.erkelens@wkap.nl
T +31 78 65 76 387

Floor Oosting
PHILOSOPHY AND RELIGIOUS STUDIES
E floor.oosting@wkap.nl
T +31 78 65 76 205

kluwer
the language of science

NEW PUBLICATIONS

Geometry of State Spaces of Operator Algebras (Mathematics. Theory and Applications). Erik M. Alfsen, Frederic W. Shultz. $74.95. Springer Verlag; (January 2003); ISBN: 0817643192. This book gives a complete and self-contained solution to the long-standing problem of giving a geometric description of state spaces of C*-algebras and von Neumann algebras, and of their Jordan algebraic analogs (JB-algebras and JBW-algebras). This material, which has previously only appeared in research papers based on substantial prerequisites, is made accessible to a broad mathematical audience. The state space completely determines a Jordan algebra, and when an orientation is specified, it also determines the associative algebra. The role of orientations was described in the authors' previous book, "State Spaces of Operator Algebras, Basic Theory, Orientations and C*-Products", which also gives the necessary prerequisites on C*-algebras and von Neumann algebras. These prerequisites are summarized in an appendix which contains all relevant definitions and results. All necessary background on Jordan algebras is given in the present book, and the first part of the book may be of independent interest for those wanting a quick introduction to Jordan algebras. Key features include: The properties used to describe state spaces are primarily of a geometric nature, but many can also be interpreted in terms of physics. There are numerous remarks discussing these connections * A quick introduction to Jordan algebras is given; no previous knowledge is assumed and all necessary background on the subject is given * A discussion of dynamical correspondences, which tie together Lie and Jordan structures, and relate the observables and the generators of time evolution in physics * The connection with Connes' notions of orientation and homogeneity in cones is explained * Chapters conclude with notes placing the material in historical context * Prerequisites are a standard graduate courses in real and complex variables, measure theory, and functional analysis * Excellent bibliography and index.

Logic, Meaning, and Conversation: Semantical Underdeterminacy, Implicature, and Their Interface. Jay David Atlas. $55.00. Oxford University Press; (October 2003); ISBN: 0195133005. This fresh look at the philosophy of language focuses on the interface between a theory of literal meaning and pragmatics–a philosophical examination of the relationship between meaning and language use and its contexts. Here, Atlas develops the contrast between verbal ambiguity and verbal generality, works out a detailed theory of conversational inference using the work of Paul Grice on Implicature as a starting point, and gives an account of their interface as an example of the relationship between Chomsky's Internalist Semantics and Language Performance. Atlas then discusses consequences of his theory of the Interface for the distinction between metaphorical and literal language, for Grice's account of meaning, for the Analytic/Synthetic distinction, for Meaning Holism, and for Formal Semantics of Natural Language. This book makes an important contribution to the philosophy of

language and will appeal to philosophers, linguists, and cognitive scientists.

Logics of Conversation. Nicholas Asher, Alex Lascarides. $70.00. Cambridge University Press; (July 2003); ISBN: 0521650585. People often mean more than they say because grammar is typically insufficient for determining the full meaning of an utterance. The assumption that the discourse is coherent or "makes sense" has an important role to play in determining meaning as well. This study presents a dynamic semantic framework called Segmented Discourse Representation Theory, or SDRT, where the interaction between discourse coherence and discourse interpretation is explored in a logically precise manner.

Carnap Brought Home: The View from Jena (Publications of the Archive of Scientific Philosophy Series). Steve Awodey (Editor), Carsten Klein (Editor). $52.95. Open Court Publishing Company; (October 2003); ISBN: 081269550X.

Deflating Existential Consequence: A Case for Nominalism. Jody Azzouni. $49.95. Oxford University Press; (September 2003); ISBN: 0195159888.

The Logic Book. Merrie Bergmann, James Moor, Jack Nelson. $83.80. McGraw-Hill Humanities/Social Sciences/Languages; 4th edition (September 2003); ISBN: 0072401893. This outstanding book is a leading text for symbolic or formal logic courses All techniques and concepts are presented with clear, comprehensive explanations and numerous, carefully constructed examples. Its flexible organization (all chapters are complete and self-contained) allows instructors the freedom to cover the topics they want in the order they choose. The third edition incorporates many new and updated exercises and expanded discussions on evaluating arguments and symbolization in predicate logic. A free Student Solutions Manual is packaged with every copy of the textbook. Two logic programs, Bertie III and Twootie, are available as a free download from the University of Connecticut Philosophy Department's Web site.Bertie 3 is a proof checker for the natural deduction method and Twootie is a proof checker for the truth tree method.

Many-Valued Logics 2. Leonard Bolc, Piotr Borowik. $59.95. Springer Verlag; 1st edition (April 2003); ISBN: 3540645071.

Fuzzy Probabilities. James J. Buckley, Gustav Klimt. $59.00. Physica Verlag; (January 2003); ISBN: 379081542X.

A First Course in Logic. K. Codell Carter. $74.00. Longman; 1st edition (June 2003); ISBN: 0321108825.

Brain Busters: Mind-Stretching Puzzles in Math and Logic. Barry R. Clarke. $5.95. Dover Publications; ISBN: 0486427552; (June 2003).

Categorical Closure Operators. Gabriele Castellini. Birkhauser Boston; (January 2003); ISBN: 3764342501.

Logics for Emerging Applications of Databases. Jan Chomicki (Editor), Ron van der Meyden (Editor), Gunter Saake (Editor). $79.95. Springer Verlag; (September 2003); ISBN: 3540007059.

The Evolution of Reason: Logic as a Branch of Biology. William S. Cooper. $28.00. Cambridge University Press; (August 2003); ISBN: 0521540259. The formal systems of logic have ordinarily been regarded as independent of biology, but recent developments in evolutionary theory suggest that biology and logic may be intimately interrelated. In this book, William S. Cooper outlines a theory of rationality in which logical law emerges as an intrinsic aspect of evolutionary biology. He examines the connections between logic and evolutionary biology and illustrates how logical rules are derived directly from evolutionary principles, and therefore, have no independent status of their own. This biological perspective on logic, though at present unorthodox, could change traditional ideas about the reasoning process.

Analysis of Dis/Agreement, in Law and Jurisprudence (Law and Philosophy Library, V. 66). Svein Eng. Kluwer Academic Publishers; (August 2003); ISBN: 1402014902.

Representing Reason: Feminist Theory and Formal Logic. Rachel Joffe Falmagne (Editor), Marjorie Hass (Editor). $65.00. Rowman & Littlefield; (January 2003); ISBN: 0847696685. "Philosophy's traditional man of reason" – independent, neutral, unemotional – is an illusion. That's because the "man of reason" ignores one very important thing – the woman. As feminist philosophy grew in the 1980s and '90s, it became clear that the attributes philosophical tradition wrote off as "womanly" are in fact part of human nature. No longer can philosophy maintain the dichotomy between the rational man and the emotional woman, but must now examine a more complex human being, able to reason and feel. Yet feminist philosophy also makes it clear that men and women theorize the world in different ways, from different perspectives. *Representing Reasons: Feminist Theory and Formal Logic* collects new and old essays that shed light on the underexplored intersection of logic and feminism. The papers in this collection cross over many of the traditional divides between continental and analytic philosophy, between philosophical reflection and empirical investigation, and between empirical investigations with an individual or societal grain of analysis. This is possible because *Representing Reasons* frames the relationship between logic and feminism in terms of issues rather than historical figures or methodologies. As such, the articles serve as a model for crossing these divides, just as they break down the traditional divide between logic and feminism.

Feisty Fragments — for Philosophy. Vincent F. Hendricks. £15.00. King's College Publications; (December 2003). Philosophers have had a way of sometimes obstructing the otherwise admirable endeavour of philosophy: To address the fundamental issues of human existence and the workings of nature. This obstruction is emphasized by suggesting rather odd and exotic prerequisites for solving a seemingly simple problem; a particularly intractable jargon in which no words occurring have less than seven syllables and by insane thought experiments. When the impenetrable jargon is paired up with ludicrous thought experiments and the philosopher at the same time continues to insist that he or she is addressing the fundamental problems of human existence and condition, it begins to sound pretty much like the wizardry of Medieval alchemy. This is what *Feisty Fragments* echoes in words from Nietzsche to Einstein, from Catherine the Great to Woody Allen. *Feisty Fragments* is a collection of more than 270 commented quotations from people from all the walks of life expressing their rather critical and often quite humorous takes on both philosophy and philosophers.

Knowledge Contributors. Vincent F. Hendricks (Editor), Klaus Frovin Jørgensen (Editor), Stig Andur Pedersen (Editor). Synthese Library, vol. 322, Kluwer Academic Publishers. $32.00; (December 2003); (paperback) ISBN 1402017480; (hardback) ISBN 1402017472. In the 1950's and 1960's seminal works on the logic of knowledge and belief were published by notably von Wright and Hintikka. Epistemic and doxastic logics have since then grown into mature disciplines enjoying many important applications in philosophy, computer science, game theory, economics and linguistics to mention but a few fields. The aim of this thematically unified anthology is to track the history of epistemic logic, to consider some important applications of epistemic logic in a variety of fields, and finally to discuss future directions of research in epistemic logic with particular emphasis on multi-modal systems and 'active agenthood'. *Knowledge Contributors* include H.v. Ditmarsch, R. Fagin, J. Halpern, J. Hintikka, W.v.d. Hoek, B. Kooi, W. Lenzen, Y. Moses, H. Rott, J. Sowa, M. Vardi and R. Wójcicki.

Trends in Logic: 50 Years of Studia Logica. Vincent F. Hendricks (Editor), Jacek Malinowski (Editor). $149.00. Trends in Logic: Studia Logica Library, vol. 21, Kluwer Academic Publishers; (October 2003); ISBN 1402016018. In 1953, exactly 50 years ago to this day, the first volume of *Studia Logica* appeared under the auspices of The Philosophical Committee of The Polish Academy of Sciences. Now, 5 decades later the present volume is dedicated to a celebration of this 50th Anniversary of *Studia Logica.* The volume features a series of papers by distinguished scholars reflecting both the aim and scope of this journal for symbolic logic. The Anniversary volume offers contributions from J. van Benthem, W. Buszkowski, M.L. Dalla Chiara, M. Fitting, J.M. Font, R. Giuntini, R. Goldblatt, V. Marra, D. Mundici, R. Leporini, S.P. Odintsov, H. Ono, G. Priest, H. Wansing, V.R. Wójcicki and J. Zygmunt.

Beyond Two: Theory and Applications of Multiple Valued Logic. Melvin Fitting (Editor), E. Orlowska (Editor), Michael Schneider (Editor). Physica Verlag; (February 12, 2003); ISBN: 3790815411.

Agenda Relevance: A Study in Formal Pragmatics (A Practical Logic of Cognitive Systems, Vol. 1). Dov M. Gabbay, John Woods. $125.00. North-Holland; (June 2003); ISBN: 044451385X. *Agenda Relevance* is the first volume in the authors' omnibus investigation of the logic of practical reasoning, under the collective title, *A Practical Logic of Cognitive Systems.* In this highly original approach, practical reasoning is identified as reasoning performed with comparatively few cognitive assets, including resources such as information, time and computational capacity. Unlike what is proposed in optimization models of human cognition, a practical reasoner lacks perfect information, boundless time and unconstrained access to computational complexity. The practical reasoner is therefore obliged to be a cognitive economizer and to achieve his cognitive ends with considerable efficiency. Accordingly, the practical reasoner avails himself of various scarce-resource compensation strategies. He also possesses neurocognitive traits that abet him in his reasoning tasks.

From Naming to Saying: The Unity of the Proposition. Martha I. Gibson, Martha Gobson. $64.95. Blackwell Publishers; (December 2003); ISBN: 0631226559.

The Reason's Proper Study: Essays Towards a Neo-Fregean Philosophy of Mathematics. Bob Hale, Crispin Wright. $27.50. Oxford University Press; (November 2003); ISBN: 0199266328. Hale and Wright draw together the key writings in which they have worked out their distinctive neo-Fregean approach to the philosophy of mathematics. The two main components in Frege's mathematical philosophy were his platonism and his logicism—the claims, respectively, that mathematics is a body of knowledge about independently existing objects, and that this knowledge may be acquired on the basis of general logical laws and suitable definitions. The central thesis of this collection is that Frege was – his own eventual recantation notwithstanding – substantially right in both claims. Where neo-Fregeanism principally differs from Frege is in taking a more optimistic view of the kind of contextual explanation (proceeding via what are now commonly called abstraction principles) of the fundamental concepts of arithmetic and analysis which Frege considered and rejected. On this basis, neo-Fregeanism promises defensible and attractive answers to some of the most important ontological and epistemological questions in the philosophy of mathematics.

Reasoning about Uncertainty. Joseph Y. Halpern. $50.00. Cambridge, MA: MIT Press; ISBN: 0262083205. (September 2003). Uncertainty is a fundamental and unavoidable feature of daily life; in order to deal with uncertaintly intelligently, we

need to be able to represent it and reason about it. In this book Joseph Halpern examines formal ways of representing uncertainty and considers various logics for reasoning about it. While the ideas presented are formalized in terms of definitions and theorems, the emphasis is on the philosophy of representing and reasoning about uncertainty; the material is accessible and relevant to researchers and students in many fields, including computer science, artificial intelligence, economics (particularly game theory), mathematics, philosophy, and statistics. Halpern begins by surveying possible formal systems for representing uncertainty, including probability measures, possibility measures, and plausibility measures. He considers the updating of beliefs based on changing information and the relation to Bayes theorem; this leads to a discussion of qualitative, quantitative, and plausibilistic Bayesian networks. He considers not only the uncertainty of a single agent but also uncertainty in a multi-agent framework. Halpern then considers the formal logical systems for reasoning about uncertainty. He discusses knowledge and belief; default reasoning, and the semantics of default; reasoning about counterfactuals, and combining probability and counterfactuals; belief revision; first-order modal logic; and statistics and beliefs. He includes a series of exercises at the end of each chapter.

The Principles of Mathematics Revisited. Jaakko Hintikka. $30.00. Cambridge University Press; Reprint edition (April 2003); ISBN: 0521624983. This book, written by one of philosophy's preeminent logicians, argues that many of the basic assumptions common to logic, philosophy of mathematics and metaphysics are in need of change. Jaakko Hintikka proposes a new basic first-order logic and uses it to explore the foundations of mathematics. This new logic enables logicians to express on the first-order level such concepts as equicardinality, infinity, and truth in the same language. Hintikka's new logic is highly original and will prove appealing to logicians, philosophers of mathematics, and mathematicians concerned with the foundations of the discipline.

Hume's Problem: Induction and the Justification of Belief. Colin Howson. $22.95. Oxford University Press; (May 2003); ISBN: 019825038X.

Wittgenstein and the End of Philosophy: Neither Theory Nor Therapy. Daniel D. Hutto. Palgrave Macmillan; ISBN: 0333918800; (September 2003). What is the true worth of Wittgenstein's contribution to philosophy? Answers to this question are strongly divided. However, most assessments rest on certain popular misreadings of his purpose. This book challenges both "theoretical" and "therapeutic" interpretations. In their place, it seeks to establish that, from beginning to end, Wittgenstein regarded clarification as the true end of philosophy. It argues that, properly understood, his approach exemplifies rather than betrays critical philosophy and provides a viable alternative to other contemporary offerings.

Fuzzy Logic for Embedded Systems Applications. Ahmad M. Ibrahim. $49.99. Butterworth-Heinemann; (August 2003); ISBN: 0750676051. *Fuzzy Logic for Embedded Systems Applications*, by a recognized expert in the field, covers all the basic theory relevant to electronics design, with particular emphasis on embedded systems, and shows how the techniques can be applied to shorten design cycles and handle logic problems that are tough to solve using conventional linear techniques. All the latest advances in the field aree discussed and practical circuit design examples presented. Fuzzy logic has been found to be particularly suitable for many embedded control applications. The intuitive nature of the fuzzy-based system design saves engineers time and reduces costs by shortening product development cycles and making system maintenance and adjustments easier. Yet despite its wide acceptance-and perhaps because of its name-it is still misunderstood and feared by many engineers. There is a need for embedded systems designers-both hardware and software-to get up to speed on the principles and applications of fuzzy logic in order to ascertain when and how to use them appropriately. *Fuzzy Logic for Embedded Systems Applications* provides practical guidelines for designing electronic circuits and devices for embedded systems using fuzzy-based logic. It covers both theory and applications with design examples.

Strategic Logic. J. Carlos Jarillo. $55.00. Palgrave Macmillan; (August 2003); ISBN: 1403912599.

Time, Tense, and Reference. Aleksandar Jokic (Editor), Quentin Smith (Editor). $38.00. MIT Press; (October 2003); ISBN: 0262600501. Among the many branches of philosophy, the philosophy of time and the philosophy of language are more intimately interconnected than most, yet their practitioners have long pursued independent paths. This book helps to bridge the gap between the two groups. As it makes clear, it is increasingly difficult to do philosophy of language without any metaphysical commitments as to the nature of time, and it is equally difficult to resolve the metaphysical question of whether time is tensed or tenseless independently of the philosophy of language. Indeed, one is tempted to see philosophy of language and metaphysics as a continuum with no sharp boundary. The essays, which were written expressly for this book by leading philosophers of language and philosophers of time, discuss the philosophy of language and its implications for the philosophy of time and vice versa. The intention is not only to further dialogue between philosophers of language and of time but also to present new theories to advance the state of knowledge in the two fields. The essays are organized in two sections–one on the philosophy of tensed language, the other on the metaphysics of time.

Problems in Set Theory, Mathematical Logic and the Theory of Algorithms (University Series in Mathematics). I. A. Lavrov, Jonathan L. Swift. $125.00. Kluwer

Academic Publishers; (March 1, 2003); ISBN: 0306477122. Problems in Set Theory, Mathematical Logic and the Theory of Algorithms by I. Lavrov & L. Maksimova is an English translation of the fourth edition of the most popular student problem book in mathematical logic in Russian. It covers major classical topics in proof theory and the semantics of propositional and predicate logic as well as set theory and computation theory. Each chapter begins with 1-2 pages of terminology and definitions that make the book self-contained. Solutions are provided. The book is likely to become an essential part of curricula in logic.

Finite Automata. Mark Lawson. $56.00. CRC Press; (July 2003); ISBN: 1584882557.

Foundations of the Formal Sciences II: Applications of Mathematical Logic in Philosophy and Linguistics: Papers of a Conference Held in Bonn. Benedikt Löwe (Editor), Wolfgang Malzkorn (Editor), Thoralf Rasch (Editor), Joseph Agassi (Editor). $106.00. Kluwer Academic Publishers; (February 2003); ISBN: 1402011547. "Foundations of the Formal Sciences" (FotFS) is a series of interdisciplinary conferences in mathematics, philosophy, computer science and linguistics. The main goal is to reestablish the traditionally strong links between these areas of research that have been lost in the past decades. The second conference in the series had the subtitle "Applications of Mathematical Logic in Philosophy and Linguistics" and brought speakers from all parts of the Formal Sciences together to give a holistic view of how mathematical methods can improve our philosophical and technical understanding of language and scientific discourse, ranging from the theoretical level up to applications in language recognition software. Audience: This volume is of interest to all formal philosophers and theoretical linguists. In addition to that, logicians interested in the applications of their field and logic students in mathematics, computer science, philosophy and linguistics can use the volume to broaden their knowledge of applications of logic.

A Guide to Classical and Modern Model Theory (Trends in Logic, V. 19). A. Marcja, Carlo Toffalori. $115.00. Kluwer Academic Publishers; (July 2003); ISBN: 1402013302.

There Are Two Errors in the the Title of This Book: A Sourcebook of Philosophical Puzzles, Paradoxes and Problems.* Robert M. Martin. $18.95. Broadview Press; ISBN: 1551114933; (February 2003).

Essays in the Metaphysics of Modality. Alvin Plantinga, Matthew Davidson (Editor). $60.00. Oxford University Press; (April 2003); ISBN: 0195103769. Perhaps no one has done more in the last 30 years to advance thinking in the metaphysics of modality than has Alvin Plantinga. Collected here are some of his most important essays

on this influential subject. Dating back from the late 1960's to the present, they chronicle the development of Plantinga's thoughts about some of the most fundamental issues in metaphysics: what is the nature of abstract objects like possible worlds, properties, propositions, and such phenomena? Are there possible but non-actual objects? Can objects that do not exist exemplify properties? Plantinga gives thorough and penetrating answers to all of these questions and many others. This volume contains some of the best work in metaphysics from the past 30 years, and will remain a source of critical contention and keen interest among philosophers of metaphysics and philosophical logic for years to come.

Logic for Concurrency and Synchronisation (Trends in Logic, V. 18). Ruy J. G. B. de Queiroz (Editor). $100.00. Kluwer Academic Publishers; (July 2003); ISBN: 1402012705.

Ambiguity and Logic. Frederic Schick. $55.00. Cambridge University Press; (June 2003); ISBN: 0521824583. In this book, Frederic Schick extends and applies the decision theory he proposed in two previous Cambridge books: Understanding Action (1991) and Making Choices (1997). He shows how the way we see situations affects the choices we make, and he develops a logic of thought responsive to how things are seen. The book considers many questions of choosing and some familiar human predicaments. Why do people in choice experiments act so often against expectations? How might they and the experimenters be looking at different problems in them? Why do people cooperate so often where the textbook logic excludes that? How can there be weakness of will — and must it always be faulted? Does how we see things affect what they mean, and what are people reporting who say that their lives have no meaning for them? These very different questions turn out to have some closely related answers. There are vivid discussions here of cases drawn from many sources. The book will interest all who study how we choose and act, whether they are philosophers, psychologists, or economists — or any combination.

Ordered Sets: An Introduction. Bernd S. W. Schroder. Birkhauser Boston; (January 2003); ISBN: 3764341289.

Multiple Analogies in Science and Philosophy (Human Cognitive Processing, 11). Cameron Shelly. $85.00. John Benjamins Publishing Company; (June 2003); ISBN: 1588114023.

Logical Number Theory II (Universitext , No 2). Craig Smorynski. Springer Verlag; ISBN: 3540522352; (June 2003).

Language and Mind: Philosophical Perspectives. James E. Tomberlin (Editor). $34.95. Blackwell Publishers; ISBN: 0631234098 (January 2003).

Medieval Modal Systems: Problems and Concepts (Ashgate Studies in Medieval Philosophy). Paul Thom. $79.95. Ashgate Publishing Company; (October 2003); ISBN: 0754608336.

An Outline of the Necessary Laws of Thought. William Thomson. Thoemmes Press; (April 1, 2003); ISBN: 1843713233.

Memoirs of a Proof Theorist: Godel and Other Logicians. Mariko Yasugi, Nicholas Passell. $28.00. World Scientific Pub Co; (February 2003); ISBN: 9812382798. This volume is a translation of the book Gödel, written in Japanese by Gaisi Takeuti, a distinguished proof theorist. The core of the book comprises a memoir of K Gödel, Takeuti's personal recollections, and his interpretation of Gödel's attitudes towards mathematical logic. It also contains Takeuti's recollection of association with some other famous logicians. Everything in the book is original, as the author adheres to his own experiences and interpretations. There is also an article on Hilbert's second problem as well as on the author's fundamental conjecture about second order logic.

Lattice-Valued Logic: An Alternative Approach to Treat Fuzziness and Incomparability (Studies in Fuzziness and Soft Computing, V. 132). Yang Xu (Editor). Springer Verlag; (July 2003); ISBN: 354040175X.

AiML – ADVANCES IN MODAL LOGIC

AiML—*Advances in Modal Logic* is the main international forum at which research on all aspects of modal logic is presented. The Advances in Modal Logic Initiative was founded in 1995 by Maarten de Rijke (Amsterdam), Heinrich Wansing (Dresden), and Michael Zakharyaschev (Moscow) and the first AiML Workshop was held in 1996 in Berlin, Germany. Since then the AiML Workshop has been organised on an bi-annual basis with previous meetings being held in 1998 in Uppsala, Sweden, in 2000 in Leipzig, Germany (jointly with ICTL-2000), and in 2002 in Toulouse, France. For more information refer to

`http://www.aiml.net`

The next workshop

AiML-2004

Advances in Modal Logic

September 9–11, 2004, Manchester, UK

will be hosted by the Department of Computer Science of the University of Manchester. During the workshop there will be a special session on 'Modal Logics for Knowledge and Action.'

The venue for the workshop will be the Chancellors Residential Conference Centre of the University of Manchester. The Chancellors is a purpose-built conference hotel, 3 star Hotel standard. It is situated in five acres of landscaped gardens located not far from the University and the city centre.

Topics

- Complexity and decidability of modal and temporal logics
- Deontic logic
- Description logics
- Dynamic logic

- Epistemic logic
- Modal logics of space
- Modal logic and game theory
- Modal logic and grammar formalisms
- Modal and temporal logic programming and theorem proving
- Model theory and proof theory of modal logics
- Computational aspects of modal logics
- Correspondence theory, duality theory
- Representation of time in natural language semantics
- Non-monotonic modal logics
- Modal logics for agent-based systems
- Modal logic in Computer Science and AI
- Provability logic
- Mathematics of modal logic
- Philosophy of modal logic

Invited Speakers

- Philippe Balbiani, Institut de Recherche en Informatique in Toulouse, France
- Keith Devlin, Center for the Study of Language and Information, Stanford, USA
- Valentin Goranko, Rand Afrikaans University, Johannesburg, South Africa
- Wiebe van der Hoek, University of Liverpool, UK
- Maarten Marx, Institute for Logic, Language and Computation, University of Amsterdam, The Netherlands
- Robert Stalnaker, Massachusetts Institute of Technology, USA

Paper Submission

Authors are invited to submit a detailed abstract of a full paper of at most 10 pages (a4paper, 11pt) by e-mail to one of the programme chairs, using 'AiML Submission' as the subject line. The cover page should include title, names of authors, the coordinates of the corresponding author, and some keywords describing the topic of the paper. To be considered, submissions must be received no later than April 15, 2004. Note that at least one author of each accepted paper is required to register for and attend the conference to present the paper. (Otherwise there is a risk of not being invited to the formal proceedings volume.)

Publication Details

Preliminary versions of the full papers will be made available at the meeting. Authors will be invited to submit a full version, which will again be refereed. The selected papers will be included in the formal proceedings to be published by King's College Publications. Notification date for the conference is June 15, 2004; for the formal proceedings it is December 1, 2004.

Program Committee Chairs

- Heinrich Wansing (wansing@rcs.urz.tu-dresden.de), Dresden University of Technology, Germany
- Mark Reynolds (m.reynolds@murdoch.edu.au), Murdoch University, Perth, Australia

Program Committee

- Patrick Blackburn, INRIA Lorraine, Nancy, France
- Alexander Chagrov, Tver University, Russia
- Vincent F. Hendricks, Roskilde University, Denmark
- Ian Pratt-Hartmann, University of Manchester, UK
- Mark Reynolds, Murdoch University, Perth, Australia
- Maarten de Rijke, University of Amsterdam, The Netherlands

- Ulrike Sattler, University of Manchester , UK
- Holger Schlingloff, Humboldt University of Berlin, Germany
- Renate Schmidt, University of Manchester, UK
- Nobu-Yuki Suzuki, Shizuoka University, Japan
- Heinrich Wansing, Dresden University of Technology, Germany
- Frank Wolter, University of Liverpool, UK
- Michael Zakharyaschev, King's College London, UK

Steering Committee

- Mark Reynolds, Murdoch University, Perth, Australia
- Maarten de Rijke, University of Amsterdam, The Netherlands
- Renate Schmidt, University of Manchester, UK
- Nobu-Yuki Suzuki, Shizuoka University, Japan
- Heinrich Wansing, Dresden University of Technology, Germany
- Frank Wolter, University of Liverpool, UK
- Michael Zakharyaschev, King's College London, UK

Local Organisers

- Renate Schmidt (schmidt@cs.man.ac.uk), University of Manchester, UK
- Ian Pratt-Hartmann (ipratt@cs.man.ac.uk), University of Manchester, UK

Important Dates

- Submission deadline: April 15, 2004
- Acceptance notification: June 15, 2004
- Conference: September 9—11, 2004

- Preliminary versions for conference due: July 15, 2004
- Notification of acceptance for full papers: December 1, 2004

Further Information

Information about AiML-2004 can be obtained at

`http://www.cs.man.ac.uk/aiml04`

E-mail enquiries about AiML-2004 should be directed to the local organizers or the program co-chairs.

ASL – ASSOCIATION FOR SYMBOLIC LOGIC

2003-04 ASL Winter Meeting (with Joint Mathematics Meetings). Phoenix, Arizona. January 9–10, 2004. This meeting will take place in conjunction with the Joint Mathematics Meetings, which will be held January 7–10, 2004. The members of the Program Committee are V. Harizanov, J. Steel, and C. Wood (Chair). Invited speakers include: M. Foreman, S. Jackson, B. Kim, J. Knight, R.W. Knight, S. Lempp, Y. Peterzil, F. Point, and S. Solecki. There will be an AMS-ASL Joint Special Session on Infinite Combinatorics and Inner Model Theory, organized by M. D. Foreman and M. Zeman. Abstracts of contributed talks submitted by ASL members will be published in *The Bulletin of Symbolic Logic* if they satisfy the Rules for Abstracts (see above). Abstracts must be received by the deadline of September 15, 2003, at the ASL Business Office: ASL, Box 742, Vassar College, 124 Raymond Avenue, Poughkeepsie, New York 12604, USA; Fax: 1-845-437-7830; email: asl@vassar.edu.

2004 ASL Spring Meeting (with APA). Chicago, Illinois. April 22–25, 2004. This meeting will be held jointly with the Annual Meeting of the Central Division of the American Philosophical Association. The program includes three invited sessions. The first, on Frege's Logic, will be chaired by M. Kremer and includes the speakers W. Goldfarb and E. Reck, and the commentator, P. Sullivan. The session on The Philosophy of Proof Theory, chaired by T. Bays, includes the speakers J. Avigad and M. Detlefsen, and the commentator, B. Tait. The third session, on Category Theory and Structuralism, will be chaired by S. Awodey, and includes the speakers G. Hellman and C. McClarty, and the commentator, D. Scott. The Program Committee members for the ASL meeting are: S. Awodey, T. Bays, and M. Kremer (Chair). Abstracts of contributed talks submitted by ASL members will be published in The Bulletin of Symbolic Logic if they satisfy the Rules for Abstracts (see above). Abstracts must be received by the deadline of January 15, 2004, at the ASL Business Office: ASL, Box 742, Vassar College, 124 Raymond Avenue, Poughkeepsie, New York 12604, USA; Fax: 1-845-437-7830; email: asl@vassar.edu.

2004 ASL Annual Meeting. Carnegie Mellon University, Pittsburgh, Pennsylvania. May 19–23, 2004. The members of the Program Committee are: S. Artemov (Chair), T. Bartoszynski, D. Hirschfeldt, M.C. Laskowski, and W. Sieg. The Local Organizing Committee members include J. Avigad (Chair), S. Awodey, L. Blum, J. Cummings,

E. Schimmerling, and W. Sieg. The 2004 Mathematical Foundations of Programming Semantics (MFPS) Meeting, to begin on May 23, 2004, will co-locate with the ASL Annual Meeting. For more information about MFPS, visit the website below. Abstracts of contributed talks submitted by ASL members will be published in *The Bulletin of Symbolic Logic* if they satisfy the Rules for Abstracts (see above). Abstracts must be received by the deadline of February 10, 2004, at the ASL Business Office: ASL, Box 742, Vassar College, 124 Raymond Avenue, Poughkeepsie, New York 12604, USA; Fax: 1-845-437-7830; email: asl@vassar.edu.

`http://www.math.tulane.edu/MFPS.html`

2004 ASL European Summer Meeting (Logic Colloquium '04). Torino, Italy. July 25–31, 2004. The members of the Program Committee are: T. Arai, D. DeJongh, W. Goldfarb, G. Hjorth, S. Lempp, G. Lolli, D. Marker, D. Martin, R. McKenzie, W. Pohlers (Chair), W. Sieg, A. Sorbi, and A. Wilkie. The Local Organizing Committee includes: A. Andretta (Chair), S. Berardi, R. Camerlo, U. De Liguoro, M. Dezani, A. Marcone, N. Olivetti, and D. Zambella. For further information visit the website below.

`http://lc2004.unito.it`

2005 ASL Annual Meeting. Stanford, California. March 19–22, 2005. The members of the Local Organizing Committee include: A. Arana, S. Feferman, G. Mints, J. Mitchell, and R. Sommer.

Latin American Symposium on Mathematical Logic (XIIth SLALM). Universidad de Costa Rica, San José, Costa Rica. January 12-16, 2004. Topics include: algebraic logic, history and philosophy of logic, model theory, philosophical logic, proof theory, recursion theory and algorithm complexity, and set theory. Invited speakers include: J. Bagaria, S. Buss, L. van den Dries, E.G. K. López Escobar, I. Nemeti, A. Prestel, S. Todorcevic, J. Väänänen, and A. Villaveces. The Program Committee members are: X. Caicedo, C. Di Prisco, J.I. Guier, R. Lewin, E. G. K. López Escobar, F. Miraglia, and M. Sagastume. The Organizing Committee consists of E. Chinchilla, M. Freund, J. I. Guier, and B. Montero. The deadline for submission of abstracts is September 1, 2003. As in previous symposia, a School in Mathematical Logic will precede the symposium on January 7–10, and offer the following short courses: Teoría de Modelos y Formas cuadráticas (M. Dickmann), Teoría de la Complejidad para Cálculo Numérico (F. Cucker), an Introduction to Determinacy (I. Neeman), and an Introduction to Proof Theory (L.C. Pereira). For further information, visit the website below. (ASL Sponsored Meeting.)

`http://www.vinv.ucr.ac.cr/slalm04/`

Third International Symposium on Foundations of Information and Knowledge Systems (FoIKS 2004). Vienna, Austria. February 17 - 20, 2004. The goal of the FoIKS

symposia, which take place once every two years, is to bring together researchers working on the theoretical foundations of information and knowledge systems and to attract researchers working in mathematical fields such as discrete mathematics, combinatorics, logics, and finite model theory, who are interested in applying their theories to research on database and knowledge base theory. The Co-chairs of the Program Committee are D. Seipel and J.-M. Turull-Torres. T. Eiter is in charge of local organization. For further information, visit the website below. (ASL Sponsored Meeting.)

`http://foiks.massey.ac.nz/foiks04/`

FoLLI – FOUNDATION OF LOGIC, LANGUAGE AND INFORMATION

FoLLI—The Foundation of Logic, Language and Information was founded in 1991 to advance the practising of research and education on the interfaces between logic, linguistics, computer science and cognitive science and related disciplines in Europe. Each year FoLLI organizes the European Summer School on Logic, Language and Information (ESSLLI). FoLLI has its own journal, the *Journal of Logic, Language and Information* (JoLLI), and book series, the *Studies in Logic, Language and Information* (SiLLI).

`http://www.folli.org`

Sixteenth European Summer School in Logic, Language and Information (ESSLLI-2004). Nancy, France. August 9–21, 2004. The main focus of the European Summer Schools in Logic, Language and Information is on the interface between linguistics, logic and computation. Foundational, introductory and advanced courses together with workshops cover a wide variety of topics within the three areas of interest: Language and Computation, Language and Logic, and Logic and Computation. ESSLLI-2004 is organized under the auspices of the European Association for Logic, Language and Information (FoLLI). Program Committee: Antal van den Bosch (chair), Philippe de Groote (local co-chair) Tim Fernando and Gerard Huet (Logic and Language), David Pym and Francesca Rossi (Logic and Computation), Paul Buitelaar and Detlef Prescher (Language and Computation). Local Organizing Committee: Patrick Blackburn (chair). For further information about ESSLLI-2004, visit:

`http://www.esslli.org/2004`

THE LOGIC OF TIME AND MODALITY

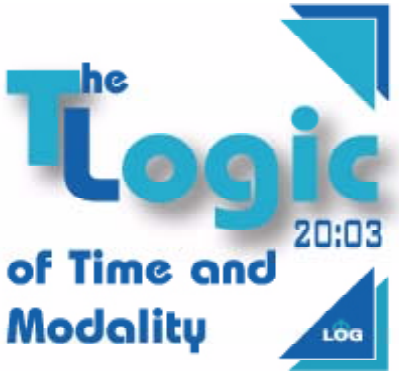
CONFERENCE BOOKLET

October 31—November 1, 2003
Roskilde University
Denmark

ΦLOG

CONFERENCE BOOKLET: THE LOGIC OF TIME AND MODALITY

CONFERENCE
Roskilde University (DK), October 31 – November 1, 2003



Arthur Norman Prior (1914–69) was the founding father of the modern logic of time and modality. In the 1950's and 1960's he laid out the foundation of temporal logic and showed that this discipline was intimately connected with modal logic. Since then, temporal and modal logic has grown into a mature discipline with many important applications in philosophy, computer science, and also linguistics.

One characteristic of Prior's work is the point of view that logic should be related as closely as possible to intuitions embodied in everyday discourse. He also argued that temporal logic is fundamental for understanding and describing the world in which we live. An important contribution by Prior was the foundation of what is now known as hybrid logics. One simple form of a hybrid logic is a temporal logic in which a special sort of formulas called instant-propositions can be used to refer to specific instants in a model. Thereby further expressive power is obtained. Hybrid logics are closely related to the so-called description logics used for knowledge representation in computer science. Prior's work on hybrid logic was motivated by a philosophical debate regarding two different conceptions of time: The A-series and B-series conceptions of

time. The A-series conception is based on the notions of past, present, and future, as opposed to a tapestry view on time, as embodied by the B-series conception of time according to which time is just a set of instants ordered with an earlier-later relation. Prior considered the A-conception to be the fundamental one and in his view, the B-concepts can be defined in terms of the A-concepts using instant-propositions. Branching time logic is another important contribution by Prior. Using this temporal logic, he analysed the fundamental philosophical question of determinism versus freedom of choice. In this analysis Prior demonstrated that it is possible to interpret the general idea of branching time in several fundamentally different ways.

There is still a lot to learn from Prior's writings, indeed, Oxford University Press has recently published a revised and enlarged edition of Prior's last book, *Papers on Time and Tense*. Since Prior's foundational work on the logic of time and modality, this discipline has attracted ever more attention not only within logic, but also within computer science, formal linguistics and philosophy in general. It is the aim of the conference at Roskilde University to discuss the modern challenges, problems, and applications of the Priorean approach to the logic of time and modality.

The conference is directed at researchers as well as graduate and PhD students in the fields of philosophical, computational, and mathematical logic. For more information, refer to the conference home page:

`http://www.philog.ruc.dk/phiconf3.html`

Speakers

- **Patrick Blackburn**
  INRIA Lorraine, France
  `http://www.loria.fr/~blackbur/`
- **Jack Copeland**
  Philosophy Department, University of Canterbury, New Zealand
  `http://www.phil.canterbury.ac.nz/jack_copeland/index.html`
- **Kit Fine**
  Department of Philosophy, New York University, USA
  `http://www.nyu.edu/gsas/dept/philo/faculty/fine/`
- **Antony Galton**
  Department of Computer Science, University of Exeter, England
  `http://www.dcs.ex.ac.uk/people/apgalton/index.htm`

- **Peter Simons**
  School of Philosophy, University of Leeds, England
  `http://www.philosophy.leeds.ac.uk/Staff/Ps/Index.htm`
- **Heinrich Wansing**
  Institute of Philosophy, Dresden University of Technology, Germany
  `http://www.tu-dresden.de/phfiph/dozenten/hwa2.htm`
- **Alberto Zanardo**
  Department of Pure and Applied Mathematics, University of Padove, Italy
  `http://www.math.unipd.it/~azanardo/index.html`

Abstracts

- Patrick Blackburn / An Introduction to Contemporary Hybrid Logic

  In orthodox modal logic it is not possible to refer to the states (times, worlds, individuals...) of our models. This shortcoming renders modal logic unsuitable for many applications. Hybrid logic is a form of modal logic in which reference to states is possible; the key ideas trace back to work by Arthur Prior in the 1960s. Hybridisation not only improves the utility of modal logic, it also improves its metalogical properties in a number of ways; for example, general completeness and interpolation results can be proved, and a number of standard proof techniques (including natural deduction, sequent calculus, and resolution) can be straightforwardly adapted to hybrid logics.This is the first of two talks on hybrid logic.
  Here I present an overview of contemporary hybrid logic, stressing the intuitions which have guided its development, indicating the uses to which it can be put, and generally trying to make it clear exactly what advantages hybrid logic has over orthodox modal systems. I make little or no direct contact with the work of Arthur Prior; rather, my aim is to present a vivid snapshot of what contemporary hybrid logic is all about, and how it relates to current work in modal and description logic. I discuss Prior's work in my second talk.

- Patrick Blackburn / Arthur Prior and Hybrid Logic

  Over the last few years the basic ideas underlying hybrid logic have become

increasingly familiar to modal logicians: nowadays most active researchers in modal logic (and most researchers in the neighbouring field of description logic) are familiar with the idea of 'naming' points using nominals, and are aware that this idea can be traced back to work of Arthur Prior in the 1960s.
In spite of this, Prior's work in this area remains largely uncited and undiscussed. This is surprising, for hybridisation plays a role in Prior's work that is both central and problematic. Hybridisation isn't some optional extra in Priorean logic: it's the crucial technical idea needed to ensure that B-series talk can be reduced to A-series talk. However although hybridisation solves Prior's reduction problem, it solves it rather too well: as Prior came to realise, hybridisation could be applied to any domain, and this casts doubt on his insistence that tensed talk is special.
In this talk, I shall discuss Prior's work on hybrid logic, and explain why it is both important to and problematic for his philosophy. And (building on my first talk) I shall contrast the Priorean perspective on hybrid logic with the (model theoretic) perspective that underlies contemporary work.

- Jack Copeland / Free Will and Modality

  In chapter VII of *Past, Present and Future* Prior formalised an argument for the impossibility of free will which he found in the writings of Peter de Rivo. Neither of Prior's two responses to the argument-his 'Ockhamist' and 'Peircean' answers-is entirely satisfactory. I explore an alternative response to the argument, targeted on the premiss (unquestioned by Prior) that 'only the unpreventable follows from the unpreventable': $\mathrm{CLC}pq\mathrm{CL}p\mathrm{L}q$.

- Kit Fine / The Metaphysics of Time and Modality

  Abstract: Prior brought into prominence certain fundamental metaphysical questions concerning the nature of time and modality. Is a tensed language required to describe temporal reality or can it be completely described in purely tenseless terms? And is a modal language required to describe modal reality or can it be completely described in terms of the disposition of possible worlds? My aim is to clarify the issue. I shall argue that we cannot even make sense of what the issue is without appeal to a metaphysical concept of reality, one that serves to distinguish how things *really* are from how they are. I shall also argue that once the issue is formulated in this way, we find that there are two ways in which reality might be taken to be essentially tensed or essentially modal. One takes a certain time or world to be privileged while the other treats all times and all worlds as alike. It is the first of these two views that is most plausible

in the modal case and the second that is most plausible in the tense-logical case. Thus modal actualism and temporal presentism, in their most plausible forms, are not strictly analogous.

- Antony Galton / Operators versus Arguments: the Ins and Outs of Reification

  So-called 'reified temporal logics' were introduced by researchers in Artificial Intelligence (AI) in the early 1980s, and gave rise to a long-running dialogue concerning the proper way to represent states, events, causation, action, and other notions identified as crucial to the knowledge representation needs of AI. Although conducted within the context of practical computation rather than philosophy, many of these arguments resonated with earlier debates about the relative merits of modal and first-order approaches to temporal logic, as well as general issues of reification and ontology that have long been of concern to philosophical logicians. These debates never resulted in a definitive resolution of the issues under discussion, and indeed continue to produce aftershocks to the present day; none the less, we are now sufficiently far removed in time from their heyday for it to be a worthwhile exercise to stand back and review them in a broader historical context.

- Peter Simons / The Logic of Location

  In the first part of this paper I consider the propositional logic of location based on the following semantic framework, derived from ideas of Prior. We have a collection L of locations and a collection S of statements such that a statement may be evaluated for truth at each location. Typically one and the same statement may be true at one location and false at another. In addition there may be a distinguished or Home location, generalizing the role of the present in tense logic and the actual world in modal logic. Given this semantic framework we may proceed in two ways: introducing names for locations, predicates for the relations among them and an "at" preposition to allow us to assert the truth of statements at locations; or introduce statement operators which do not name locations but whose truth-conditional effect depends on the truth or falsity of embedded statements at various locations. The latter is akin to Prior's approach to tense logic. In any logic of location there will be some basic operators which we can define. By ringing the changes on the topology of locations, different logical systems may be generated, and the challenge for the logician is then in each case to find operators, axioms and rules yielding a proof theory adequate to the semantics. The generality of the approach is illustrated with familiar and not so familiar examples from modal, tense and

place logic. I express some methodological reservations against the Priorian approach.
In the second part I consider the interaction between the logic of location and the ontology of extended entities. Again two broad strategies may be developed: one of concentration, which allows one and the same entity to exist at a multiplicity of locations; or one of dispersion, where objects covering multiple locations are taken to have parts corresponding to the different locations they cover. Again the different approaches will be illustrated from familiar ontological disputes, and the relative merits of the two strategies assessed for different cases.

- Heinrich Wansing / Logical Connectives for Constructive Modal Logic

  A prominent theme in Arthur Prior's scientific work was the definability of logical operations in modal and tense logic. What perhaps comes to mind first in this connection is the problem of expressive completeness: to find a modal language such that for any first-order expression from its correspondence language there exists a modal equivalent. Another definability problem is the problem of functional completeness: to find a modal language such that every semantically admissible logical operation can be explicitly defined from the available logical constants. This problem is, of course, well-known from classical propositional logic, where the admissible logical operations are, for example, the two-valued truth functions. But also for non-classical and modal logics, notably for intuitionistic logic, functional completeness results are known. Clearly, semantical frameworks more general than two-valued truth-functions are required to specify the non-classical semantically admissible connectives.
  In this note I shall modify D. McCullough's functional completeness result for intuitionistic propositional logic and for the modal intuitionistic propositional logic MIPC to obtain a functional completeness result for all Kripke complete modal extensions of the constructive modal logic NKdD with strong negation, which is the basic constructive modal logic NKd enriched by the seriality axiom schema D. The semantical framework is given by a certain fragment of a classical first-order metalanguage comprising two binary predicates ("supporting the truth" and "supporting the falsity") and two further binary relation symbols, one for interpreting constructive implication and one for interpreting the modal operators. The fragment imposes constraints on the verification and the falsification conditions in relational models. In this sense the presented framework is model-theoretic.

- Aberto Zanardo / Structures and Languages for Branching-Time

Ockhamist and Peircean logics of branching-time were first considered by Arthur Prior as two different answers to puzzling issues on the conflict between *God's Foreknowledge* and the *Freedom of the Will*. Interestingly, in the last decades, theoretical computer science has re-discovered variants of these logics (and has called them CTL* and CTL, respectively) as powerful tools for describing properties of programs.

The basic semantical entities in both Ockhamist and Peircean logics are *moments* and *histories* (*states* end *paths* in the computer science terminology) and the most peculiar aspect of these logics is that their semantical rules involve a quantification over histories.

In the tree-like representation of time, moments are viewed as elements of a tree and histories can be defined as maximal chains of moments; thus, in this environment, the quantification over histories turns out to be a (second-order) quantification over sets of moments. However, other kinds of structures are used to provide a semantics for Ockhamist and Peircean logics. A common aspect of these structures (which makes them essentially different from trees) is that the set of moments and the temporal relation between them do not determine the set on which the quantification over histories ranges. This raises interesting technical problems, but also changes the ontological perspective. In particular, in the so-called *geometrical approach* both moments and histories are primitive entities and there is no set theoretical (and ontological) dependency of the latter on the former.

In recent technical developments of the matter, the original ontological perspective of trees is completely inverted: time is presented as a set of histories and moments can be defined as particular sets of histories. This approach can be called the *topological approach* because moments can be viewed as a suitable base of a topology on the set of histories.

Moving forward in this direction, it can be shown that neighborhoods in the set of histories can also be defined on the basis of a ternary *relative closeness* or *relative similarity* relation on this set. This leads to a further representation of branching time simply as a set (of histories) endowed with a suitable relation.

Program Committee

- Torben Braüner / Roskilde University / torben@ruc.dk
- Per Hasle / Aalborg University / hasle@hum.auc.dk
- Peter Øhrstrøm / Aalborg University / poe@hum.auc.dk

The conference is organized by ΦLOG and the Department of Computer Science, Roskilde University.

Time Tables

	Friday, Oct. 31
09:00 - 09:20	Registration
09:20 - 09:30	Opening
09:30 - 11:00	K. Fine
11:00 - 11:30	Coffee Break
11:30 - 13:00	P. Blackburn
13:00 - 14:00	Lunch
14:00 - 15:30	P. Simons
15:30 - 16:00	Coffee Break
16:00 - 17:30	A. Galton
19:00 -	Conference Dinner

	Saturday, Nov. 1
09:00 - 10:30	J. Copeland
10:30 - 11:00	Coffee Break
11:00 - 12:30	A. Zanardo
12:30 - 13:30	Lunch
13:30 - 15:00	H. Wansing
15:00 - 15:30	Coffee Break
15:30 - 17:00	P. Blackburn
17:00 - 17:30	Discussion

Location and Transportation

All presentations will take place at Roskilde University (RUC) in the auditorium in building 46 (circled on the map below). To reach RUC Friday at 8:45 take the regional train from the Central Station of Copenhagen at 8:10 towards Roskilde and get off at Trekroner Station (an appropiate train for Saturday leaves Copenhagen Central Station at 8:08). To reach RUC from Roskilde Friday at 8:55 take the regional train from Roskilde Station at 8:41 towards Copenhagen and get off at Trekroner Station (an appropriate train for Saturday leaves Roskilde Station at 8:22). There will be signs from the station guiding to the conference site.

Lunch and Dinner Arrangements

On Friday and Saturday participants may choose to order lunch through the conference organization; payments for these arrangements are due during final conference registration on Friday, October 31. Each lunch costs 70,00 Dkr and includes besides Danish 'smørrebrød' (open sandwiches) one beverage.

A conference dinner is scheduled for Friday, October 31 at 19:00, Restaurant A Porta in the center of Copenhagen. The dinner costs 400,00 Danish kroner and holds a three course meal and wine. Only a limited number of seats are available.

Participants interested in lunch orders and/or conference dinner participation should notify the ΦLOG-secretary Pelle Guldborg Hansen (pgh@ruc.dk) no later than **Friday**, **October 24**. Only cash payments are accepted and no later than upon final conference registration during Friday, October 31. *Undue cancellation of dinner*

and/or lunch orders is subject to full charge.

Registration

Please write the ΦLOG-secretary Pelle Guldborg Hansen to register:

Department of Philosophy and Science Studies
Roskilde University, P6
P.O. Box 260
DK4000 Roskilde, Denmark
Phone: (+45) 4674 2540 Cell: (+45) 2334 2175
Fax: (+45) 4674 3012 Email: pgh@ruc.dk

A small conference fee is to be paid upon final registration (Friday, October 31, 2003). The conference fee is 75,00 Danish kroner a day, thus participation for the entire duration of the conference (Friday, October 31 – Saturday, November 1, 2003) is 150,00 Danish kroner. The conference fee covers the additional conference booklet, tea and coffee during the breaks.
If email is used include 'TIME—DK' in the subject entry. All questions pertaining to registration and accommodations should be directed to Pelle Guldborg Hansen. No individual notification upon registration will be forwarded to individual participants but the ΦLOG-website will keep a list of registered participants.

BOOK SERIES:
TRENDS IN LOGIC 21

Hardbound
ISBN 1-4020-1601-8
September 2003, 382 pp.
€ 135.00 / $ 149.00 / £ 93.00
For more information please
contact Charles Erkelens

In honor of the 50th anniversary of Studia Logica

Trends in Logic
50 Years of *Studia Logica*

Edited by
Vincent F. Hendricks *Department of Philosophy and Science Studies, Roskilde University, Denmark*
Jacek Malinowski *Institute of Philosophy and Sociology, The Polish Academy of Sciences, Poland*

In 1953, exactly 50 years ago to this day, the first volume of *Studia Logica* appeared under the auspices of The Philosophical Committee of The Polish Academy of Sciences. Now, 5 decades later the present volume is dedicated to a celebration of this 50th Anniversary of *Studia Logica*. The volume features a series of papers by distinguished scholars reflecting both the aim and scope of this journal for symbolic logic.

The Anniversary volume offers contributions from

J. van Benthem	W. Buszkowski
M.L. Dalla Chiara	M. Fitting
J.M. Font	R. Giuntini
R. Goldblatt	V. Marra
D. Mundici	R. Leporini
S.P. Odintsov	H. Ono
H. Wansing	G. Priest
J. Zygmunt	V.R. Wojcicki

Contact information:
Charles Erkelens
PHILOSOPHY OF SCIENCE AND LOGIC
E charles.erkelens@wkap.nl
T +31 78 65 76 387

Floor Oosting
PHILOSOPHY AND RELIGIOUS STUDIES
E floor.oosting@wkap.nl
T +31 78 65 76 205

for up-to-date information: www.wkap.nl/prod/b/1-4020-1601-8

kluwer
the language of science

TRENDS IN LOGIC
50 YEARS OF STUDIA LOGICA

CONFERENCE BOOKLET

November 20—22, 2003
The Carlsberg Academy, Copenhagen
Denmark

ΦLOG

CONFERENCE BOOKLET: 50 YEARS OF STUDIA LOGICA

CONFERENCE
The Carlsberg Academy, Copenhagen (DK), November 20 – 22, 2003

Year 2003 marks the 50th Anniversary of *Studia Logica—An International Journal for Symbolic Logic*. ΦLOG in association with *Studia Logica* pay tribute to this Anniversary by hosting the second of two conferences entitled

50 Years of Studia Logica—Trends in Logic

at The Carlsberg Academy, Copenhagen (DK), November 20–22, 2003.

The journal *Studia Logica* has for the past 50 years been one of the leading journals in symbolic logic. The journal covers contemporary formal logic and its applications and relations to other disciplines. These include artificial intelligence, informatics, cognitive science, philosophy of science, and the philosophy of language. However this list is not exhaustive, moreover, the range of applications, comparisons and sources of inspiration is open and evolves over time. The journal is also serving as an important East-West link.

Speakers and Abstracts

- Johan van Benthem (The Netherlands) / Fifty Years: Changes and Constants in Logic

In this year of celebrations of 'First-Order Logic 75' and 'Trends in Logic – 50 Years of Studia Logica', two phenomena stand out. One is the rapid expansion of themes in modern logic, the other the remarkable constancy of the basic methods encapsulated in first-order logic. We will show some broad patterns by means of a historical survey. Topics include: (a) truth, meaning and mechanisms of semantic interpretation, (b) varieties of inference, (c) logical dynamics: systems for communication, theory revision, and multi-agent interaction, (d) long-term phenomena: emergent statistical properties of logical systems. We use these to discuss the modern agenda of logic, taking into account its natural interactions with (amongst others) philosophy and computer science.

- Wojciech Buszkowski (Poland) / Type Logics in Grammar

  Interesting developments in the theory of formal grammars are based on representing syntactic and semantic information by means of types and processing the types by means of certain logics, e.g. different versions of the Lambek calculus, the typed lambda calculus and combinatory logic, other substructural logics (fragments and extensions of linear logic). In this paper we survey main notions and results in this area. We also discuss applications to natural language processing and language learning.

- Leo Esakia (Georgia) / Heyting Algebras and their Modal Satellites: Past and Recent Observations

  We shall present a survey (mixing algebraic and topological viewpoints) of some aspects of Heyting algebras and the most important modern (non-Lewis) modal systems (satellites of the Heyting Calculus), which admit an adequate arithmetical and set-theoretical interpretation: namely (a) the Gödel-Löb system GL ('$\Box$' as Provability in Peano Arithmetic), (b) the Grzegorczyk system Grz ($\Box p$ as p is true and provable, alias, p is demostrable), (c) the Solovay system Sol ($\Box p$ means p is true in every transitive model of Zermelo-Fraenkel set theory **ZF**). We shall also discuss an adequate topological interpretation of this system and Heyting Calculus in terms of the Cantor Scattered spaces and the Hausdorff theory of residues.

- Melvin Fitting (USA) / Intensional Logic – Beyond First Order

  Classical first-order logic can be extended in two different ways to serve as a foundation for mathematics: introduce higher orders, type theory, or introduce

sets. As it happens, both approaches have natural analogs for quantified modal logics, both approaches date from the 1960's, one is not very well-known, and the other is well-known as something else. I will present the basic semantic ideas of both higher order intensional logic, and intensional set theory. Before doing so, I'll quickly sketch some necessary background material from quantified modal logic. Except for standard material concerning propositional modal logics, the paper is essentially self-contained.

- Josep M. Font (Spain) / The Isomorphism Theorem

  In this talk I will survey the evolution of the so-called 'isomorphism theorem', the fact that for certain classes of algebraic structures the congruences of each of its members can be isomorphically represented as subsets of a particular kind. This is familiar e.g. in groups, where congruences are associated with normal subgroups, or in Boolean algebras, where congruences correspond bijectively with filters (or, dually, with ideals). I will show how the logical significance of these results gradually arose through the years (partly in *Studia Logica* papers), how several generalizations were subsequently found, and how some of these have a central position in the new topic of 'abstract algebraic logic'. Along the talk some key notions of XXth century algebraic logic will also be reviewed.

- Robert Goldblatt (New Zealand) / Questions of Canonicity

  Every modal logic has a special associated relational structure, called its 'canonical frame', and the logic itself is called 'canonical' if it is validated by this structure. It has been known since 1973 that if a logic is determined by a class of Kripke frames that is elementary, i.e. definable in first-order logic, then it is canonical. But the converse question, 'is every canonical logic also elementary?', has remained unresolved for nearly three decades. This paper will survey these notions and the progress that has been made on the canonicity problem. It will explain how the question generalises to one about varieties of Boolean algebras with operators, including cylindric algebras and relation algebras. Some unpublished results about canonicity of such varieties will be included.

- Daniele Mundici (Italy) / Łukasiewicz Logic and Chang's MV Algebras in Action

  In the last years the number of papers devoted to Łukasiewicz infinite-valued logic and to Chang's MV-algebras has been increasing so rapidly that, since

the year 2000 the AMS Classification Index contains the special item 06D35 for MV-algebras. To quote just a handful of books, the monograph by Cignoli et al. is entirely devoted to MV-algebras, Hajek's monograph and Gottwald's book devote ample space to these algebras. MV-algebras also provide an important example of 'quantum structures'. The second volume of the *Handbook of Measure Theory* includes several chapters on MV-algebraic measure theory. As the Lindenbaum algebras of Łukasiewicz infinite-valued logic, MV-algebras are also considered in various surveys. We shall review these developments, stressing the active role of infinite-valued logic in various parts of mathematics, such as polyhedral geometry, lattice-ordered groups and AF C*-algebras of operators.

- Hiroakira Ono (Japan) / Substructural Logics and Residuated Lattices

Recent studies show that 'substructural logic' will serve a quite good framework in which many of non-classical logics, including linear logic, relevant logics and many-valued logics, can be discussed together. But, there seem to be no proper explanations of why this framework works so well. Substructural logics are often regarded as 'resource-sensitive' logics, and this resource sensitivity, caused by the absence or the presence of some of structural rules, are usually considered a main source of the success. This may be a partial answer to the above question, but is not the whole story, we think. The main source of differences among logical reasonings will be differences of their logical implications. If we look at these implications within 'residuated structures' behind, which can be seen explicitly by introducing 'fusions', we will get a much more clear view of substructural logics. In our talk, we will try to show the importance of algebraic approach to the study of substructural logics, by introducing some of the interesting results in this area.

Heinrich Wansing (Germany) / Constructive Description Logic

Description logics are among the most prominent formalisms for knowledge representation. Many expressive but still decidable description logics have been investigated and implemented. Although there is some work on description logics using non-monotonic, many-valued, or fuzzy-logic, the underlying logic of almost all systems of description logic is classical. In the present paper, we shall replace the classical base logic by a non-classical logic, namely Nelson's four-valued constructive and paraconsistent logic N4. In particular, we shall replace material implication by intuitionistic implication and Boolean negation by constructive, strong negation.

It is well-known that the basic description logic ALC is nothing but the multi-

modal extension of the smallest normal modal propositional logic K. In the literature on intuitionistic modal logic, different proposals have been made for an intuitionistic counterpart of K. One basic system is due to Sotirov. In the relational semantics for this logic, three accessibility relations are used: one for intuitionistic implication, one for the necessity operator and another one for possibility. The logic may be described as the fragment of classical first-order logic obtained by the standard translation of the modal language into the language of classical first-order logic with a unary predicate for every propositional variable (concept name), a binary relation symbol for every modal operator, and one binary relation symbol for intuitionistic implication.
The translation of constructive description logic with strong negation into classical predicate logic induces a semantics. Since in the semantics for classical first-order logic formulas are not evaluated at states, both the role restrictions and implication are interpreted wrt a single set of entities, namely individual/state pairs in which the state is left implicit.
Another basic intuitionistic modal logic is Fischer Servi's system FS. This system corresponds to the fragment of intuitionistic first-order logic obtained by the standard translation into the language of intuitionistic predicate logic. Hence, as a result, there exists more than one basic constructive version of ALC with intuitionistic implication and constructive, strong negation. We shall refer to the system obtained by the translation into classical predicate logic as constructive classical ALC. Another constructive description logic is obtained by a translation into quantified N4. This translation treats the role restrictions as restricted universal and existential quantifiers, and in the resulting logic the universal and existential role restrictions fail to be dual operators with respect to strong negation. Duality can be obtained by another translation into QN4 that treats the role restrictions as unary operators. In this paper we shall motivate and define these three distinct basic systems of constructive description logic and examine some of their properties.

Program Committee

- Vincent F. Hendricks / Roskilde University / vincent@ruc.dk
- Jacek Malinowski / Polish Academy of Sciences / jacekm@cc.uni.torun.pl
- Stig Andur Pedersen / Roskilde University / sap@ruc.dk
- Ryszard Wójcicki / Polish Academy of Sciences / stud@ifispan.waw.pl

Program

	Thursday, Nov. 20
09:00 - 09:20	Registration
09:20 - 09:30	Opening
09:30 - 10:30	J. van Benthem
10:30 - 11:00	Discussion
11:00 - 11:30	Coffee Break
11:30 - 12:30	W. Buszkowski
12:30 - 13:00	Discussion
13:00 - 14:00	Lunch
14:00 - 15:00	L. Esakia
15:00 - 15:30	Discussion
15:30 - 16:00	Coffee
16:00 - 18:00	Sight-seeing Tour

Conference Chair: Vincent F. Hendricks

	Friday, Nov. 21
09:00 - 09:30	Coffee
09:30 - 10:30	M. Fitting
10:30 - 11:00	Discussion
11:00 - 11:30	Coffee Break
11:30 - 12:30	J.M. Font
12:30 - 13:00	Discussion
13:00 - 14:00	Lunch
14:00 - 15:00	R. Goldblatt
15:00 - 15:30	Discussion
15:30 - 16:00	Coffee
19:00 -	Conference Dinner

Conference Chair: Stig Andur Pedersen

	Saturday, Nov. 22
09:00 - 09:30	Coffee
09:30 - 10:30	D. Mundici
10:30 - 11:00	Discussion
11:00 - 11:30	Coffee Break
11:30 - 12:30	H. Ono
12:30 - 13:00	Discussion
13:00 - 14:00	Lunch
14:00 - 15:00	H. Wansing
15:00 - 15:30	Discussion
15:30 - 16:45	Closing

Conference Chair: Ryszard Wójcicki / Vincent F. Hendricks

Lunch and Dinner Arrangements

On Thursday, Friday and Saturday participants may choose to order lunch through the conference organization; payments for these arrangements are due during final conference registration on Thursday, November 20. Each lunch costs 70,00 Dkr and includes besides Danish 'smørrebrød' (open sandwiches) one beverage.

A conference dinner is scheduled for Friday, November 21 at 19:00, Restaurant A Porta in the center of Copenhagen. The dinner costs 400,00 Dkr and includes a three course meal and wine. Only a limited number of seats is available.

Participants interested in lunch orders and/or conference dinner participation should notify ΦLOG-secretary Pelle Guldborg Hansen (see address below) no later than **Friday, November 14**. Only *cash* payments are accepted and no later than upon final conference registration during Thursday, November 20. *Undue cancellation of dinner and/or lunch orders is subject to full charge.*

Sight-seeing Tour

A sight-seeing tour of Copenhagen is planned for Thursday, November 20. The tour will cost 50,00 Dkr which includes transportation, guides and passes. Signing up for the tour is, as for the lunch and dinner arrangements, no later than **Friday, November 14**, and payment is due no later than upon final registration.

Registration

Conference participation is free. Please write the ΦLOG-secretary Pelle Guldborg Hansen to register for the conference:

Department of Philosophy and Science Studies

Roskilde University P.O. Box 260 DK4000 Roskilde Denmark

Phone: (+45) 4674 2540 Cell: (+45) 2334 2175 Email: pgh@ruc.dk

Be sure to include your name, institution, country and zip-code and your email address.
If email is used include '50YRS—DK' in the subject entry. All questions pertaining to registration and accommodations should be directed to Pelle Guldborg Hansen. No individual notification upon registration will be forwarded to individual participants but the home page will keep a list of registered participants. For more information refer to

`http://www.50yrs.philog.ruc.dk/conference2.html`

Location and Transportation

All presentations will take place at

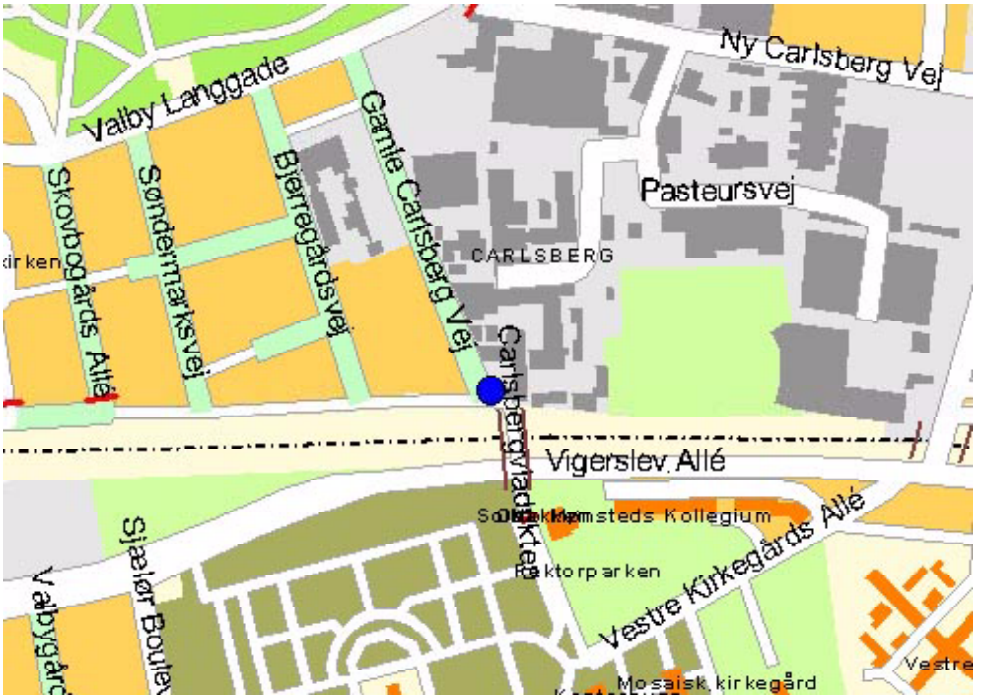
The Carlsberg Academy

Gamle Carlsberg Vej 15, DK2500 Valby, in Copenhagen. See below for a map of the conference site location.
To reach the Carlsberg Academy at 09:00 on Thursday, November 20 and Friday, November 21 from Roskilde University, follow the schedule below:

Departure	**Arrival**
08:10, Trekroner St.	08:30, Valby St. ♯
08:34, Valby St.	08:38, Bjerregårdsvej ♣
08:38, Bjerregårdsvej	08:43, Carlsberg Academy ♠

♯ = Train RE 4422, Direction Østerport St.
♣ = Bus 18, Direction Nordhavn St.
♠ = Walk

To reach the Carlsberg Academy at 09:00 on Saturday, November 22 from Roskilde University, follow the schedule below:



15. The Carlsberg Academy, Copenhagen

Departure	Arrival
08:19, Trekroner St.	08:38, Valby St. ♯
08:47, Valby St.	08:50, Bjerregårdsvej ♣
08:50, Bjerregårdsvej	08:55, Carlsberg Academy ♠

♯ = Train RE 5504, Direction Østerport St.
♣ = Bus 18, Direction Nordhavn St.
♠ = Walk

To reach the Carlsberg Academy at 09:00 on Thursday, November 20 and Friday, November 21 from Copenhagen Central Station, follow the schedule below:

Departure	Arrival
08:38, Central Station.	08:42, Enghavevej. ♣
08:42, Enghavevej	08:54, Carlsberg Academy ♠

♣ = Bus, 650S Direction Avedøre St.
♠ = Walk

To reach the Carlsberg Academy at 09:00 on Saturday, November 22 from Copenhagen Central Station, follow the schedule below:

Departure	**Arrival**
08:43, Central Station.	08:50, De Små Haver ♣
08:50, De Små Haver	09:00, Carlsberg Academy ♠

♣ = Bus, 550S Direction Glostrup St.
♠ = Walk

For more information on transportation, refer to the DSB website (Danish Transportation Authority) and the journey planner at

`http://www.dsb.dk/journey_planner/`

Publication

Now Available! *Trends in Logic: 50 Years of Studia Logica.* Vincent F. Hendricks (Editor), Jacek Malinowski (Editor). $149. Trends in Logic: Studia Logica Library, vol. 21, Kluwer Academic Publishers; ISBN 1402016018; (October 2003). In 1953, exactly 50 years ago to this day, the first volume of *Studia Logica* appeared under the auspices of The Philosophical Committee of The Polish Academy of Sciences. Now, 5 decades later the present volume is dedicated to a celebration of this 50th Anniversary of *Studia Logica.* The volume features a series of papers by distinguished scholars reflecting both the aim and scope of this journal for symbolic logic. The Anniversary volume offers contributions from J. van Benthem, W. Buszkowski, M.L. Dalla Chiara, M. Fitting, J.M. Font, R. Giuntini, R. Goldblatt, V. Marra, D. Mundici, R. Leporini, S.P. Odintsov, H. Ono, G. Priest, H. Wansing, V.R. Wójcicki and J. Zygmunt.

BOOK SERIES:
TRENDS IN LOGIC 17

Hardbound
ISBN 1-4020-1154-7
February 2003, 304 pp.
€ 110.00 / $ 106.00 / £ 70.00

Foundations of the Formal Sciences II

Applications of Mathematical Logic in Philosophy and Linguistics

Papers of a Conference held in Bonn, November 10-13, 2000

Edited by
Benedikt Löwe *Rheinische Friedrich-Wilhelms-Universität Bonn, Germany*
Wolfgang Malzkorn *Rheinische Friedrich-Wilhelms-Universität Bonn, Germany*
Thoralf Räsch *Universität Potsdam, Germany*

Foundations of the Formal Sciences (FotFS) is a series of interdisciplinary conferences in mathematics, philosophy, computer science and linguistics. The main goal is to reestablish the traditionally strong links between these areas of research that have been lost in the past decades.

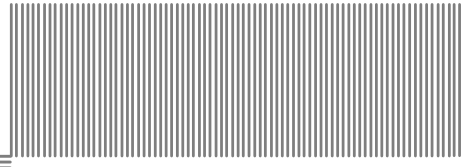
The second conference in the series had the subtitle "Applications of Mathematical Logic in Philosophy and Linguistics" and brought speakers from all parts of the Formal Sciences together to give a holistic view of how mathematical methods can improve our philosophical and technical understanding of language and scientific discourse, ranging from the theoretical level up to applications in language recognition software.

Audience: This volume is of interest to all formal philosophers and theoretical linguists. In addition to that, logicians interested in the applications of their field and logic students in mathematics, computer science, philosophy and linguistics can use the volume to broaden their knowledge of applications of logic.

Contact information:
Charles Erkelens
PHILOSOPHY OF SCIENCE AND LOGIC
E charles.erkelens@wkap.nl
T +31 78 65 76 387

Floor Oosting
PHILOSOPHY AND RELIGIOUS STUDIES
E floor.oosting@wkap.nl
T +31 78 65 76 205

for up-to-date information: www.wkap.nl/prod/b/1-4020-1154-7



kluwer
the language of science

The Free Newsletter for Philosophical Logic and Its Applications

ΦNEWS is the freely distributed newsletter associated with ΦLOG and has much the same aims:

- To consolidate philosophical logic as an interdisciplinary activity
- To report on, and hopefully aid the coordination of, the research activities, conference activities and publications in philosophical logic, its applications and neighboring disciplines
- To shape and sharpen the general interest in philosophical logic and communicate important results and break-throughs in the field to a less specialized audience

ΦNEWS is edited by Vincent F. Hendricks, Stig Andur Pedersen and Dov M. Gabbay. The newsletter is published by ΦLOG and Kluwer Academic Publishers.

Submissions

ΦNEWS publishes contributions in terms of

- Extensive expositional papers
- Announcements
- New initiatives

Extensive Expositional Papers

ΦNEWS invites authors to submit extensive expositional papers (30-50 pages) on philosophical logic (including inductive logic, alethic logic, temporal logic, epistemic logic, deontic logic, conditional logic ... with a special focus on multi-modal logics) and its relations to notably epistemology, methodology, philosophy of science, philosophy of language, philosophy of mind ... and its applications in computer science, information theory, cognitive science, mathematics, linguistics, economics and game

theory ... These lists are not exhaustive. The papers should be expositional in nature rather than detailed technical accounts or analyses. Observe that ΦNEWS only publishes a limited number of papers a volume.

Annoucements

ΦNEWS publishes annoucements of

- upcoming workshops, seminars and conferences
- forthcoming publications

Be sure to provide as detailed information as possible including the title of the event, time and place, contact information, website address and an abstract/description of the event or publication.

New Initiatives

ΦNEWS attempts to keep track of new initiatives pertinent to philosophical logic and its applications such as new networks, societies, foundations, bulletin boards, journals etc. To place an add for a new initiative in the newsletter contact the ΦNEWS editors.

ΦNEWS*, volume 5 is scheduled for April 2004. Deadline for submissions is March 1, 2004.*

Format

ΦNEWS encourages contributors to format their submissions according to the following guidelines: Contributors are asked to state their name, affiliation and contact information on a cover sheet together with information on the nature of the contribution. Contributions should preferably be written in TEX, LATEX or LATEX2$_\varepsilon$ but other word processing packages are accepted provided that the contributions are saved in rich text format (RTF) with a minimum of formatting (remember to state your system platform). If either TEX, LATEX or LATEX2$_\varepsilon$ is used contributors are instructed to include all special packages and macros used to generate the document. In addition to hard-copy printouts of figures, contributors are requested to supply the electronic versions of figures in either Encapsulated PostScript (EPS), TIFF format, GIF format or JPG format.

- References to books should follow the citation format: Glymour, C. (1992). *Thinking Things Through.* Cambridge, MA: The MIT Press
- References to articles should follow the citation format: Lewis, D. (1996). Elusive Knowledge, *The Australasian Journal of Philosophy*, **74**(1996): 549-67

- References to articles in conference proceedings should follow the citation format: Halpern, J.Y. and Vardi, M. Y. (1988). The Complexity of Reasoning about Knowledge and Time, in *Proc. 20th ACM Symp. on Theory of Computing*: 53-65

Submissions should be sent to the ΦNEWS editors either electronically or by regular mail to the address stated on the inner sleeve of this newsletter. The contribution should be accompanied with a cover letter stating full address for correspondence, including telephone and fax number and e-mail address. Proofs will be sent to the corresponding contributor electronically in PS or PDF format. The corresponding contributor is kindly requested to return one corrected hard-copy of the manuscript inside 2 weeks of receipt. Deadline for submissions for ΦNEWS volume 5 is March 1, 2004.

Free Subscription

Subscription to ΦNEWS is free. Please write the editors to obtain your free subscription to the newsletter. Be sure to include the following information:

- Name
- Position
- Affiliation
- Mailing address
- Email
- A short description of your interest in philosophical logic

(Over)Interpreting Wittgenstein

BOOK SERIES:
SYNTHESE LIBRARY 319

Hardbound
ISBN 1-4020-1326-4
July 2003, 248 pp.
€ 99.00 / $ 99.00 / £ 63.00

PAPERBACK

Paperback
ISBN 1-4020-1327-2
July 2003, 248 pp.
€ 35.00 / $ 35.00 / £ 22.00

By
Anat Biletzki *Dept. of Philosophy, Tel Aviv University, Israel*

(Over)Interpreting Wittgenstein will be read by philosophers investigating Wittgenstein and by scholars, interpreters, students, and specialists, in both analytic and continental philosophy. It will intrigue readers interested in issues of interpretation and cultural studies.

This book tells the story - as yet untold - of Wittgenstein interpretation during the past eighty years. It provides different interpretations, chronologies, developments, and controversies. It aims to discover the (socio-cultural rather than psychological) motives and motivations behind the philosophical community's project of interpreting Wittgenstein. As a cultural history of ideas, it traces the parallelism between Wittgenstein interpretation and the move from metaphysics, to language, to postmodernism effected in the twentieth century.

Review(s)
'This is an impressive book: learned, judicious yet provocative, and very readable. It will interest not only Wittgenstein aficionados, but also a much wider readership. It provides a rapid and remarkably helpful orientation for readers who want to know more about Wittgenstein but have trouble navigating around the forbiddingly large and difficult literature. The survey of the extraordinary range of approaches is wide-ranging but well chosen, nearly always focussing on the most significant figures, but giving enough depth and detail of coverage to avoid the dangers that come with an overly schematic summary. Biletzki successfully steers between the Scylla of overly technical philosophical argumentation and the Charybdis of popular oversimplification.'
David G. Stern, Associate Professor, University of Iowa, Editor (with Hans Sluga) of The Cambridge Companion to Wittgenstein.

Contact information:
Charles Erkelens
PHILOSOPHY OF SCIENCE AND LOGIC
E charles.erkelens@wkap.nl
T +31 78 65 76 387

Floor Oosting
PHILOSOPHY AND RELIGIOUS STUDIES
E floor.oosting@wkap.nl
T +31 78 65 76 205

for up-to-date information: www.wkap.nl/prod/b/1-4020-1326-4

kluwer
the language of science

INDEX OF NAMES

Agassi, J., 65
Alferes, J., 53
Alfsen, E.M., 58
Allwood, J., 52
Andretta, A., 74
Apresjan, J., 52
Arai, T., 74
Arana, A., 74
Artemov, S., 73
Asher, N., 59
Astesiano, E., 55
Atlas, J.D., 58
Avigad, J., 73
Awodey, S., 59, 73
Azzouni, J., 59

Baaz, M., 52
Bagaria, J., 74
Balbiani, P., 69
Baral, C., 53
Bartoszynski, T., 73
Basin, D., 55
Bays, T., 73
Beklemishev, L., 52
Benthem, J.v., 61, 90
Berardi, S., 74
Bergmann, M., 59
Binmore, K., 50
Blackburn, P., 70, 76, 79
Blum, L., 73
Bolc, L., 59
Bosch, A.v.d., 76
Braüner, T., 84
Buckley, J.J., 59
Buitelaar, P., 76
Buss, S., 74
Buszkowski, W., 61, 91

Caicedo, X., 74
Camerlo, R., 74
Carter, K.C., 59
Castellini, G., 60
Chagrov, A., 70
Chinchilla, E., 74
Chomicki, J, 60
Clarke, B.R., 59
Clavel, M., 55
Conder, M., 52
Cooper, W.S., 60
Copeland, J., 79
Cortadella, J., 55
Cucker, F., 74
Cummings, J., 73

Dalla Chiara, M.L., 61
Davidson, M., 65
Degano, P., 55
DeJongh, D., 74
DeRose, K., 54
Detlefsen, M., 73
Devlin, K., 69
Dezani, M., 74
Di Prisco, C., 74
Dickmann, M., 74
Dimopoulos, Y., 53
Ditmarsch, H.v., 61
Dix, J., 53
Downey, R., 52, 54
Dries, L.v.d., 74
Duesterwald, E., 55
Dung, P.M., 53

Ehrig, H., 55
Eker, S., 55
Eng, S., 60
Engdahl, E., 52

Erdem, E., 53
Esakia, L., 91

Fages, F., 56
Fagin, R., 61
Falmagne, R.J., 60
Feferman, S., 74
Fernando, T., 76
Féry, C., 52
Fiadeiro, J.L., 55
Fine, K., 79
Fitting, M., 61, 62, 91
Font, J.M., 61, 92
Foreman, M., 73
Freund, M., 74
Futatsugi, K., 55

Gabbay, D.M., 62
Gadducci, F., 55
Galton, A., 79
Garavel, H., 55
Gardent, C., 52
Garrigue, J., 56
Gaudel, M.-C., 55
Gauld, D., 52
Gelfond, M., 53
Geuvers, H., 56
Gibson, M.I., 62
Ginzburg, J., 52
Giuntini, R., 61
Gobson, M., 62
Goldblatt, R., 61, 92
Goldfarb, W., 73, 74
Goldman, A., 54
Goncharov, S., 53
Goranko, V., 69
Gordon, A., 55
Gorrieri, R., 55
Graf, S., 55
Groote, P.d., 76
Guier, J.I., 74
Gundersen, L.B., 54

Hagiya, M., 56
Hale, B., 62
Halpern, J., 61
Halpern, J.Y., 62
Hansen, P.G., 50, 87, 97
Hanus, M., 56
Harizanov, V., 73
Hasle, P., 84
Hass, M., 60
Hedin, G., 55
Hellman, G., 73
Hendricks, V.F., 48, 50, 54, 61, 70, 94
Hintikka, J., 54, 61, 63
Hirschfeldt, D., 73
Hjorth, G., 74
Hodges, W., 52
Hodkinson, I., 53
Hoek, W.v.d., 50, 61, 69
Hofman, M., 56
Horspool, R.N., 55
Hosoya, H., 56
Howson, C., 63
Huet, G., 76
Hutto, D.D., 63

Ibrahim, A.M., 64
Iemhoff, R., 52

Jackson, S., 73
Janhunen, T., 53
Jarillo, J.C., 64
Jensen, K., 55
Jiborn, M., 50
Jockusch, C., 53
Jokic, A., 64
Jones, V., 52, 54

Kamareddine, F., 52
Kameyama, Y., 56
Khoussainov, B., 53
Kim, B., 73
Kirchner, C., 55
Klein, C., 59
Klimt, G., 59
Klint, P., 55
Knapp, A., 55
Knight, J., 73
Knight, R.W., 73

Kobayashi, N., 56
Kooi, B., 61
Kozen, D., 53
Kremer, M., 73

Lascarides, A., 59
Laskowski, M.C., 73
Lavrov, I.A., 64
Lawson, M.V., 65
Lempp, S., 53, 73, 74
Lenzen, W., 61
Leporini, R., 61
Lewin, R., 74
Lifschitz, V., 53
Liguoro, U.d., 74
Lin, F., 53
Lloyd, J., 56
Lobo, J., 53
Lolli, G., 74
López Escobar, E.G.K., 74
Löve, B., 65
Lucas, S., 55

Makowsky, J., 54
Malinowski, J., 61, 94
Malzkorn, W., 65
Marcja, A., 65
Marcone, A., 74
Marek, V., 53
Margaria, T., 55
Marker, D., 74
Marra, V., 61
Marti-Oliet, N., 55
Martin, D., 74
Martin, G., 52
Martin, R.M., 65
Marx, M., 69
McClarty, C., 73
McKenzie, R., 74
McLachlan, R., 54
Melchuk, I., 52
Meseguer, J., 55
Meyden, R.v.d., 60
Middeldorp, A., 56
Miller, J., 53
Mints, G., 74
Miraglia, F., 74
Mitchell, J., 74
Montanari, U., 55
Montero, B., 74
Moor, J., 59
Moreau, P.-E., 55
Moses, Y., 61
Mundici, D., 92
Mylonakis, N., 55

Neeman, I., 74
Nelson, J., 59
Nemeti, I., 74
Nielsen, M., 55
Nielson, H.R., 55
Niemela, I., 53
Nies, A., 54
Nieuwenhuis, R., 55

Odintsov, S.P., 61
Ohori, A., 56
Olivetti, N., 74
Ono, H., 61, 93
Orejas, F., 55
Orlowska, E., 62
Otero, R.P., 53

Palamodov, V., 54
Parikh, R., 50
Partee, B., 52
Pasarella, E., 55
Passell, N., 67
Pedersen, S.A., 50, 94
Pereira, L.C., 74
Peterzil, Y., 73
Pezzè, M., 55
Pfeifer, G., 53
Pino, E., 55
Plantinga, A., 65
Podelski, A., 55
Pohlers, W., 74
Point, F., 73
Pollock, J.L., 54
Pontelli, E., 53
Pratt-Hartmann, I., 70

Prescher, D., 76
Prestel, A., 74
Priest, G., 61
Przymusinski, T., 53
Puebla, G., 56
Pym, D., 76

Queiroz, R.J.G.B.d., 66

Rabinowicz, W., 50
Rasch, T., 65
Raz, R., 54
Reck, E., 73
Reynolds, M., 70
Rhiger, M., 56
Rijke, M.d., 68, 70
Rooij, R.v., 50
Rossi, F., 76
Rosu, G., 55
Rott, H., 50, 61
Rubio, A., 55

Saake, G., 60
Sabry, A., 56
Sagastume, M., 74
Sakama, C., 53
Sannella, D., 55
Sattler, U., 70
Schick, F., 66
Schimmerling, E., 74
Schlingloff, H., 71
Schmidt, R., 71
Schmitt, D., 55
Schneider, M., 62
Schroder, B.S.W., 66
Schuermann, C., 56
Schultz, F.W., 58
Scott, D., 73
Seipel, D., 75
Selinger, P., 56
Shelly, C., 66
Sieg, W., 73, 74
Simons, P., 80
Skyrms, B., 50
Smith, Q., 64
Smorynski, C., 66
Solecki, S., 73
Sommer, R., 74
Son, T.C., 53
Sorbi, A., 74
Sowa, J., 61
Stalnaker, R., 54, 69
Steel, J., 73
Steffen, B., 55
Stirling, C., 52
Stuckey, P., 56
Sullivan, P., 73
Sulzmann, M., 56
Suzuki, N.-Y., 71
Swart, H.d., 52
Swift, J.L., 64

Tait, B., 73
Talcott, C., 55
Tarlecki, A., 55
Thom, P., 67
Thomson, W., 67
Todorcevic, S., 74
Toffalori, C., 65
Tomberlin, J.E., 66
Turner, H., 53
Turull-Torres, J.-M., 75

Ueda, K., 56

Väänänen, J., 74
Vallduví, E., 52
Vardi, M., 61
Villaveces, A., 74
Voronkov, A., 52

Wadler, P., 56
Walukiewicz, I., 55
Wansing, H., 68, 70, 71, 80, 93
Warren, D., 53
Weber, H., 55
Wilkie, A., 74
Williams, M., 54
Williamson, T., 54
Wójcicki, R., 61, 94
Wolter, F., 71

Wood, C., 73
Woodin, H., 54
Woods, J., 62
Wright, C., 54, 62

Xu, Y., 67

Yasugi, M., 67
You, J.-H., 53

Zakharyaschev, M., 68, 71
Zambella, D., 74
Zanardo, A., 52, 80
Zimmermann, E., 52
Zygmunt, J., 61
Øhrstrøm, P., 84