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XIV LATIN AMERICAN SYMPOSIUM ON MATHEMATICAL LOGIC (SLALM)

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Paraty, Brazil
May 11–17, 2008

The "CLE 30 YEARS/ XV Brazilian Logic Conference/ XIV Latin-American Symposium on Mathematical Logic", organized by the Centre for Logic, Epistemology and the History of Science (CLE) of the State University of Campinas (UNICAMP) and the Brazilian Logic Society (SBL), was held in Paraty, Brazil, from May 11th to 17th, 2008. The Organizing Committee was co-chaired by Walter Carnielli, Marcelo Coniglio, and Itala D'Ottaviano.

As is traditional at the Latin-American Symposia, during the week preceding the conference, from May 7th to 9th, the Centre for Logic hosted a Logic School aimed at advanced graduate students and others interested in the study of logic and related areas. Six tutorials were held: *Aristotle's Underlying Logic*, by John Corcoran (University of New York at Buffalo, USA), *Translations between logics*, by Itala M. Loffredo D'Ottaviano (UNICAMP); *Possible-translations semantics*, by Walter Alexandre Carnielli (UNICAMP); *Combining logics*, by Marcelo Esteban Coniglio (UNICAMP); *Algebraic aspects of substructural logics*, by Roberto Leonardo Oscar Cignoli (Buenos Aires University, Argentina); *Logic and information*, by Jaako Hintikka (Boston University, USA). Approximately fifty students and other individuals from Brazilian and other Latin-American institutions, as well as from European and North-American universities, participated in the School.

The Conference and Logic School were sponsored by the Centre for Logic, Epistemology and History of Science (CLE/UNICAMP/Brazil), Fundo de Apoio ao Ensino, á Pesquisa e á Extensão (FAEPEX/UNICAMP/Brazil), Brazilian Logic Society (SBL/Brazil), The State of São Paulo Research Foundation (FAPESP/Brazil), The National Council for Scientific and Technological Development (CNPq/Brazil), Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES/Brazil), Association for Symbolic Logic (ASL) and the National Science Foundation (NSF/USA). The scientific and financial support of the Association for Symbolic Logic in particular made it possible, for the first time, to support the participation of Brazilian, Latin-American, and North-American students in both the Conference and the Logic School. The CLE 30 YEARS/ XV EBL/ XIV SLALM was a great success that also contributed importantly to the development of Logic in Brazil and Latin-America.

The conference participants included about 180 researchers and students from the international scientific community, a number that exceeded attendance at all previously held Brazilian Logic Conferences and Latin-American Symposia on Mathematical Logic. Conference attendees came from São Paulo State, other Brazilian states, and several other countries including Argentina, Belgium, Colombia, Italy, Mexico, The Netherlands, Poland, Spain, the United States, Uruguay and Venezuela.

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During the event the members of the Brazilian Logic Society held their Assembly to elect the officers for the next two-year period. During the meeting, Newton Carneiro Affonso da Costa was honored for his pioneering contributions to logic in Brazil and in Latin-America, and in particular for his creation of paraconsistent logic.

More than eighty communications, of excellent quality, were presented in parallel sessions at three distinct locations within Paraty. The extended abstracts of the papers are electronically published by the *CLE e-Prints*, edited by the Centre for Logic. The Proceedings, containing selected papers, will be published in the volume, *The Many Sides of Logic*, in the series *Studies in Logic*, College Publications, London.

The following invited plenary lectures were delivered:

Atocha Aliseda (Universidad Nacional Autónoma de México, Mexico), *Logic and knowledge: the case of abduction*.

Arnon Avron (Tel-Aviv University, Israel), *Non-deterministic semantics for paraconsistent logics*.

Joan Bagaria (CREA and Departament de Lògica, Història i Filosofia de la Ciència, Universitat de Barcelona, Spain), *On the role of large cardinals in category theory*.

Diderik Batens (Centre for Logic and Philosophy of Science, Ghent University, Belgium), *Adaptive* $\boldsymbol{C}_n$*-logics*.

Jean-Yves Béziau (Université Neuchâtel, Switzerland), *From Formal Logic to Universal Logic*.

Xavier Caicedo (Department of Mathematics, Universidad de los Andes, Bogotá, Colombia), *Uniformizable logics*.

Gregorio Chaitin (IBM Research Yorktown Heights, New York, USA), *Leibniz, complexity and incompleteness*.

Oswaldo Chateaubriand (Catholic University of Rio de Janeiro, Brazil), *A theory of predication and some applications*.

Roberto Cignoli (Universidad de Buenos Aires, Buenos Aires, Argentina), *Constructive logic with strong negation as a substructural logic*.

John Corcoran (Philosophy, University of Buffalo, USA), *Defining 'logical' for properties and relations of first-order*.

Newton Carneiro Affonso Da Costa (University of São Paulo and Federal University of Santa Catarina, Brazil), *On the foundations of quantum field theory*.

Jairo José da Silva (Mathematics Department, UNESP, Rio Claro, Brazil), *A structural perspective on mathematical proofs*.

Carlos Di Prisco (Instituto Venezolano de Investigaciones Científicas, Caracas, Venezuela), *Extensions of Solovay models*.

Aldo V. Figalo (Universidad Nacional del Sur and Universidad Nacional de San Juan, Argentina), *Monteiro, Nelson and Markov logic, Nelson algebras, Ockham-Nelson algebras*.

Jaakko Hintikka (Boston University, USA), *There is only one logic (but it is not the one you know)*.

E. G. K. Lopez-Escobar (University of Maryland, USA and CLE, Brazil), *Logic and Mathematics: A propositional calculus with just three primitive terms*.

David Miller (Department of Philosophy, University of Warwick, Coventry, UK), *Truth defined*.

Francisco Miraglia (University of São Paulo, Brazil), *Geometric functors and quadratic forms over preordered von Neumann regular rings*.

Raymundo Morado (Universidad Nacional Autónoma de México, Mexico), *The philosophical analysis of non-monotonicity*.

Claudio Pizzi (Dipartimento di Filosofia e Scienze Sociali, Università di Siena, Italy), *The problem of existential import in first order consequential logics*.

Marta Sagastume (Universidad Nacional de La Plata, Argentina), *About a link between* *integral residuated lattices and involutive residuated lattices*.

Raymond Smullyan (USA), *Coercive logic and other matters*.

Charles Steinhorn (Vassar College, USA), *On Model theory for classes of finite structures*.

José María Turull-Torres (School of Engineering and Advanced Technology, Massey University, New Zealand), *Higher order logics on finite relational structures*.

Paulo A. S. Veloso (COPPE-UFRJ, Rio de Janeiro, Brazil), *Graph relational calculi: some aspects*.

Andrés Villaveces (Universidad Nacional de Colombia, Colombia), *Continuous model theory, metric AECs: simplicity issues, expansions by predicates*.

Heinrich Wansing (Dresden University of Technology, Germany), *Constructive negation, implication, and co-implication*.

Abstracts of invited plenary talks and contributed communications and papers presented by title follow.

For the Organizing Committee
ITALA MARIA LOFFREDO D'OTTAVIANO

Abstracts of tutorials

► WALTER CARNIELLI, *A tutorial on possible-translations semantics*.
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The possible-translations semantics (PTS's) were devised in 1990 (cf. [1]) in order to offer a palatable interpretation to some non-classical logics. For expositions and improvements see [2] and [3]. PTS's interpret a given logic by considering its translations (maps between logics preserving their consequence relations) into other logics. If translations are thought as different "world views", the concept of PTS's offer a way to interpret a given logic L as the combination of all "possible world views", technically viewed as an appropriate set of translations of the wffs of L into the wffs of a class of "simpler" logics with known semantic characterization. PTS's are specially adequate to the logics of formal inconsistency (general paraconsistent logics, see [2]) but can be given to non-paraconsistent logics as well. Many paraconsistent logics which are not characterizable by means of finite matrices can be characterized by suitable combinations of many-valued logics through PTS's. Serving as a powerful tool to decompose logics in the spirit of the program of combining logics, PTS's can even offer a solution to the problem of algebrizing paraconsistent logics.

[1] W. A. CARNIELLI, *Many-valued logics and plausible reasoning*, ***Proceedings of the XX International Congress on Many-Valued logics***, IEEE Computer Society, 1990, pp. 328–335.

[2] W. A. CARNIELLI, M. E. CONIGLIO AND J. MARCOS, *Logics of formal inconsistency*, ***Handbook of philosophical logic***, (D. Gabbay and F. Guenthner, editors), Springer, Amsterdam, 2007, pp. 15–107.

[3] J. MARCOS, *Possible-translations semantics for some weak classically based paraconsistent logics*, ***Journal of Applied Non-Classical Logics***, to appear.

► ROBERTO CIGNOLI, *Algebraic aspects of substructural logics*.
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Residuated lattices constitute an adequate framework for classifying a large class of non-classical logics studied nowadays. The purpose of this tutorial is to develop this framework, with special emphasis in many-valued logics originated from t-norms over the real interval

$[0,1]$. Completeness results for these logics will be discussed, as well as the finite-model property for the continuous case.

► MARCELO E. CONIGLIO, *A tutorial on combining logics*.
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The subject of Combining Logics, besides its philosophical interest, is also motivated by pragmatical and methodological reasons. Indeed, the use of logic systems as a tool for knowledge representation in Computer Science can require the integration of systems into a homogeneous environment. In this tutorial, based on [1] and [2], several important techniques for combining and decomposing logics will be analyzed: fusion and product of modal logics, fibring and possible-translations semantics. Some application examples will illustrate the methods.

[1] W. A. CARNIELLI AND M. E. CONIGLIO, *Combining logics*, ***Stanford encyclopedia of philosophy***, http://plato.stanford.edu/entries/logic-combining/, 2007.

[2] W. CARNIELLI, M. E. CONIGLIO, D. GABBAY, P. GOUVEIA AND C. SERNADAS, ***Analysis and synthesis of logics***, Applied Logic Series, vol. 35, Springer, 2008.

► JOHN CORCORAN, *Aristotle's underlying logics: a three-hour tutorial*.
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This tutorial on Aristotle's *underlying logics* begins with a treatment of his *demonstrative logic*, the principal motivation for his interest in the field. It ends with a faithful translation of Aristotle's categorical syllogistic into a Hilbert-style many-sorted logic. Demonstrative logic, or *apodictics*, studies *demonstration* as opposed to persuasion. It presupposes the Socratic knowledge/opinion distinction—between knowledge (beliefs that are known) and opinion (those that are not known). Every demonstration produces (or confirms) *knowledge* of (the truth of) its *conclusion* for every person who comprehends the demonstration. Persuasion merely produces *opinion*. Aristotle was the first to see that every demonstrative science presupposes for its deductions what Church called an underlying logic. Aristotle presented a general *truth-and-consequence conception of demonstration* meant to apply to all demonstrations not just to those that are complete categorical syllogisms. According to him, a demonstration is an extended argumentation that begins with premises known to be *truths* and involves a chain of reasoning showing by deductively evident steps that its conclusion is a *consequence* of its premises. For Aristotle, starting with premises known to be true and a conclusion not known to be true, the knower demonstrates the conclusion by *deducing* it from the premises. As Tarski emphasized, modern formal proof resulted from refinement and "formalization" of traditional Aristotelian demonstration. Aristotle's general theory of demonstration required a prior general theory of deduction presented in the *Prior Analytics*. His general *immediate-deduction-chaining conception* of deduction was meant to apply to all deductions, not just to complete categorical syllogisms. For him, any deduction that is not immediately evident is an extended argumentation that involves a chaining of immediately evident steps that shows its final conclusion to follow logically from its premises.

► ITALA MARIA LOFFREDO D'OTTAVIANO, *Translations between logics*.
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In [2] we propose a general definition for the concept of *translation* between logics, as maps preserving consequence relations. In this Tutorial I will present an initial segment of a theory of translations and will study an important subclass of translations that preserve and conserve consequence relations, the *conservative translations*, introduced and investigated by [3]. Some conservative translations involving classical and several non-classical logics will be presented. By dealing with the Lindenbaum–Tarski algebraic structures associated to the logics, I will study the problem several times mentioned in the literature of the existence of conservative translations from distinct logics into classical logic. Other developments for which our wider notion of translation plays an essential role are for instance the *possible-translations semantics*, *possible-translations algebraic semantics* and investigations on *combining logics*. I will present the notion of *transfer* between logics, as introduced by Coniglio and Carnielli (2002). I will also present the notion of *contextual translation*, as proposed by Coniglio (2005) and analysed by [1]. Finally, the concepts of conservative translation, transfer and contextual translation will be compared in the scope of our general definition of translation.

[1] W. A. Carnielli, M. E. Coniglio and I. M. L. D'Ottaviano, *New dimensions on translations between logics*, ***UNILOG'07***, Xi'an, 2007.

[2] J. J. da Silva, I. M. L. D'Ottaviano and A. M. Sette, *Translations between logics*, ***Models, algebras and proofs***, Lectures Notes in Pure and Applied Mathematics, vol. 203, Marcel Dekker, New York, 1999, pp. 435–448.

[3] H. A. Feitosa and I. M. L. D'Ottaviano, *Conservative translations*, ***Annals of Pure and Applied Logic***, vol. 108 (2001), pp. 205–227.

► JAAKKO HINTIKKA, *Logic and information*.
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Logicians have apparently failed to relate their subject to the most pervasive and potentially most important concept of information. Yet in reality there already exists a theory synthesizing first-order logic and the basic features of a concept of semantical information. It is disguised under the title of the theory of distributive normal forms. In general, the information of a first-order propositions S is determined by the possibilities concerning the world that S excludes and hence by contrast the set of all different possibilities S admits. This set is what the normal form of S displays, the different mutually exclusive possibilities being represented by its constituents. Constituents relative to the quantificational equal or larger than that of depth d are S. Hence S is equivalent to a disjunction (1) $C_1^{(d)} \vee C_2^{(d)} \vee \cdots \vee C_{k(d)}^{(d)}$. When d is increased to $d+1$, (1) is split up into a (usually longer) disjunction of constituents of depth $d+1$. The resulting tree exhibits the informational structure of S. Numerical measures of information are obtained by weighting the different constituents appropriately. It can be shown that the natural weights cannot be determined a priori but depend on the different kinds of order in the model in question, a model in which it is true. The information of S is determined by the disjunction (1), with shorter disjunctions being the most informative ones. This clear-cut labeled tree structure of constituents makes them useful in logical theory, even in approaching major unsolved problems. One application here starts from the facts that a syntactically defined constituent can be inconsistent and that there is no recursive method of locating the nontrivially inconsistent ones. Hence, we understand the information role of (1) in two different ways. Either we assume that all the inconsistent constituents have been eliminated (assigned the weight zero). Then we get an analysis of what has been called depth information. If nontrivially inconsistent constituents are assigned nonzero weight, we are dealing with surface information. Alternatively, one can try to measure the information of a nontrivially inconsistent constituent by the length of the logical proof of its inconsistency. Then you have what is very nearly complexity theorists' notion of information. The highly structured and model theoretically significant nature of distributive normal forms promises applications to different logic problems.

Abstracts of invited plenary talks

► ATOCHA ALISEDA, *Logic and knowledge: the case of abduction*.
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In this talk I explore some aspects of the relationship between logic and knowledge, especially for the case of abduction. The type of knowledge managed and produced by logical analysis, is concerned with cognitive abilities *human or automatic* being the patterns of reasoning the guides to give us new information about the World. This is in great contrast with the production of knowledge manifested in concrete objects, such as chemical substances, or in abstract objects like physical laws, the cases for Chemistry and Physics. Logic is a useful tool for many disciplines, all in which knowledge may be expressed in an inferential format, from a set of premises to a conclusion. However, this relationship may be of a diverse nature, be it abductive, inductive or deductive. And even more: abduction has no unique pattern for manifesting itself. It is not a logic, but a style of reasoning manifested in diverse types of logical consequence.

► ARNON AVRON, *Non-deterministic semantics for paraconsistent logics*.
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One of the oldest and best known approaches to the problem of designing useful paraconsistent logics is da Costa's approach, which seeks to allow the use of classical logic whenever it is safe to do so, but behaves completely differently when contradictions are involved. da Costa's approach has led to the family of Logics of Formal (In)consistency (LFIs). In this paper we provide non-deterministic semantics for a very large family of first-order LFIs (which includes da Costa's original system C_1, as well as thousands of other logics). We show that our semantics is effective and modular, and we use this effectiveness to derive some important properties of logics in this family.

► JOAN BAGARIA, *On the role of large cardinals in category theory*.
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In the first part of the talk we give an overview of some results in abstract category theory, proven in the last 50 years, that involve the use of measurable cardinals and other stronger large-cardinal principles. In particular, we concentrate on some results involving Vopěnka's Principle (VP). As was amply demonstrated in the work of Adamék and Rosický [1], VP plays an essential role in the study of accessible and locally presentable categories. Indeed, certain questions on boundedness for such categories turn out to be equivalent to VP. Recently, VP has also showed up in [2], which answers a well-known question on homotopical localization. The second part of the talk presents some recent results on the existence of localizations, obtained in collaboration with Casacuberta and Mathias, assuming the existence of supercompact cardinals, a much weaker hypothesis than VP. The proof involves an analysis of definability of proper classes of structures and the notion of *absolute* category.

[1] J. Adámek and J. Rosický, ***Locally presentable and accessible categories***, London Mathematical Society Lecture Note Series 189, Cambridge University Press, 1994.

[2] J. H. Smith, C. Casacuberta and D. Scevenels, *Implications of large cardinal principles in homotopical localization*, ***Advances in Mathematics***, vol. 197 (2005), no. 1, pp. 120–139.

► DIDERIK BATENS, *Adaptive $\mathbf{C}_n$-logics*.
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In $\mathbf{C}_n$ logics $(1 \leq n < \omega)$, $A^{(n)}$ expresses that A behaves consistently (e.g., [3]), a striking feature absent in most other paraconsistent logics. Newton da Costa clearly had the following intention: (i) replace the logic of a theory that turns out inconsistent by a $\mathbf{C}_n$ logic, and (ii) add consistency statements. Step (ii) drastically enriches the theory, but involves the danger of triviality. When this occurs, one retracts the consistency statements, or replaces the logic $\mathbf{C}_n$ by $\mathbf{C}_{n+1}$. Inconsistency-adaptive logics (e.g., [1]) approach the same problem differently. They interpret the *original* non-logical axioms in a maximally consistent way. Both approaches will be compared. That $\mathbf{C}_n$ logics introduce dependencies between inconsistencies, endangers the resulting inconsistency-adaptive logics to be flip-flops. A recently developed method offers full control in this respect. Given the computational complexity of adaptive logics, procedural criteria for final derivability are introduced. These lead to success whenever possible, a relevant feature in view of formal learning theory. The adaptive framework also enables one to add further consistency statement *in a defeasible way*. The Logics of Formal Inconsistency (e.g., [2]) generalize the addition of a consistency operator to nearly every paraconsistent logic. The comparison with inconsistency-adaptive logics is generalized similarly.

[1] D. Batens, *A universal logic approach to adaptive logics*, ***Logica Universalis***, vol. 1 (2007), pp. 221–242.

[2] W. A. Carnielli, M. E. Coniglio and J. Marcos, *Logics of Formal Inconsistency*, ***Handbook of philosophical logic***, (D. Gabbay and F. Guenthner, editors), vol. 14, Springer, 2007, pp. 15–107.

[3] N. C. A. da Costa, *On the theory of inconsistent formal systems*, ***Notre Dame Journal of Formal Logic***, vol. 15 (1974), pp. 497–510.

► JEAN-YVES BÉZIAU, *From Formal Logic to Universal Logic*.
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Modern logic was at some point dominated by the formalist ideology, and was often called "Formal Logic". After a critical analysis of this conception of logic, I will explain how we can develop a different approach, called "Universal Logic" unifying different conceptions and tendencies of logic.

► XAVIER CAICEDO, *Uniformizable logics*.
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Many general results in abstract model theory depend on closure under negations of the logics involved. This is the case of Lindström's characterizations of first order logic and various characterizations of compactness properties of logics. We show in this talk that under appropriate reformulation these results hold in negationless uniformizable logics, uniformizability being a topological hypothesis satisfied, among others, by continuous logics with values in the real interval [0, 1].

► GREGORIO CHAITIN, *Leibniz, complexity and incompleteness*.
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I will discuss Leibniz's ideas on complexity (*Discours de metaphysique*, 1686), leading to modern work on program-size complexity, the halting probability and incompleteness. Leibniz's principle of sufficient reason asserts that if anything is true it is true for a reason. But the bits of the numerical value of the halting probability are mathematical truths that are true for no reason. More precisely, as I will explain, they are irreducible mathematical truths, that is, true for no reason simpler than themselves.

► OSWALDO CHATEAUBRIAND, *A theory of predication and some applications*.
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The basic intuition of traditional logic that every sentence is of subject-predicate form was generalized by Frege through two main moves: the analysis of sentences in terms of function and arguments, and the analysis of quantification as higher-order predication. Combining these two ideas, every linguistic assertion, and every logical formula, can be interpreted in different ways as a predication involving one or more subjects. This has important applications to theories of truth and falsity, theories of descriptions, as well as to other logical and philosophical issues.

► ROBERTO CIGNOLI, *Constructive logic with strong negation as a substructural logic*.
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Recently, M. Spinks and R. Veroff showed that Nelson constructive logic with strong negation can be considered as a substructural logic. The aim of this talk, based on joint work with M. Busaniche, is to show how this approach can be exploited to obtain information on the algebraic semantics of Nelson logic and to relate it to some non-classical logics existing in the literature.

► JOHN CORCORAN, *Defining 'logical' for properties and relations of first-order*.
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Logical truth and logical falsehood were called *logical properties*; 2-place logical consequence and logical independence were called logical relations-in contexts where no appropriate definition of 'logical' was provided. Let L be a first-order language. A *formal* 1–1 function f on L's vocabulary carries each non-logical constant to one in the same syntactic category and leaves every other character fixed. Any formal f extends to L: for each sentence s, the n-th character in the sentence fs is fk where k is the n-th character in s. A sentence p is *formally similar* to a sentence q if, for some formal f, fp is an alphabetic variant of q. Any [extended] formal f extends to [ordered] couples (p, q) of sentences: $f(p, q) = (fp, fq)$. *Formal similarity* extends to couples: (p, p^*) is *formally similar* to (q, q^*) if, for some formal f, fp and fp^* are respectively alphabetic variants of q and q^*. A property (set) or a relation (set of couples) closed under formal similarity is *formal*. A sentence p is *contentually similar to* a sentence q if they are logically equivalent. *Contentual similarity* extends to ordered pairs: (p, p^*) is *contentually similar* to (q, q^*) if p and p^* are logically equivalent to q and q^* respectively. A property (set), or a relation (set of couples), closed under contentual similarity is *contentual*. Each "logical" property and relation mentioned above is both formal and contentual. This paper explains the historical and philosophical adequacy of the proposal to define a property or relation to be *logical* if it is both formal and contentual. This lecture sharpens discussions in this BULLETIN vol. 7 (2001), pp. 105–106 and vol. 10 (2004), p. 445.

► NEWTON CARNEIRO AFFONSO DA COSTA, *On the foundations of quantum field theory*.
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We consider some questions on the logical foundations of quantum field theory, involving the electromagnetic, the weak and the strong interactions, and argue that in quantum field theory the classical notion of truth (à la Tarski) has to be replaced by the more general concept of quasi-truth. As a consequence, we have to modify the notion of physical theory. It is also suggested that to cope with the foundational problems of present-day physics, a paraconsistent logic could be helpful.

► JAIRO JOSÉ DA SILVA, *A structural perspective on mathematical proofs*.
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In order to prove theorems of a given interpreted mathematical theory, a standard procedure is to appeal to other interpreted theories, governing different mathematical domains. This, I claim, changes the meaning of the theorem. The question is why this change is mathematically irrelevant. The introduction of purely formal objects in the domain of an interpreted theory for handling problems originally circumscribed to this domain by strictly symbolic means raises a similar question: how can what has no meaning have any bearing on what has a definite meaning? The answer to these questions, I claim, lies in the fact that the meaning attributed to mathematical domains is irrelevant, and only their formal or structural properties matter (what eliminates substantial mathematical differences between interpreted and purely formal theories). Formal properties are invariant under isomorphisms, such as, typically, mathematical properties. This is why mathematical domains can be embedded one into another or extended by the adjunction of formal entities in the search for more convenient contexts where formal properties can be established, and then transferred back to their original domains. This also accounts for the applicability of mathematics to science. Scientific contexts can be mathematized to the extent that only their formal properties matter; so, the applicability of mathematics to science depends on its ability to provide adequate formal domains in which to embed (or interpret) those of scientific interest. This does not require either that scientific domains themselves instantiate mathematical structures (against a way of understanding the applicability of mathematical structures to science), or that mathematical domains (and the objects therein) exist in any strong sense of the term (against the so-called indispensability argument).

► CARLOS DI PRISCO, *Extensions of Solovay models*.
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Solovay, assuming the existence of an inaccessible cardinal, constructed a model of Zermelo–Fraenkel set theory in which all sets of real numbers are Lebesgue measurable and satisfy other regularity properties (Solovay, 1970). Mathias showed that in SolovayŠs model every set of real numbers is Ramsey (Mathias, 1977). It is known that the characteristics of this model are preserved by some forcing notions. Recent work done in collaboration with J. Bagaria describes a wide class of forcing notions which have this property. We apply this together with absoluteness arguments to obtain generalizations of Mathias' result.

► ALDO V. FIGALLO, *Monteiro, Nelson and Markov logic, Nelson algebras, Ockham–Nelson algebras*.
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This lecture is divided into two parts. It is a well known fact that on May 31st, 2007 it was Professor Antonio Monteiro's 100th anniversary. He was my dear teacher who taught me mathematics with generosity, dedication and great talent. In his honour, I will thence try to summarize a part of his immense influence on the development of Mathematics in Argentina, where he motivated a great number of young people, who later became outstanding mathematicians and philosophers. It is also in Argentina where he changed direction in his research, gradually leaving aside analysis research to devote himself to the study of algebraic models of various propositional logics obtaining some remarkable results. In the second part, I will talk about Monteiro's contribution on the subject pointed out in the title of this lecture and finally, I will describe briefly my own contribution to these topics.

► JAAKKO HINTIKKA, *There is only one logic* (*but it is not the one you know*).
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It was once thought that there is only one basic logic, the received first-order logic (FOL). A variety of "alternative logics" have since sprung up. Recently the situation has again changed. The received FOL has turned out to have serious flaws. The result of correcting them is known as independence-friendly FOL, in brief IF logic. In IF logic the law of excluded middle does not hold. When it is extended by adding a sentence-initial contradictory negation, the result (called EIF logic) can serve as a new basic logic. It can do justice to the intentions of intuitionistic logic, epistemic logic, paraconsistent logic and quantum logic while being elementary in a natural sense. By allowing arbitrary occurrences of the contradictory negation which means allowing arbitrary applications of tertium non datur it becomes as strong as the entire second order logic and hence capable of serving as the logic of mathematics, replacing set theory. Most of the other "alternative logics" can be viewed as attempts to formulate rules of proof for assumptions that are not built into the usual logical languages. This is unsatisfactory as long as the semantics of such concepts is not spelled out. Typical cases in point include circumscriptive logic and inductive logic.

► E. G. K. LOPEZ-ESCOBAR, *Logic and Mathematics: A propositional calculus with just three primitive terms*.
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An Extended (Second Order) Propositional Calculus, whose primitive terms are: (i) *the universal quantifier over propositions*, (ii) *the biconditional* and (iii) a binary operation of *subordination*, is introduced. Its rules of inference are the familiar Introduction/Elimination Gentzenian rules for the universal quantifier and the biconditional as well as an additional Introduction/Elimination rule for the *subordination-universal quantifier* combination. **Any non-primitive term** has to be introduced by a unique and explicit definitional axiom (which, in principle, is eliminable). By the addition of **finitely** many axioms (and appropriate definitions) the above propositional system ***includes***: (i) the Extended Intuitionistic Propositional Calculus, (ii) Schröder's Algebra of Logic, (iii) Second order number theory, (iv) Tarski's General Class theory, (v) Kelley–Morse Impredicative Set Theory, *etc.*. Note that because the definitions are incorporated into the system, no *translation* is required. A complete Beth-like semantics is also discussed.

► DAVID MILLER, *Truth defined*.
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The author's (unpublished) contribution to the III World Congress on Paraconsistency in Toulouse in 2003 sketched a definition of truth that is (a) materially adequate, if not precisely in Tarski's sense; (b) formally correct, involving no confusion of linguistic items with their names; (c) explicit, conservatively extending a fragment of naive (or axiomatic) set theory that contains no semantic primitives; (d) universal, beholden to no doctrine of language hierarchies; (e) versatile, applicable to any system that admits the necessary deductive theories; and (f) modestly paraconsistent, requiring no deviation from classical logic that is not for other reasons unavoidable. What is defined is not, of course, the term 'true sentence', since Tarski's theorem excludes the possibility of any such definition, but (roughly speaking) a function ϑ from names of sentences to deductive theories such that $\vartheta(\mathfrak{y})$ states conditions that are necessary and sufficient for the sentence named by $\mathfrak{y}$ is true. This deductive theory $\vartheta(\mathfrak{y})$, which is in general unaxiomatizable, may with care be read 'the truth of $\mathfrak{y}$'. In the present paper the definition is extended from sentences to deductive theories, and an attempt is made accurately to locate the liar paradox in its framework. The paper concludes with some frankly philosophical speculations.

► FRANCISCO MIRAGLIA, *Geometric functors and quadratic forms over preordered von Neumann regular rings*.
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We show in this talk that the preordered von Neumann regular rings satisfy Lam and Milnor's conjectures. These results will appear in the "Journal of Algebra" in 2008.

► RAYMUNDO MORADO, *The philosophical analysis of non-monotonicity*.
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This paper tries to flesh out several important challenges in the philosophical analysis of non-monotonic inferences. The goal is to further clarify several issues in three main areas. (1) Logicality issues: (1.1) In what sense can there be logic without perfect validity? (1.2) To what extent is it legitimate to introduce practical considerations about the limits of finite agents into the construction of a theory of logical inference? (2) Representation issues: (2.1) What is required of an acceptable formalization of the notion of inferential context? (2.2) When should a non-monotonic system be declarative, formal, symbolic? (2.3) What are the proper units of analysis in these logics: beliefs, pieces of knowledge, sentences, statements? (2.4) Which metalanguages are adequate for these formalisms? (3) Intrasystematicity issues: (3.1) Should all conclusions of non-monotonic inferences be in the intersection of the extensions? (3.2) What is the precise relation between the deactivation of rules and assumptions, and their denial? (3.3) In what sense do non-monotonic formalisms reject rules such as Modus Ponens?

► CLAUDIO PIZZI, *The problem of existential import in first order consequential logics*.
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McCall [1] argued that the question of existential import of universal statements should be seen as a puzzle yielded not by the properties of quantification but by the properties of implication. If $\rightarrow$ stands for "connexive" implication, $A \rightarrow B$ implies $\neg(A \rightarrow \neg B)$ and $\forall x(Ax \rightarrow Bx)$ ("all unicorns are mortal") implies $\exists x \neg(Ax \rightarrow \neg Bx)$ ("some unicorns are mortal") which does not entail that at least a unicorn exists. Two points should be considered: (1) Even if the basic intuitions at the ground of connexive implication are strongly plausible, the axiomatization for it developed in the Sixties is untenable; (2) The connection between A and B in $A \rightarrow B$ could also be interpreted as a relation of "consequential implication", this meaning (i) that A strictly implies B (ii) that the modal status (in the aristotelian sense) of A is the same as the modal status of B (see [2]). The central aim of the paper is to show that in order to treat the question of existential import in the spirit of [1] not only we have at our disposal the language of first order consequential implication, but also the possibility of translating modal operators into first order quantifiers, so to define a new kind of consequential operator in terms of quantification itself. It is also stressed that a weaker consequential operator definable in terms of $\rightarrow$ could be used to give account of different intuitions about conditionals with vacuous clauses.

[1] S. McCall, *Connexive Implication and the Syllogism*, ***Mind***, vol. 76 (1967), no. 303, pp. 346–356.

[2] C. Pizzi, *Aristotle's cubes and Consequential Implication*, ***Logica Universalis***, vol. 2 (2008), pp. 143–153.

► MARTA SAGASTUME, *About a link between integral residuated lattices and involutive residuated lattices*.
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In this joint work with J. L. Castiglioni and M. Menni we define the functor $\mathsf{K}^{\bullet}$ relating the category IRL_0 of integral residuated lattices with 0 with certain involutive residuated lattices. We are originally motivated by an old construction due to Kalman linking distributive lattices and centered Kleene algebras and by two categorical equivalences based on that construction: between ℓ-groups and conical BCK-algebras and between MV and MV*-algebras. Our work is based on Cignoli's results about an adjunction between Heyting and Nelson algebras. Our functor $\mathsf{K}^{\bullet}$ has a left adjoint C and has another interesting properties, for example, it preserves lattices of congruences. Also, we prove that when condition $(\mathsf{CK}^{\bullet})$ holds then the adjunction $\mathsf{C} \dashv \mathsf{K}^{\bullet}$ restricts to an equivalence. In the original Kalman's setting, we begin with a functor $\widehat{(\_)}$ which assigns to an object A the product $A \times A^0$, that goes from distributive lattices to De Morgan algebras. We lift $\widehat{(\_)}$ to a functor from the category IRL_0 (integral residuated lattices with 0) to iRL_b (involutive residuated bounded lattices). The original Kalman construction maps a lattice A into the Kleene algebra $KA = \{(x, y) \in \widehat{(A)} \colon x \wedge y = 0\}$. We replace "$\wedge$" by "$\cdot$" and define for a residuated lattice A: $\mathsf{K}^{\bullet}A := \{(x, y) \in \widehat{(A)} \colon x \cdot y = 0\}$. We give an interesting factorization of $\mathsf{K}^{\bullet}$ through $\widehat{(\_)}$ and an explicit description of the isomorphisms between congruence lattices associated to the equivalence $\mathsf{C} \dashv \mathsf{K}^{\bullet}$. Finally, we prove that the image of the functor $\mathsf{K}^{\bullet}$ determines a variety.

► RAYMOND SMULLYAN, *Coercive logic and other matters*.
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Coercive logic is a logic that forces people to do things that they would not normally want to do. Several examples will be given. As to the "Other matters", first, I will be considering several paradoxes including my Cantorian paradox, and its relation to William Zwicker's Hypergame, and some variants of mine of the Newcombe paradox and the envelope paradox. Finally, I will exhibit a miniature mathematical system that in a very instructive way, captures the essential ideas behind results of Tarski and Gödel on undefinability and incompleteness.

► CHARLES STEINHORN, *On model theory for classes of finite structures*.
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We survey work done in collaboration with Macpherson, and subsequently continued by some of his Ph.D. students, dealing with the development of model theory for classes of finite structures. The underlying theme of this project is to bring to the study of classes of finite structures various aspects of the point of view of contemporary model theory for infinite structures.

▶ JOSÉ MARÍA TURULL-TORRES, *Higher order logics on finite relational structures*.
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We will discuss the expressive power of higher order logics on finite relational structures or databases. First, we give a characterization of the expressive power of the fragments Σ^i_j and Π^i_j, for each $i \geq 1$ and each number of alternations of quantifier blocks j. Then we get as a corollary the expressive power of HO^i for each order $i \geq 2$. From our results, as well as from the results of R. Hull and J. Su, it turns out that no higher order logic can be complete. Even if we consider the union of higher order logics of all natural orders, i.e., $\bigcup_{i\geq 2} HO^i$, we still do not get a complete logic. So, we define a logic which we call *variable order logic* (VO) which permits the use of untyped relation variables, i.e., variables of variable order, by allowing quantification over orders. We show that this logic is *complete*, though even non recursive queries can be expressed in VO. Then we define a fragment of VO and we prove that it expresses exactly the class of r.e. queries. We finally give a characterization of the class of computable queries through a fragment of VO, which is undecidable. This talk is based mainly on results obtained through join research with Lauri Hella.

▶ PAULO A. S. VELOSO, *Graph relational calculi: some aspects*.
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The study of binary relations has a long and interesting history, with contributions from Peirce, Schröder, Tarski, etc. Binary relations have important connections with logic and foundations as well as with computer science (e.g., allegory theory, graph theory, relational semantics, program derivation). Despite their simple apparatus, binary relations provide rather useful tools for some tasks involving specification and reasoning. This talk will concentrate on some aspects of graph relational calculi: basic intuitions and ideas, results and possible extensions. We will emphasize the playful nature of such calculi. Towards this goal we start with a restricted positive calculus and introduce a series of more powerful extensions. Each one of these calculi, whose derivations are linear (rather than trees), is sound and complete (for the valid inclusions). The basic idea hinges on a simple notational device: represent the fact that u is related to v by R, i.e., the pair (u, v) belongs to R, by means of an arrow labeled by R from u to v. Operations on relations correspond to simple manipulations on such arrows (e.g., conversion to inverting the arrow and intersection to parallel arrows). A set of such arrows represent a relation by means of restrictions to be satisfied. We will introduce some of these graph relational calculi illustrating their playful nature by examples and indicate the basic proof methods (e.g., canonical model construction). We will also comment on some ongoing research and future work.

▶ ANDRÉS VILLAVECES, *Continuous model theory, metric AECs: simplicity issues, expansions by predicates*.
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In recent years Continuous Model Theory has developed very steadily in the works of Henson, Ben Yaacov, Usvyatsov, Berenstein and others. Based on earlier developments of Henson and Iovino, these authors have been developing a good deal of Stability Theory in the Continuous context. I will address two issues here: problems with the development of a reasonable Simplicity Theory in this context and current developments generalizing results of Casanovas–Ziegler on stability spectra of expansions by predicates. This is joint work with Berenstein and Hyttinen. I will end with some new examples of Metric Abstract Elementary Classes.

► HEINRICH WANSING, *Constructive negation, implication, and co-implication.*
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A family of propositional logics with constructive negation, constructive implication, and constructive co-implication is introduced. Although some fragments of these logics are known from the literature and although these logics emerge quite naturally, it seems that none of them has been considered so far. A relational semantics and cut-free sound and complete display sequent calculi for the nonclassical logics under consideration are presented.

Abstracts of contributed talks

► M. ABAD, C. R. CIMADAMORE AND J. P. DÍAZ VARELA, *A duality for 3-valued Łukasiewicz implication algebras with* Δ.
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In this work we give a topological representation for 3-valued Łukasiewicz implication algebras with Δ. These algebras were introduced and studied by A. Figallo in [2]. They are the class of all $\{\rightarrow, \Delta, 1\}$-subreducts of 3-valued Łukasiewicz algebras. Every 3-valued Łukasiewicz implication algebra with Δ is represented as a union of a unique family of implication filters of a suitable 3-valued Łukasiewicz algebra. Inspired in this representation, we introduce the notion of topological 3-valued implication space, and we prove a dual equivalence. The main tool we use in the proofs of this result is the duality between implication algebras and certain topological spaces, developed in [1]. As an application, we describe the 3-valued implication space of free 3-valued Łukasiewicz implication algebra with Δ.

[1] M. ABAD, J. P. DÍAZ VARELA AND A. TORRENS, *Topological representation for implication algebras*, ***Algebra Universalis***, vol. 52 (2004), no. 1, pp. 39–48.
[2] A. V. FIGALLO, $I\Delta_3$*-algebras*, ***Reports on Mathematical Logic***, no. 24 (1990), pp. 3–16.

► JUAN C. AGUDELO, *Paraconsistency and quantum computation.*
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A method to define axiomatic theories for deterministic Turing machine computations is here proposed. This method, when applied to axiomatizing computations in non-deterministic Turing machines, produces (in some cases) contradictory theories, therefore trivial theories (considering classical logic as the underlying logic). By defining a paraconsistent logic with a connective expressing entangled states in a logical fashion, and substituting the underlying logic of theories expressing Turing machine computations by this logic, we define a new model of computation which we call *entangled paraconsistent Turing machine*. Some similarities of this model with the model of quantum Turing machines are discussed. Finally, we define complexity classes for the model introduced and establish a relationship with the well-known NP complexity class.

► MARCOS ANTONIO ALVES AND ITALA M. LOFFREDO D'OTTAVIANO, *An argument against the concept of logical consequence*.
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In this work we present three characteristics of the logical consequence, based on its intuitive notion: necessity, formality and apriority. Following we explain the standard semantic conception, or model-theoretic, of logical consequence. We illustrate an argument against its conceptual adequacy, looking for showing that it does not satisfy the three mentioned characteristics. We suggest, according to Etchemendy's argument, that this conception does not satisfy these characteristics for being based on a specific universe, the universe of set theories of type Zermelo-Fraenkel. Finally, we explain an informational notion of logical consequence and we analyze its extensional and conceptual adequacy.

[1] J. Etchemendy, ***The concept of logical consequence***, Harvard, Cambridge, 1990.
[2] A. Tarski, ***Logic, semantics, metamathematics***, Clarendon Press, Oxford, 1956.

► EDUARDO ALEJANDRO BARRIO, *Semantic self-sufficiency and unrestricted quantification*.
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In this paper, I analyze if it is possible to develop a language in which its quantifiers are completely unrestricted. Usually, paradoxes show what might have appeared to be absolutely unrestricted quantification to be somehow restricted. So, I consider a new version of Russell Paradox formulated by Williamson in [2]. This argument is taken as the strongest against the coherence of unrestricted quantification. Then, I show some problems with the most promising defense of unrestricted quantification developed to date. This approach, formulated by Rayo in [1], uses a hierarchy of metalinguistic resources. So, no language at all can talk about all interpretations (including the interpretations that it is used in all levels). However, I point out that this explanation is be able to offer an interpretation of first order quantifiers in which they range over absolutely all object.

[1] A. Rayo, *Beyond plurals*, ***Absolute generality*** (A. Rayo and G. Uzquiano, editors), Oxford University Press, Oxford, 2006.
[2] T. Williamson, *Everything*, ***Philosophical Perspectives***, vol. 17, (D. W. Zimmerman and J. Hawthorne, editors), 2004, pp. 415–465.

► MARIO R. F. BENEVIDES AND L. MENASCHÉ SCHECHTER, *Decidability of a syntactic fragment of the hybrid computation tree logic with the ↓ operator*.
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Hybrid logics with the $\downarrow$ operator are generally undecidable. In this paper, we present a fragment of the hybrid CTL with the $\downarrow$ operator ($\mathrm{HCTL}(@,\downarrow)$), called the reducible fragment, that has the same complexity for the satisfiability problem as standard CTL (EXPTIME-Complete). In order to prove this, we show that the satisfiability problem for a formula in this fragment can be polynomially reduced to the satisfiability problem for a formula in the hybrid CTL without the $\downarrow$ operator (HCTL(@)).

► ESTELA BIANCO AND ALICIA ZILIANI, *A new algebraic counterpart of four-valued Monteiro propositional calculus*.
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In the XII Latin American Symposium on Mathematical Logic we presented a Hilbert-style propositional calculus called four-valued Monteiro propositional calculus in terms of the connectives implication ($\rightarrow$), conjunction ($\wedge$), negation ($\sim$) and a modal operator (∇) which has tetravalent modal algebras as an algebraic counterpart. In this paper, following the study of this calculus, we prove that it belongs to the class of standard systems of implicative extensional propositional calculi. Furthermore, we prove that the completeness theorem for this calculus holds. Besides, we introduce the notion of modal distributive lattices with implication [1] and we prove that these algebras are more convenient than tetravalent modal algebras in order to study four-valued Monteiro propositional calculus from an algebraic point of view. This last statement follows from the fact that the implication $\rightarrow$ is one of its basic binary operations.

[1] E. Bianco and A. Ziliani, *Categorical equivalence between the 4–valued modal algebras and the implicative modal algebras*, ***Preprints del Instituto de Ciencias Básicas, Universidad Nacional de San Juan***, vol. 2 (1997), no. 2, pp. 23–33.

► GUSTAVO BODANZA, *The "lottery paradox" paradox: an extension semantics for dealing with this and other self-attacking arguments*.
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The "lottery paradox" paradox—a problem derived from the well-known lottery paradox —arises as the result of chaining defeasible reasons that lead from the statement 'the lottery is fair' to the statement 'the lottery is not fair', conforming in consequence a self-attacking argument. In the argument systems community, the common intuition is that the subargument concluding 'the lottery is fair' should not be defeated by the whole, self-attacking argument. This paper shows two simple extension semantics that capture this intuition. The semantics, called *sustainable* and *lax* respectively, are modeled upon argumentation frameworks and constructed on the common ground of the powerful concept of admissibility introduced by P. M. Dung [1]. Sustainable semantics results to be more "credulous" than preferred semantics, since enables the acceptance of arguments that are attacked only by other arguments that in time are self-attacking. Lax semantics, on the other hand, behaves the same as sustainable semantics, in addition to the acceptance of arguments that are self-attacking only in an indirect way (viz., those involved in odd-length cycles of attack).

[1] P. M. Dung, *On the acceptability of arguments and its fundamental role in non-monotonic reasoning, logic programming, and* n-*person games*, ***Artificial Intelligence***, vol. 77 (1995), pp. 321–357.

► JULIANA BUENO-SOLER, *Possible-translations semantics for cathodic modal logics*.
Centre for Logic, Epistemology and the History of Science and Department of Philosophy, State University of Campinas, P.O. Box 6133, 13081-970 Campinas – SP, Brazil.
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I discuss the motivations and the possibilities for defining possible-translations semantics (introduced in [1] and further developed in [2]) to a class of logics that I call *cathodic modal logics*. These logics are defined as extensions of positive modal logics, the *anodic modal logics*, by means of consistency operators. The construction is based on the modal systems introduced in [4] and treated in full generality in [3]. In this way, cathodic modal logics are logics of formal inconsistency (LFIs, treated in [2]) enriched with modal operators. The strategy consists in adding to the clauses of translations t in the possible-translations semantics for the LFIs mbC, Ci and bC the new clause $t(\Box\alpha) = \Box t(\alpha)$. These systems constitute, then, the first examples of modal systems endowed with possible-translations semantics. The motivations for studying cathodic modal logics stem from the fact that these systems are able to provide alternatives for coping with some deontic and epistemic paradoxes, at least the ones engendered by combination of the classical negation with modal operators.

[1] W. A. Carnielli, *Possible-translations semantics for paraconsistent logics*, ***Frontiers of Paraconsistent Logic: Proceedings of the I World Congress on Paraconsistency***, (D. Batens, et al.), Baldock: Research Studies Press, King's College Publications, 2000, pp. 149–163.

[2] W. A. Carnielli, M. E. Coniglio and J. Marcos, *Logics of Formal Inconsistency*, ***Handbook of philosophical logic***, (D. Gabbay and F. Guenthner, editors), vol. 14, Springer-Verlag, 2007, pp. 1–93.

[3] W. A. Carnielli and C. Pizzi, ***Modalities and multimodalities***, Springer, 2008.

[4] E. J. Lemmon and D. Scott, ***An introduction to modal logic***, (K. Segerberg, editor), Blackwell, 1977.

► LEONARDO M. CABRER AND SERGIO A. CELANI, *Kripke Semantic for monoidal t-norm based logics $\mathcal{MTL}$ and $\mathcal{IMTL}$*.
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Monoidal t-norm based logic ($\mathcal{MTL}$) was introduced and studied by F. Esteva and L. Godo as the logic of left-continuous t-norms, being a natural generalization of *basic logic* defined by Hájek. They proved that the deductive system $\mathcal{MTL}$ is algebraizable and that its algebraic equivalent semantics is the variety of **MTL**-algebras (MTL), that is the distributive residuated lattices that satisfy the prelinearity condition. Each **MTL**-algebra has a $\wedge$-semilattice reduct, this allows us to use the variety MTL to define a finitary selfextensional deductive system $\mathcal{S}(\mathsf{MTL})$ following the techniques developed by Jansana in [2]. In this work we are going to present a Kripke style semantic for the logic $\mathcal{MTL}$. This semantic is based in posets with a ternary relation and it is closely related to the duality presented for **MTL** -algebras in [1]. We define two notions of validity over these structures: one called local and the other called global, analogously to the Kripke semantics for modal logic. We are going to prove that the global deduction is sound and correct with respect to the logic $\mathcal{MTL}$ and the local deduction is sound and correct with $\mathcal{S}(\mathsf{MTL})$. After that we study how to restrict this semantic to the logic $\mathcal{IMTL}$ associated with involutive **MTL**-algebras.

[1] L. M. Cabrer and S. A. Celani, *Priestley Dualities for Lattice-Ordered Algebraic Structures, including MTL, IMTL and MV-algebras*, ***Central European Journal of Mathematics***, vol. 4 (2006), no. 4, pp. 600–623.

[2] R. Jansana, *Selfextensional logics with a conjuntion*, ***Studia Logica***, vol. 84 (2006), pp. 63–104.

► M. CANALS FRAU, *The subdirectly irreducible modal n-valued Heyting algebras*.
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The Heyting symmetric algebras of n-order with $(n-1)$ unary operators $\sigma_1, \dots, \sigma_{n-1}$ were introduced by L. Iturrioz in 1997. These modal operators agree with the operators of possibility considered by Moisil in the definition of n-valued Łukasiewicz–Moisil algebras with negation. On the other hand, the modal n-valued Heyting algebras were introduced and studied in collaboration with A. V. Figallo. These algebras present as reducts the n-valued Hilbert algebras and the modal implicative semilattices (see [1] and [2]). In the present work, two descriptions of subdirectly irreducible modal n-valued Heyting algebras with the Moisil possibility operators are given. In one of them algebraic techniques were used, whereas a topological duality, previously determined for the variety, was employed to obtain the other.

[1] M. CANALS FRAU AND A. V. FIGALLO, $(n+1)$ *valued Hilbert modal algebras*, ***Notas de la Sociedad Matematica de Chile***, vol. X, no. 1, Santiago de Chile (1991), pp. 143–149.

[2] M. CANALS FRAU AND A. V. FIGALLO, $(n+1)$-*valued modal implicative Semilattices*, ***Proceedings of the twenty second International Symposium on Multiple Valued Logic***, Sendai, (1992), pp. 190–196.

► FRANQUI CÁRDENAS, *A model of a simplified* $(\kappa, 1)$*-morass falling the GCH at* κ *for* κ *unfoldable cardinal*.
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We give a model of a $(\kappa, 1)$ morass and falling *GCH* at κ using a strongly unfoldable cardinal. If κ is strongly unfoldable cardinal then by [2], κ in a forcing extension is still strongly unfoldable cardinal and it is indestructible by forcing $< \kappa$-closed and κ-proper forcing. The forcing which adds a $(\kappa, 1)$-morass satisfies both conditions. Then using [1] since we can add κ^{++} sets to κ without destroying neither the κ unfoldability nor the $(\kappa, 1)$ morass we have in this forcing extension an unfoldable cardinal (but not a strongly unfoldable cardinal, see [1]) such that $2^\kappa = \kappa^{++}$.

[1] J. HAMKINS, *Unfoldable cardinals and the GCH*, ***The Journal of Symbolic Logic***, vol. 66 (2001), no. 3, pp. 1186–1198.

[2] T. JOHNSTONE, *Indestructibility of strongly unfoldable cardinals*, ***The Bulletin of Symbolic Logic***, vol. 12 (2006), no. 3, pp. 509.

► WALTER CARNIELLI AND MARCELO FINGER, *Minimal axiomatizations and algebraic rings: a conjectured relationship*.
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A relationship between known minimal axiomatizations for classical propositional logic and the expressivity of boolean connectives in boolean rings is presented. We conjecture that the minimal size of terms using a given set of connectives expressing the connectives of the boolean ring provide a lower bound for the size of minimal axiomatizations using only that set of connectives, and discuss the basis on which such conjecture may be proven.

► PIETRO CAROLINO AND WALTER CARNIELLI, *Counterexample to a conjecture of Erdős*.
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Paul Erdős, in his well-known five-page paper [1], refines some bounds for the following problem, posed in [2]. Given n complex numbers $z_1, \dots, z_n$, each of length at least 1, consider the 2^n signed sums $\sum_{i=1}^n \varepsilon_i z_i$, where each ε_i is either 1 or -1. How many of these sums can fall within the same circle of radius 1? The main theorem of the paper asserts an upper bound on that number, that is, a limit to how closely "packed" the sums can be. It is also conjectured that this upper bound holds for vectors in a general Hilbert space. The paper ends with a converse conjecture, which asserts that a minimal amount of packing always holds: if $z_1, \ldots, z_n$ are vectors in a Hilbert space, all of length exactly 1, then at least $c2^n/n$ of the sums lie within a circle of unit radius centered at the origin, for some absolute constant c. We present a family of strong counterexamples to this conjecture. Further, we obtain tight bounds for a natural weakening of the conjecture, where sums are only required to be close to each other, instead of to the origin.

[1] P. Erdős, *On a lemma of Littlewood and Offord*, ***Bulletin of the American Mathematical Society***, vol. 51 (1945), pp. 898–902.

[2] J. Littlewood and A. Offord, *On the number of real roots of a random algebraic equation, III*, ***Rossiĭskaya Akademiya Nauk. Matematicheskiĭ Sbornik***, vol. 12 (1943), pp. 277–286.

► ALEJANDRO CASSINI, *Aristotelian syllogistic and axiomatic method.*
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Aristotle's theory of demonstrative science contains many fundamental elements of the axiomatic method. In spite of the deficiencies and shortcomings of his model, we can easily recognize that Aristotle is pioneering the ideal of finitely axiomatizable theories. Surprisingly, Aristotle never makes use of his normative model of science in his own scientific writings, where we cannot find a single example of axiomatic proof, let alone a whole axiomatic system. Many scholars have noticed this fact, which has come to be a standard problem for modern interpreters. This vexed problem is not solvable by means of direct textual references from the Aristotelian corpus, as there is no textual evidence on this subject. We do not even know whether Aristotle attempted to build an axiomatic theory in the first place. Hence, some kind of interpretive conjecture is necessary. My own conjecture is that Aristotle must have realized that the task was near impossible. The problem lies in the syllogistic consequence, defined between sets of propositions as an irreflexive, asymmetric and non-transitive relation. Thus, if syllogistic (restricted to syllogisms in Barbara) is employed as the only underlying logic of an axiomatic system, the resulting theory is always a non-ordered finite set of propositions, in which the number of theorems is a function of the number of axioms. This fact is in sharp contrast with modern axiomatic theories, which are infinite, partially ordered sets of propositions. On the other hand, Aristotelian axiomatic systems turn out to be incompatible with the fundamental ideal, endorsed by Aristotle himself, of proving a large number of theorems by means of a reduced number of principles. In conclusion, there are strong logical reasons to think that AristotleŠs axiomatic model of science is unattainable.

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The term *proof theory* was introduced by Hilbert to identify the study about formal proofs. Research in this area aims, among other things, to investigate structural characteristics of the formal proofs and prove the consistency of mathematics using only finitistic methods. Within a proof-theoretical perspective, Prawitz defined a Theory of Meaning for logical operators, and proposed a schematic introduction rule and a schematic elimination rule that characterized propositional connectives. Schröeder-Heister extended Prawitz's definitions and formalized the use of rules as hypotheses, making possible the use of inference rules for assumptions apart from the ones for logical operators. We are not interested in the investigation of schematic rules to give meaning to logical operators. We intended, actually, to define generic normalization procedures, based on such schematic rules, with the purpose of identifying sufficient conditions for a system to be normalizable. Such results are relevant to the Abstract Proof Theory, term used in [1] to identify the study of the abstract and general conditions for the proof-theoretical analysis of formal systems. Within this scope, this work proposed schematic rules that also make it possible to define modal operators still not properly treated by any of the systems mentioned above. In particular, we defined schematic rules that make it possible to instantiate rules for S4 modal operators, and we proved an abstract normalization theorem for the system induced by these rules.

[1] L. C. Pereira and A. T. Martins, *Abstract proof theory*, ***Handbook of the first World Congress and School on Universal Logic***, (Montreux), (J.-Y. Béziau and A. Costa-Leite, editors), vol. 1, University of Neuchâtel, 2005, pp. 21–22.

► MARCOS A. DA SILVA FILHO, *On the metaphysical roots of logic in Wittgenstein's Tractatus*.
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The current positivist interpretation to Wittgenstein's first book is well-known and well-accepted. This is paradigmatically represented by the Vienna Circle philosophers. However, this positivist account overviews the strong realistic and metaphysical roots presented in the philosophy of logic of Wittgenstein's *Tractatus Logico-philosophicus*. In opposition to the positivist point of view, this tractatian realism in logic is different from Frege's and Russell's realist account for logic. However, it still is a realist account. The main objective of this paper is to ground the statement that the tractatian philosophy of logic is metaphysical and, even more, it is realist. As a result, it gives also a contribution to the current debate on wittgensteinian philosophy by showing that the status of logic in *Tractatus* is different from the traditional metaphysical realism represented by Frege and Russell.

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In this paper we examine what Berry's paradox shows us about some arithmetical limitative results. Given a sufficiently strong arithmetic, using Berry's paradox we show that the relation of arithmetical definability is not itself definable, deriving from this Tarski's theorem on the undefinability of truth as a simple corollary. Moreover, due to Gödel's numbering, we know that the relation of arithmetical representability is definable, but applying once again Berry's paradox we obtain Gödel's first incompleteness theorem. Analyzing this kind of proofs, we try to explain why Berry's paradox, according to Boolos' words [1], provides "a *different sort of reason* for the incompleteness of algorithms". We conclude that this kind of proof does not use diagonalization and, further, it involves a kind of inspection on the number of symbols, as already mentioned by Gödel [2] in his original proof.

[1] G. Boolos, *new proof of the Gödel incompleteness theorem*, ***Notices of the American Mathematical Society***, vol. 36 (1989), pp. 388–390.

[2] K. Gödel, *Über formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme*, ***Monatshefte für Mathematik und Physik***, vol. 38 (1931), pp. 173–198.

► MILTON A. DE CASTRO AND ITALA M. LOFFREDO D'OTTAVIANO, *Analytical tableaux for da Costa's paraconsistent logics*.
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In this paper, based on [1], we introduce a hierarchy of syntactical tableaux systems $TNDC_n^*$, $1 \leq n < w$, for da Costa's hierarchy of quantificational paraconsistent logics Cn^*,

$1 \leq n < w$. In this formulation, as in [1], we introduce da Costa's 'ball' operator '$\circ$', the generalized operators 'k', '(k)' and the negations '$\sim_k$', for $k \geq 1$, as primitive operators. In this generalization it is necessary to deal with specific problems, concerning relationships between the mentioned generalized distinct operators; and relationships between the different systems of the hierarchy $TNDC_n^*$. Another peculiarity of $TNDC_n^*$ is that we define two conditions for the closure of the branches. We prove a generalized version of Cut Rule for $TNDC_n^*$ and also prove that these systems are logically equivalent to the corresponding da Costa's calculi. Our systems $TNDC_n^*$ are introduced from a denumerable (infinite) set of primitive operators; this allows us to capture Cn^* as paraconsistent extensions of classical logic. As far as we know, besides being introduced by considering da Costa's families of operators as primitive operators, this is the first paper in the literature in which every one of the systems Cn^*, $1 \leq n < w$, received a tableaux approach.

[1] I. M. L. D'Ottaviano and M. A. de Castro, *Analytical tableaux for da Costa's hierarchy of paraconsistent logics C_n*, ***Journal of Applied Non-Classical Logics***, vol. 15 (2005), no. 1, pp. 69–103.

► RENATA DE FREITAS, PAULO VELOSO, SHEILA VELOSO AND PETRUCIO VIANA, *Positive fork graph calculus*.
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We introduce and illustrate a graph calculus for deciding the positive identities and inclusions of fork algebras, i.e., those having no occurrences of complementation. Fork algebras provide a wide-spectrum formalism for program specification, verification and derivation. One of the most important characteristics of the fork algebraic apparatus is that it provides algebraic proofs of interesting program properties. Indeed, fork algebras are provided with an algebraic language where properties of program (schemata) can be expressed as equations and inferred from other equationally specified properties merely by replacing equals by equals. Although some identities are easily established, as expected, the equational theory of fork algebras is rather complex. Indeed, some non-algebraic mechanisms have been put forward to cope with the problem of establishing identities involving relations. We extend the work in [1] introducing a graph calculus for proving and deciding the positive identities and inclusions of fork algebras. In this calculus, formulas are graphs and the rules derive graphs from graphs. This calculus is sound, complete and decidable for graph inclusions, and can be directly applied to the positive fork algebraic inclusions and identities. Positive fork terms correspond to graphs and the graphical apparatus can be used to decide the equalities and identities in a playful manner.

[1] R. P. de Freitas, P. A. S. Veloso, S. R. M. Veloso, and P. Viana, *On positive relational calculi*, ***Logic Journal of the IGPL***, vol. 15 (2007), pp. 577–601.

► LAFAYETTE DE MORAES AND CARLOS TEIXEIRA, *A formalization of the self-reference and construction of the Liar's Paradox*.
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This paper aims to show that a formalization of the language, although is a solution more common to avoid problems as the linguistic self-reference, doesn't itself guarantee of control these circumstance. Here we will build a formal language of rigid rules which became self-referenced and want be used to build the Liar's Paradox.

► DAVI ROMERO DE VASCONCELOS AND EDWARD HERMANN HAEUSLER, *Quantifying in extensive games*.
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Recently, there have been a lot of approaches that uses a modal logic to model and reason about games. It seems natural to study quantification whenever games are modeled by means of the modal approach. In this work, we use a first-order modal logic, namely Game Analysis Logic (GAL) [1], in order to study the alternatives of quantification for the most used solution concepts, namely Nash equilibrium (NE) and subgame perfect equilibrium (SPE), for extensive games. We also characterize these concepts by means of the structure of an extensive game according to the different ways of quantification. Despite the fact that quantifying in a modal context might be troublesome, we show that for NE and SPE the alternatives are equivalent each other. For SPE, the equivalence is given by the equivalence for $[AG]$. On the other hand, the formulas for NE are not equivalent under both interpretation for quantification for $[EG]$; however, the equivalence for NE is true, since the quantification is taken by a specific path (the equilibrium's path). As a future work, we intend to characterize the solution concept of iterated elimination of weakly dominated strategies (forward induction) by means of the structure of an extensive game, and, in addition, study the alternatives of quantification.

[1] D. R. Vasconcelos, ***Lógica Modal de Primeira-ordem para Raciocinar sobre Jogos*** Ph.D. thesis, PUC-Rio, April 2007 (in Portuguese).

► RODOLFO ERTOLA, *On some operations in Heyting algebras*.
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In what follows we assume to be dealing with a Heyting algebra. Let $\eta(x) = min\{y\colon$ there is a z such that $y = (x \to z) \vee (z \to x)\}$. It is easy to see that η is compatible in the sense e.g., of [1], i.e., that $x \leftrightarrow y \leq \eta(x) \leftrightarrow \eta(y)$. As in the case of the constant $\delta = min\{y\colon$ there is a z such that $y = \neg z \vee \neg\neg z\}$ considered in [1, Ex. 3.3], we have that η may not be given by equations. The result on compatibility may be straightforwardly generalized writing $f(x, z)$ instead of $(x \to z) \vee (z \to x)$, where $f(x, z)$ satisfies the following condition which we call "compatibility in the first variable", i.e., $x \leftrightarrow y \leq f(x, z) \leftrightarrow f(y, z)$. That is, we have that if $g(x) = min\{y\colon$ there is a z such that $y = f(x, z)\}$, then if $f(x, z)$ is compatible in the first variable, then g is compatible. If instead of using the existential quantifier we consider the scheme $h(x) = min\{y : y = f(x, y)\}$, we may see that if $f(x, f(x, y)) = f(x, y)$ and $f(x, y)$ is compatible in the first variable, then h in compatible. In both mentioned schemes we have that if $f(x, f(x, y)) = f(x, y)$, then the resulting function is given by equations. An example of a non-compatible operation is the minimum x-dense defined as $min\{y : y \to x \leq x\}$. This operator, called "the strongest anticipator" in [2], is easily seen not to be compatible in H_3.

[1] X. Caicedo and R. Cignoli, *An algebraic approach to intuitionistic connectives*, ***The Journal of Symbolic Logic***, vol. 66, no. 4, pp. 1620–1636.
[2] L. Humberstone, *The pleasures of anticipation: enriching intuitionistic logic*, ***Journal of Philosophical Logic***, vol. 30, pp. 395–438.

► LUIS ESTRADA-GONZÁLEZ, *What is logic about? The geometric analogy*.
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Logic and geometry are analogous in at least two ways. There is an *epistemological* analogy on that pluralism is available for both logic and geometry: since in geometry one can drop certain axioms in order to obtain different geometries, so in logic. Intimately related to the former is that both geometry and logic have had a similar *historical development*. First there was just one geometry and just one logic; their theorems were regarded as necessary truths about certain province of reality, physical space in the case of geometry and norms that rules valid reasoning in the case of logic. Nonetheless, how far the analogy should be taken is an issue hardly ever discussed. One of the most detailed assessments of the analogy is in [2], which is at the same time one of the most severe critiques to the idea of regarding the analogy as a deep one. According to Rescher epistemological and developmental similarities are not enough for claiming an analogy in more important respects, namely their respective treatments of rivalry, the question about their very nature or the characterization of their subject matter. Priest [1] has argued for the legitimacy of the analogy, trying to reject some of Rescher's criticisms, but in a wrong way I think. In particular, I will show that Rescher's denial of the analogy and his rejection of the idea of a pure logic are grounded on some historical fallacies concerning the development of geometry and on an uncritically assumption about the nature of logic as an essentially applied theory.

[1] G. Priest, *On alternative geometries, arithmetics, and logics: A tribute to Łukasiewicz*, ***Studia Logica***, vol. 74 (2003), pp. 441–468.

[2] N. Rescher, ***Many-valued Logic***, McGraw-Hill, 1969.

► FRANCICLEBER FERREIRA AND ANA TERESA MARTINS, *Expressiveness and definability in circumscription*.
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We investigated expressiveness and definability issues regarding minimal models, specially in the context of *circumscription* [1]. Given a symbol set S, a predicate symbol P in S and a sequence of predicate symbols $\overline{Z}$ in S, we define the relation $\leq^{P;\overline{Z}}$ between S-structures in the usual way as $\mathfrak{A} \leq^{P;\overline{Z}} \mathfrak{B}$ iff $\mathfrak{A}$ and $\mathfrak{B}$ give the same interpretation to the symbols in $S - \{P, \overline{Z}\}$, but $P^{\mathfrak{A}} \subseteq P^{\mathfrak{B}}$. The $P;\overline{Z}$-minimal models of a theory T are those models of T which are minimal with respect to $\leq^{P;\overline{Z}}$. The models of the circumscribed theory $Circ[T, P, \overline{Z}]$ are exactly the $P;\overline{Z}$-minimal models of T. We proved that, if the class of $P;\overline{Z}$-minimal models of a first-order sentence is Δ-elementary, then it is elementary. This result shows that the class of minimal models of a first-order sentence is either elementary or it is not Δ-elementary. As a consequence, we established the following definability property regarding minimal models and circumscription. Let T be a finite first-order theory and suppose that a circumscribed theory $Circ[T, P, \overline{Z}]$ implicitly defines, in the sense of Beth and Padoa, the circumscribed predicate. We proved that, if the class of $P;\overline{Z}$-minimal models of T is Δ-elementary, then there is an explicit definition $\forall\overline{x}(P(\overline{x}) \leftrightarrow \psi(\overline{x}))$ for P such that the class of $P;\overline{Z}$-minimal models of ϕ is the class of models of $\phi \wedge \forall\overline{x}(P(\overline{x}) \leftrightarrow \psi(\overline{x}))$. Hence, the circumscribed theory $Circ[T, P, \overline{Z}]$ is equivalent to $\phi \wedge \forall\overline{x}(P(\overline{x}) \leftrightarrow \psi(\overline{x}))$.

[1] J. McCarthy, *Applications of circumscription to formalizing common-sense knowledge*, ***Artificial Intelligence***, vol. 28 (1986), no. 1, pp. 89–116.

► ALDO FIGALLO, JR., *Free algebras over a poset in varieties finitely generated*.
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In 1945, Dilworth introduced the notion of free lattice over a poset. Later on, several constructions of free algebras over a poset in different classes of algebras were considered. In this note, the study of the one presented in [1] is continued. It is shown that this construction can be generalized to a variety generated by a finite number of algebras which can be finite or not. It is also proved that if the variety V is generated by an equationally ordered algebra such that the order is an antichain, then the free algebra $F(I)$ over a poset I exists if and only if I is an antichain. Finally, this construction was successfully applied to different varieties of algebras which arise from the logic.

[1] A. FIGALLO, JR., *Free algebras over a poset*, ***Algebraic and topological methods in non-classical logics II*** (Barcelona), 2005.

► ALDO V. FIGALLO, INÉS PASCUAL AND ALICIA ZILIANI, *Monadic distributive lattices and monadic augmented Kripke frames*.

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Monadic distributive lattices (or m-lattices) were defined in [2]. These algebras constitute a natural generalization of monadic Heyting algebras introduced by Monteiro and Varsavsky and developed exhaustively by Bezhanishvili [1]. In this article, the study of m-lattices is continued. A new duality for these algebras is described from the one obtained by Cignoli for $Q-$distributive lattices. As a consequence, subdirectly irreducible algebras in this variety are determined in a simple way and the finite ones are characterized. Besides, the category $\boldsymbol{mKF}$ whose objects are monadic augmented Kripke frames and whose morphisms are increasing continuous functions verifying certain additional conditions is introduced and it is proved that it is equivalent to the one obtained above. Finally, it is shown that the category of perfect augmented Kripke frames given in [1] is a proper subcategory of $\boldsymbol{mKF}$.

[1] G. BEZHANISHVILI, *Varieties of monadic Heyting algebras. Part II: Duality theory*, ***Studia Logica***, vol. 62 (1998), no. 1, pp. 1–28.

[2] A. V. FIGALLO AND A. ZILIANI, *A note on monadic distributive lattices*, ***Preprints del Instituto de Ciencias Básicas, Universidad Nacional de San Juan, Argentina***, vol. 2 (1997), no. 1, pp. 19–35.

► ALDO V. FIGALLO, INÉS PASCUAL AND ALICIA ZILIANI, *$\theta-$valued Łukasiewicz–Moisil algebras with and without negation*.

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Philosophical problems arising from the idea that there are statements which are neither true nor false, led to the formulation of many-valued logics by Łukasiewicz. Since then, plenty of research has been developed in this area. In 1968, Moisil found an example which gave him the motivation he had been looking for in order to legitimate the introduction and study of infinitely-valued Łukasiewicz algebras, so he defined $\theta-$valued Łukasiewicz algebras, where θ is the order type of a chain. In this article, we determine a topological duality for $\theta-$valued Łukasiewicz–Moisil algebras (or $\mathrm{LM}_\theta-$algebras) equivalent to the one given by Filipoiu in [2]. Not only does the duality enable us to obtain a description of the $\mathrm{LM}_\theta-$congruences on an $\mathrm{LM}_\theta-$algebra, but also to characterize the subdirectly irreducible

$\mathrm{LM}_\theta-$algebras. Furthermore, we extend the above study to the case of $\mathrm{LM}_\theta-$algebras with negation arriving through a different method at the results indicated in [1].

[1] C. Boicescu, A. Filipoiu, G. Georgescu and S. Rudeanu, ***Łukasiewicz–Moisil algebras***, Annals of Discrete Mathematics 49, North Holland, 1991.

[2] A. Filipoiu, *Representation of Łukasiewicz algebras by means of ordered Stone spaces*, ***Discrete Mathematics***, vol. 30 (1980), pp. 111–116.

[3] Gr. C. Moisil, ***Essais sur les logiques non-chrysippiennes***, Editura Academiei, Bucureşti 1972.

► ALDO V. FIGALLO AND CLAUDIA SANZA, *The $\mathcal{NS}_{n\times m}$-propositional calculus*.
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In 2000, $n \times m$-valued Łukasiewicz algebras with negation (or $NS_{n\times m}$-algebras) were introduced. These algebras constitute a non-trivial generalization of n-valued Łukasiewicz–Moisil algebras and they were investigated in different papers [1, 2]. In this article, the $\mathcal{NS}_{n\times m}$-propositional calculus, denoted by $\mathcal{S}_{n\times m}$, is introduced in terms of the binary connectives $\hookrightarrow$ (implication), $\to$ (weak implication), $\wedge$ (conjunction), $\vee$ (disjunction) and the unary ones $\sim$ (negation) and σ_{ij}, $1 \leq i \leq n-1$, $1 \leq j \leq m-1$ (generalized Moisil modal operators). It is proved that $\mathcal{S}_{n\times m}$ belongs to the class of standard systems of implicative extensional propositional calculi as defined by Rasiowa. Besides, it is shown that the definitions of $NS_{n\times m}$-algebra and $\mathcal{S}_{n\times m}$-algebra are equivalent. Finally, the completeness theorem for $\mathcal{S}_{n\times m}$ is obtained.

[1] C. Sanza, *Notes on $n \times m-$valued Łukasiewicz algebras with negation*, ***Logic Journal of the IGPL***, vol. 6 (2004), no. 12, pp. 499–507.

[2] C. Sanza, *On $n \times m-$valued Łukasiewicz–Moisil algebras*, ***Central European Journal of Mathematics***, vol. 6 (2008), no. 12, pp. 372–383.

► MARTÍN FIGALLO AND CLAUDIA M. GOMES, *Subalgebras of a finite diagonal-free two-dimensional cylindric algebra*.
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Diagonal-free two-dimensional cylindric algebras ($\mathbf{Df}_2$-algebras for short) were introduced by A. Tarski, L. Chin and F. Thompson in order to provide a device for an algebraic study of the first-order predicate calculus with two variables. These algebras have been widely studied [1]. In this work, subalgebras of a finite $\mathbf{Df}_2$-algebra are considered. In particular, a description of the lattice of all subalgebras of a finite $\mathbf{Df}_2$-algebra is given.

[1] M. Figallo, *Finite diagonal-free two-dimensional cylindric algebras*, ***Logic Journal of the IGPL***, vol. 12 (2004), no. 6, pp. 509–523.

► MARÍA GABRIELA FULUGONIO, *Benno Kerry: an early critic of the logicism of Gottlob Frege*.
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Between 1885 and 1890 the young Austrian philosopher Benno Kerry (1858–1889) published a series of eight articles entitled *Über Anschauung und ihre psychische Verarbeitung*.

Kerry's articles were certainly well known to Frege, who in his famous 1892 article *Über Begriff und Gegenstand* indicates his motivation therein by Kerry's criticism of his notion of concept. Kerry's criticism, however, goes far beyond Frege's technical notion of concept; in particular, he criticised Frege's logicist definition of "following in a series" (*Begriffsschrift*, part III) as being circular. Frege took no account of this criticism; 15 years later, however, Russell did so, with considerable consequences. I divide my contribution into two main parts. Firstly, I present Frege's philosophical motivations for giving a logicist account of the induction principle, an account that relies on the "following in a series" definition. I accompany this introductory part with a conceptual analysis of this crucial definition. I then focus on Kerry's criticism thereof; I aim to show that such criticism is an antecedent of what is now known as the "impredicativity problem", being in particular an antecedent of Russell's *Vicious Circle Principle*, which appeared for the first time in 1908.

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What to do with Kant's philosophy of geometry in the aftermath of the discovery of Non-Euclidean geometries? This paper aims at suggesting that a revision of Kant's account of imagination and of the activity of schematism in mathematical reasoning might make possible to approach non-Euclidean geometries within his system. My main claim is to suggest that Non-Euclidean geometries could indeed have been thinkable to Kant, in effect, if he gave imagination at large more procedural latitude, while keeping separate metaphysical and epistemological considerations on the nature of space and of mathematical objects. To re-interpret the philosophical uses of transcendental idealism doctrine is key to this project, as well as to appreciate both the wealth and the shortcomings of Kant's understanding of arithmetical concepts regarding the category of quantity.

► EVANDRO LUÍS GOMES AND ITALA M. LOFFREDO D'OTTAVIANO, *Aristotle's theory of syllogism and paraconsistency*.
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Two passages of the Organon are interesting to appreciate the Aristotelian treatment of contradiction in his deductive theory. In the *Analytica Priora* (B15) Aristotle explains in which figures it is possible to deduce from opposite premises and, in the *Analytica Posteriora* (A11) he shows that the Principle of Non-Contradiction does not need to be presupposed in all demonstrations, but only in those that intend to prove their results from it. Bocheński in his masterpiece quotes in his discussion about this Principle in Aristotle. Concerning paraconsistency in Aristotelian syllogistic, the most ancient indication is proposed by da Costa and Bueno, but not from a historical point of view. According to Aristotle, the following syllogisms are valid from opposite premises, where small Latin letters stand for terms such as subject and predicate and, capital Latin letters stand for the categorical propositions such as in the traditional notation: (*i*) in the second figure: $Eab, Aab \vdash Ebb$ (Cesare), $Aab, Eab \vdash Ebb$ (Camestres), $Eab, Iab \vdash Obb$ (Festino), and $Aab, Oab \vdash Obb$ (Barroco); (*ii*) in the third one: $Eac, Aac \vdash Oaa$ (Felapton), $Oac, Aac \vdash Oaa$ (Borcardo) and, $Eac, Iac \vdash Oaa$ (Ferison). In the *Analytica Posteriora* (A11) the Stageiran concludes: if a syllogism of the first figure has the major term consistent, the other terms of demonstration can be each one separately inconsistent. From this we propose an interpretation of his theory of syllogism as a broad sense paraconsistent theory. We try to translate these results into da Costa's paraconsistent logics.

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We analyze familiar da Costa and Doria's "exotic formalization" of the conjecture $\mathsf{P} = \mathsf{NP}$. For any formal system $\mathsf{S} \supseteq \mathsf{PA}$ and arithmetical sentence φ, we let $\varphi^\star = \varphi \vee \neg \mathsf{Con}(\mathsf{S})$ and prove three "exotic" inferences: (1) $\mathsf{S} + \varphi^\star$ is consistent, if so is S; (2) $\mathsf{S} + \varphi$ is consistent, provided that $\mathsf{S} + \varphi^\star$ is ω-consistent; (3) $\mathsf{S} + \varphi^\star$ is ω-inconsistent, provided that S proves $\neg\varphi$. We show that 1–3 continue to hold for $\varphi^\star := \varphi \vee \neg G$, where $G = \forall x R(x)$ is any Π^0_1 sentence satisfying: (4) $(\forall n \in \mathbb{N})(\mathsf{S} \vdash R(\underline{n}))$ and (5) $\mathsf{S} \nvdash \forall x R(x)$. We observe that if $\varphi := [\mathsf{P} = \mathsf{NP}]$ and $G := [F \text{ is total}]$ for *da Costa-Doria* "exotic" function F w.r.t. S, then 4, 5 are satisfied for most familiar (presumably) consistent S in question, while $\varphi^\star$ becomes equivalent to *da Costa-Doria* "exotic formalization" $[\mathsf{P} = \mathsf{NP}]^F$. Moreover, the corresponding particular "exotic" inferences 1, 2 coincide with analogous *da Costa-Doria* results. Consequently, these "exotic" inferences are universal for all arithmetical sentences, and hence not characteristic to the conjecture $\mathsf{P} = \mathsf{NP}$. Furthermore, assumption that $\mathsf{P} < \mathsf{NP}$ is provable in S implies by 3 that $\mathsf{S} + [\mathsf{P} = \mathsf{NP}]^F$ is ω-inconsistent, which makes 1, 2 irrelevant to the consistency of $\mathsf{S} + [\mathsf{P} = \mathsf{NP}]$. Summing up, *da Costa-Doria* "exotic formalization" alone is unlikely to decide upon validity, or relative consistency, of the conjecture $\mathsf{P} = \mathsf{NP}$.

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We intend to make explicit the notion of finiteness in Hilbert's Metamathematics by studying it in more details. Dealing with the notion of finiteness in a non-technical way may just keep us inside a dense fog. Therefore, we chose to use Turing machine conceptions to manage it. In general, finitary arguments are mixed with the capacity of computers to manipulate finite numbers. Nevertheless, we are also capable of finitely dealing with computational properties. Paying attention to the notion of finiteness, we observe that Metamathematics cannot be internalised into any formal system. This non-internalisation directly represents a Mathematical foundational restriction and, actually, a great problem for Hilbert program. In particular, this fact shows us that it is impossible for formal systems to faithfully manipulate computational notions. This non-internalisation also shows us that Gödel's second Incompleteness theorem would no longer be an endpoint to Hilbert program, in contradiction to what commonly appears in the literature. It is plausible that one might be able to prove the consistency of usual formal systems inside Metamathematics. This result would suggest that Metamathematics may operate formal systems in a more powerful definition than the usual first-order (Σ_1-)axiomatizable theories. It must be done with the goal of making it able to internalise Metamathematics—thus, also, Computational complexity notions, like the $\mathcal{P} \stackrel{?}{=} \mathcal{NP}$ problem—inside a formal system in this new type of definition.

► BRUNO JACINTO, *On the rivalry between logics*.
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The rivalry between logics is one of the concepts that allow us to think the relation between logics. Some logics appear to be rival in that something between them appears to collide, and other logics, although also different, appear not to collide. Haack, in *Deviant Logic, Fuzzy Logic* proposes an analysis of what it means for two logics to collide (in which case the logics are called 'rival logics'). It is our purpose with this paper: (1) to show the flaws on Haack's analysis of the concept; (2) to propose a new conception of rivalry—semantic rivalry; (3) to exhibit different senses on which two logics are rival; (4) to show the relevance of the notion of rivalry between logics on what concerns the option for one or another logical system.

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There are two basic types of program errors: so-called "machine" errors, signalled by the computer itself (e.g., a syntax error), and infinite computations, representing infinite loops generated by the program. The difference between them is quite fundamental: machine errors can be seen as "finite", and by being signalled give us a chance of implementing some corrective action once we know they have occurred, while infinite computations are not recognizable by their very nature. Indeed, no matter how long the computation continues, in general we cannot tell whether it will continue forever or whether it will finally terminate. On a more abstract level, we know that the stop problem for programs is undecidable. The paper proposes a four-valued logic which can be employed in program specification and validation to support reasoning about the above two kinds of computation errors. Its semantics is based on a non-deterministic matrix and combines Kleene calculus for handling finite errors and McCarthy calculus for handling infinite computations. A sound and complete, decompositional proof system in Rasiowa–Sikorski style is developed for the logic using signed formulas, to be later transformed into an equivalent Gentzen-style sequent calculus.

► DÉCIO KRAUSE AND HÉRCULES DE ARAUJO FEITOSA, *Algebraic aspects of quantum indiscernibility*.
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Indiscernibility is a typical concept of quantum physics. It enters in the standard quantum formalism by symmetry postulates. In our program, the mathematical basis for quantum theory takes indiscernibility "right from the start". All considerations are performed within the quasi-set theory $\mathfrak{Q}$, where our algebraic discussion of indiscernibility is developed. In $\mathfrak{Q}$, expressions like $x = y$ are in general not well formed; however $\mathfrak{Q}$ extends standard mathematics. Two kinds of ur-elements are supposed, the M-atoms and the m-atoms, and to the later the standard theory of identity does not apply. So, expressions like $x = y$ are not well formed for m-atoms. A primitive relation $\equiv$ of indistinguishability has the properties of an equivalence relation, and a defined concept of *extensional identity* $(=)$ do not hold for m-atoms. In general, $x \equiv y \not\Rightarrow x = y$. Quasi-sets formed with m-atoms are written using] and [. Being U a non empty q-set and A a subq-set of U, the *cloud* of A is the q-set: $\overline{A} \triangleq [y \in U/\exists x(x \in A \wedge y \equiv x)]$. Then $\langle U, ^{-}\rangle$ is a topological space. If A and B are subq-sets of U, we define: $A \sqcap B \triangleq \overline{A \cap B}$; $A \sqcup B \triangleq \overline{A} \cup \overline{B}$; $A^{\perp} \triangleq U - \overline{A}$; $0 \triangleq \oslash$; $1 \triangleq U$; $A \leqslant B \triangleq A \sqcup B = \overline{B}$. Then we show that $\mathcal{Q} = \langle P(U), \sqcap, \sqcup, ^{\perp}, 0, 1, \leqslant\rangle$ is a non distributive orthomodular and orthogonal quasi-lattice. $\mathfrak{Q}$ realizes "quite naturally" some aspects attributed to quantum objects.

► MICHAŁ KRYNICKI AND KONRAD ZDANOWSKI, *End extending of infinite models for theories of finite arithmetics*.
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For a relational structure $\mathcal{A} = (\mathbb{N}, R_0, \ldots, R_k)$ having as universe the set of natural numbers, we consider a family of structures having as universe a finite initial segment of $\mathbb{N}$, $\{\mathcal{A}_n\}_{n\in\mathbb{N}}$, where each structure $\mathcal{A}_n$ is defined as $\mathcal{A}_n = (\{0, \ldots, n\}, R_0^n, \ldots, R_k^n, n)$, where, for $i \leq k$, $R_i^n = R_i \restriction \{0, \ldots, n\}$. The set of sentences *true in sufficiently large finite models of* $\mathcal{A}$ is defined as

$$sl(\mathcal{A}) = \{\varphi\colon \exists k \forall n (n \geq k \rightarrow \mathcal{A}_n \models \varphi\}.$$

FACT 1. *Let* $\mathcal{A} = (\mathbb{N}, R_1, \ldots, R_k)$. *Every* Σ_2*–sentence true in* $\mathcal{A}$ *belongs to* $sl(\mathcal{A})$.

If $\mathcal{A}$ is an ordered structure and $a \in |\mathcal{A}|$ then by $\mathcal{A}^{\leq a}$ we denote the substructure of $\mathcal{A}$ having as universe the set of all elements not greater than a. Let $\mathcal{N}$ be a standard model of arithmetic in which the standard ordering is definable by a Δ_1^0–formula.

FACT 2. *If* $\mathcal{A}$ *is a proper extension of* $\mathcal{N}$ *such that* $\mathcal{A} \models \Pi_1(\mathcal{N})$ *and* $a \in |\mathcal{A}|$ *is nonstandard* $(a > \mathbb{N})$ *then* $\mathcal{A}^{\leq a} \models sl(\mathcal{N})$.

By $\mathcal{N}_{+\times} = (\mathbb{N}, R_+, R_\times)$ we denote the standard model of arithmetic of addition and multiplication, by $\mathcal{N}_+$ we denote $(\mathbb{N}, R_+)$. Our main results show that for models $\mathcal{N}_+$ and $\mathcal{N}_{+\times}$ a converse theorem to Fact 2 holds.

THEOREM. *Let* $\mathcal{K}$ *be* $\mathcal{N}_{+\times}$ *or* $\mathcal{N}_+$. *For arbitrary* $\mathcal{A} \models sl(\mathcal{K})$ *there exists* $\mathcal{B} \models \Pi_1(\mathcal{K})$ *such that* $\mathcal{B}$ *is an end-extension of* $\mathcal{A}$ *and relations in* $\mathcal{B}$ *define graphs of total functions.*

► JAVIER LEGRIS, *On two conceptions of formality in 19th century symbolic logics*.
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This paper deals with two conceptions of formality underlying 19th Century symbolic logic. The nature of formal objects and, consequently, of formal theories was understood in various ways. As a consequence, the very formal nature of logic received different interpretations. In a paper from 1885, Frege argued for a particular conception of formal theories in Arithmetic: A theory for arithmetic is formal if every law of the theory is logically derived only from logical notions via definitions. He connected this characterization explicitly with his idea of universality: The concept of number is *universally* applicable. It can be applied to entities of every kind. Frege opposed his conception of formal theory to the idea of symbolic systems whose elements had no meaning at all. Ernst Schröder with his program of an abstract algebra had just advocated before for the latter idea of formal theory: Formal algebra could be applied to different domains, and the operations received diverse interpretations depending on the domain considered. This general *applicability* of formal algebra suggested a new idea of *universality*: Formal algebra is universal in the sense that it can be applied to every domain. The two cases of Frege and Schröder show that to different conceptions of formal theories correspond different conceptions of universality. So, Formalism and universality were strongly related notions at the end of the 19th Century.

► DANIEL LIMA-VENTURA, MAURICIO AYALA-RINCÓN AND FAIROUZ KAMAREDDINE, *Intersection type system with de Bruijn indices*.
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The λ-calculus in de Bruijn notation avoids α-conversion using indices instead of variable names. Intersection types provide finitary type polymorphism and characterise normalisable λ-terms, that is a term is normalisable if and only if it is typable. To be closer to computations and to simplify the formalisation of the atomic operations involved in β-contractions several calculi of explicit substitution were developed and most of them are written in de Bruijn notation. Versions of explicit substitutions calculi without types and with simple type systems are well investigated in contrast to versions with more elaborated type systems such as intersection types. Besides the application in real implementations, the study of a system's de Bruijn version is of interest in proof theory, since the type-contexts, usually treated as sets, are changed to sequences. As a first step, a λ-calculus in de Bruijn notation with an intersection type system is introduced in this work and it is proved that this system satisfies the subject reduction property, that is typed λ-terms preserve theirs types under β-reduction. The proof of subject reduction is done in a standard way, through a generation and substitution lemmas. For doing this, the proper definition of *free index* is given and properties corresponding to the ones in λ-calculus with names related to free variables are proved.

► EMMANUEL FELIX LOPES DA SILVA, RICARDO BIANCONI AND RUY J. G. B. DE QUEIROZ, *Polynomial space computable arithmetic*.
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We introduce a defining scheme of functions on binary strings which characterize the set of polinomial space computable functions, extending works by Fernando Ferreira. We start with basic functions $Z(x) = \emptyset$ (the empty sequence), $C(x, y) = xy$ (concatenation) $C_0(x) = x0$, $C_1(x) = x1$, $Q(x, y) = 1$ if x is an initial segment of the string y and $Q(x, y) = 0$ otherwise, $x \times y$ is the sequence x concatenated with itself the size of y times (or $x \times \emptyset = \emptyset$, $x \times (y0) = x \times (y0) = (x \times y)x$). The formation rules are composition, bounded time iteration ($f(\bar{x}, \emptyset) = g(\bar{x}, f(\bar{x}, yi) = h_i(\bar{x}, y, f(\bar{x}, y)) \restriction_{t(\bar{x})}$, $i = 0, 1$, truncation of the string $h_i(\bar{x}, y, f(\bar{x}, y))$ to the size of $t(\bar{x})$, where the function t obtained by composition of basic functions) and bounded space iteration ($f(\bar{x}, \emptyset) = g(\bar{x}, f(\bar{x}, S(y)) = h(\bar{x}, y, f(\bar{x}, y)) \restriction_{t(\bar{x})}$, where $S(\emptyset) = 0$, $S(x0) = x1$ and $S(x1) = S(x)0$ is a binary successor function). We define a first order theory with function symbols for those functions with an axiom scheme of bounded induction and show that in the theory thus obtained the provably recursive functions are exactly the polynomial space computable functions.

► JOÃO MARCOS AND DALMO MENDONÇA, *Automatic extraction of axiomatizations in terms of two-signed tableaux for finite-valued logics*.
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Many-valued logics, in contrast to the bivalent classical logic, allow for the consideration of arbitrarily large classes of truth-values. The canonical notion of entailment can be recovered by calling some of these values 'designated' and focusing on their preservation from premises to conclusion. A shade of bivalence lurks, then, in the distinction between the values that are designated and those that are not. It is known (cf. [2]) that this residual bivalence allows in fact for an alternative, and in many cases even constructively obtained (cf. [1]), representation of many-valued logics in terms of appropriate bivalent semantics. This paper presents a first implementation of the method devised in [1] in order to obtain sound and complete classic-like tableau systems for a very comprehensive class of finite-valued logics. The method is implemented in the functional programming language `ML`, and our program outputs a text file containing the corresponding theory to be processed by `Isabelle`, a flexible theorem-proving environment in which it is possible to check meta-results and theorems about the logics under scrutiny. The formulation of different many-valued logics under a common ground—two-signed tableau systems—makes it easier to compare properties of these logics and to appreciate the relations between them.

[1] C. Caleiro, W. Carnielli, M. E. Coniglio and J. Marcos, *Two's company: "The humbug of many logical values"*, ***Logica Universalis*** (J.-Y. Béziau, editor), Birkhäuser Verlag, Basel, 2005, pp. 169–189.

[2] N. C. A. da Costa, J.-Y. Béziau and O. A. S. Bueno, *Malinowski and Suszko on many-valued logics: on the reduction of many-valuedness to two-valuedness*, ***Modern Logic***, vol. 3 (1996), pp. 272–299.

► HUGO L. MARIANO, *On profinite structures*.
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We consider general first-order profinite structures, i.e., the projective limits of downward directed systems of finite discrete structures. From some results in [1], we prove that profinite structures are pure injective structures, the structures that have the extension property relatively to the class of pure embeddings. It is presented a topological characterization of the categorial notion of profinite structure, some closure properties of that class of structures and a description of its quotients objects, generalizing some results in the literature. It is described an interesting kind of elementary class of first-order (and topological) structures and a notion of "saturated" congruence and to each such pair of data we associate a functor "Profinite Hull". It is proved, by two different approaches (a categorial one and also a topological-analytical), that such functor satisfies an universal property, getting a pair of adjoint functors. We prove that the profinite hull functor preserves quotients by a saturated congruence. It is considered a "local-global principle" naturally associated to the profinite hull functor and we take first steps to obtain a categorially and logically well-behaved (canonical) construction of "spectral sheaf of structures profinite", defined over the space of saturated congruences of finite discrete index of a topological first-order structure.

[1] H. L. Mariano and F. Miraglia, *Profinite structures are retracts of ultraproducts of finite structures*, ***Reports on Mathematical Logic***, vol. 42 (2007), pp. 169–181.

► JOKE MEHEUS, *Goal-directed tableaux*.
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This paper contains a new format for analytic tableaux, called goal-directed tableaux. Their main interest lies in the fact that they are more efficient than the usual analytic tableaux (in general, they lead to less branching). They can also be used to develop an efficient tableaux-based approach to abduction. The goal-directed tableaux do not form a full decision method for propositional classical logic (because they do not sustain Ex Falso Quodlibet). For consistent sets of premises, however, they lead to the same results as the usual analytic tableaux for classical logic.

► CEZAR MORTARI, *Relational semantics for some non-normal logics: opposite logics*.
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In [2], Richard Sylvan presented relational semantics for several well-known systems modal logic, using frames having both normal and several kinds of non-normal worlds, where modalized formulas are evaluated according to different conditions. For instance, opposite worlds, where $\Box\alpha$ is true iff α is false in every accessible world. Sylvan contended that frames consisting of normal and opposite worlds would yield determination theorems for **S1** if we take the set of normal worlds to be distinguished. However, as M. J. Cresswell later proved, Sylvan's semantics characterizes a stronger system, $\mathbf{S1}^+$. In this paper, we investigate logics obtained by considering *both* normal and opposite worlds as distinguished. The smallest such "opposite" logic, which we call $\mathbf{PO}_\omega$, is a proper extension of Chellas and Segerberg's prenormal logics [1]. We also consider extensions of $\mathbf{PO}_\omega$ by means of some well-known axioms, prove determination and decidability results, and discuss their relation to **S1**, $\mathbf{S1}^+$ and some other non-normal logics.

[1] B. F. Chellas and K. Segerberg, *Modal logics in the vicinity of S1*, ***Notre Dame Journal of Formal Logic***, vol. 37 (1996), no. 1, pp. 1–25.

[2] R. Sylvan, *Relational semantics for all Lewis, Lemmon and Feys' modal logics, most notably for the systems between S0.3° and S1*, ***The Journal of Non-Classical Logic***, vol. 6 (1989), no. 2, pp. 19–40.

► CLAUDIA OLMEDO-GARCÍA, *Łukasiewicz vs. Łukasiewicz*.
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Łukasiewicz's formal proposals concerning modality and three-valuedness or four-valuedness are often assessed using contemporary alethic modal notions, which have their roots in Malebranche's and Leibniz's Works, but consolidated just with Lewis' logics and Kripke semantics. Modal notions discussed by Łukasiewicz are more akin to the old Greek Geist, where modality was intimately related to problems with time and freedom. Here we are going to defend three main theses: (1) Łukasiewicz fails in capturing his modal intuitions because his grant of expressive power to zero order logic; (2) Łukasiewicz was trying to capture notions of possibility and necessity, the indexes of evaluation of which are instants; (3) A more adequate formalization of Łukasiewicz's modal intuitions requires to take into account the temporal component.

► MARIA F. PALLARES, *Intuitionistic sequent system with multiple succedent*.
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Sequent systems were presented by Gerhard Gentzen in the thirties. The main difference between the classical and intuitionistic versions was the cardinality of the succedent: intuitionistic sequents have only one formula in the succedent. Studies on how the dependency relations between the formulas could ensure the intuitionistic character of a system, started to appear in 1990. In the system FIL (performed by De Paiva and Pereira) a new kind of sequent is presented, which has the following form: $A_1(n_1), \ldots, A_k(n_k) \Rightarrow B_1/S_1, \ldots, B_m/S_m$ where: (a) n_i $(1 \le i \le k)$ is a natural number which is the *index* of the formula A_i and (b) S_j $(1 \le j \le m)$ is the set of indexes which the formula B_j depends on. Here, the multiple succedent does not take the system to the classical logic and the intuitionistic character is concentrated in the restrictions of the conditional rule. From $\Gamma, A(n) \Rightarrow \Delta, B/S$ we can infer $\Gamma \Rightarrow \Delta, (A \to B)/S^\circ$ if (i) for each S' in Δ, the index n does not belong to S' and (ii) if n ϵ S, then $S^\circ = S - \{n\}$. In the other cases, S°= S. Then, not all the hypotheses are available in order to introduce an intuitionistic conditional. We present a version for the first-order intuitionistic logic (FIL1). Knowing the dependency relations, from a premise $\Gamma \Rightarrow A(a), \Delta$ we can obtain $\Gamma \Rightarrow \forall x A(x), \Delta$ if A(a) and the formulas of Δ have no hypotheses in common. This extension is sound, complete and it satisfies cut-elimination. These kind of systems show us how the multiple succedent can stimulate many results in proof theory. They also offer a new way of understanding the particularities of the different logics. Then, we can use information of the dependency relation in a sequent in order to simplify the formulations of systems for intermediate logics.

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Usually, a deontic paradox consists of a set of sentences in natural language which are, intuitively, logically independent and jointly consistent but, when formalized in standard deontic logic (SDL), the set derives contradictory obligations and/or has logical dependencies. In [2] two deontic systems based on *Logics Formal Inconsistency* (cf. [1]) were proposed, in such a way that contradictory obligations $O(A)$ and $O(\neg A)$ do not trivialize, but allow to infer that A is *deontically inconsistent*, represented by the sentence $O(\neg\circ A)$. This approach overcomes deontic paradoxes such as Chisholm's paradox. In this paper two new systems of this kind are proposed: the first one is closer to SDL because contradictory obligations trivialize but contradictory sentences do not. The second one is an extension of system **DmbC** introduced in [2] by adding a modality for deontic inconsistency as a primitive, such that contradictory obligations do not trivialize. Both systems have an adequate Kripke semantics, and dissolve deontic paradoxes such as Chisholm's paradox in two ways: (1) by allowing a richer repertoire of connectives which avoids logical dependencies, and (2) by avoiding logical collapse in the presence of contradictory obligations.

[1] W. A. Carnielli and J. Marcos, *A taxonomy of* **C**-*systems*, ***Paraconsistency—The logical way to the inconsistent*** (W. A. Carnielli, M. E. Coniglio, and I. M. L. D'Ottaviano, editors), Marcel Dekker, New York, 2002, pp. 1–94.

[2] M. E. Coniglio, *Logics of Deontic Inconsistency*, ***CLE e-Prints***, vol. 7 (2007), no. 4.

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Recently, linear Logic has been used to specify sequent calculus proof systems in such a way that the proof search in linear logic can yield proof search in the specified logic. Furthermore, the meta-theory of linear logic can be used to draw conclusions about the specified sequent calculus. For example, derivability of one proof system from another can be decided by a simple procedure that is implemented via bounded logic programming-style search. Also, simple and decidable conditions on the linear logic presentation of inference rules, called *homogeneous* and *coherence*, can be used to infer that the initial rules can be restricted to atoms and that cuts can be eliminated[1, 2]. In the present work we introduce *Llinda*, a logical framework based on linear logic augmented with inference rules for definition (fixed points) and induction. In this way, the above properties can be proved entirely inside the framework. To further illustrate the power of *Llinda*, we extend the definition of coherence and provide a new, semi-automated proof of cut-elimination for Girard's Logic of Unicity (LU).

[1] D. Miller and E. Pimentel, *Using linear logic to reason about sequent systems*, ***Proceedings of Tableaux 2002***, Lecture Notes in Artificial Intelligence, vol. 2381, 2002.

[2] E. Pimentel and D. Miller, ***On the specification of sequent systems***, Lecture Notes in Artificial Intelligence, vol. 3835, pp. 352–366, LPAR (2005).

► RODRIGO PODIACKI AND WALTER CARNIELLI, *A completeness theorem for first-order logics of formal inconsistency*.
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The *logics of formal inconsistency* (LFIs), introduced by W. Carnielli and J. Marcos in 2002, offer a general approach to paraconsistent logic by means of which many kinds of paraconsistent systems can be subsumed. LFIs were further developed in [1] to a greater extent, but remaining at the propositional level. Here we investigate, by an approach which differs from [2], the question of axiomatically defining first-order LFIs and characterizing them through two-valued semantics. Although we focus on the particular quantified logic **QmbC** as a study-case, it is shown how the method can be extended to a large family of quantified paraconsistent logics, supplying them with a sound and complete semantical characterization. Our semantics also grants a basis for the development of a model-theoretical treatment for such logics.

[1] W. A. Carnielli, M. E. Coniglio, and J. Marcos, *Logics of formal inconsistency*, ***Handbook of philosophical logic***, (D. Gabbay and F. Guenthner, editors), Springer, Amsterdam, 2007, pp. 15–107.

[2] A. Zamansky and A. Avron, *Effective non-deterministic semantics for first-order LFIs*, ***Multiple-valued logic and soft computing***, vol. 13 (2007), pp. 335–372.

► ANDRÉ PORTO, *Identity as back and forth correction*.
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This paper presents Wittgenstein's mature interpretation of the notion of "mathematical identity". Perhaps the most surprising aspect of this interpretation is the complete disappearance of the idea of "abstract objects". The philosopher completely refuses a most traditional understanding of a (true) mathematical identity as a denotation of one and the same "object"—the same "number"—by both sides of the equation. Instead, Wittgenstein proposes a new conception of identity as "back and forth correction", i.e., as metalinguistic criteria on alleged empirical executions of some operations. Our paper is divided in two parts. In order to motivate our proposal, the first section of our article offers an overview of two important arguments from his intermediary period concerning recurring decimals (such as "$1 \div 3 = 0.142\ldots$"). We will devote all second half of our paper to the proposal of mathematical identities as "back and forth correction".

► GIUSEPPE PRIMIERO, *Retraction for the adaptive logic of information update*.
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Designing contraction operations on knowledge bases updated with inconsistent information is crucial for the representation of dynamic reasoning. Complexity arises in describing the agent's ability to choose combinations of information updates and retractions. None of the existing approaches (AGM/DEL types) seems to provide such a rational dynamics of connected successful and unsuccessful inconsistent updates. In this paper, a model for updates with inconsistent information and connected retractions is introduced. The logic **AIUR** is defined according to the standard format for Adaptive Logics. Its Lower Limit Logic is a multi-doxastic normal modal logic **T**. The update process is based on the derivability of disjunctions of abnormal expressions of the form $I_i A \wedge \sim A$, each describing an update with inconsistent information at time i. For the retraction procedure, semantically one selects the models validating non-monotonic updates with higher temporal indices, considered less worse than those with lower indices. Consistency of the system is restored as soon as possible, retracting the most recent information update with inconsistent information. A dynamic proof-theory (sound and complete w.r.t. the static semantics) defines the epistemic operations of *successful information update* and *final information retraction*. This research expands on related adaptive information update processes that aim at preserving (instead of deleting) the most recent information, restoring consistency with new information in evolutionary databases (Adaptive Logic **AIU**).

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I will show that Hintikka's notion of 'strategy' (see e.g., [2]) can refer to proof-heuristic reasoning as well as to methodological reasoning forms. Stating this distinction allows for a better understanding of the notion and for an easier way to tackle the problem of formalization. Contrary to Hintikka's opinion, heuristic reasoning can be implemented in formal proofs by means of goal-directed proof procedures (see [1]). Methodological reasoning forms on the other hand can be formally represented by means of adaptive logics.

[1] D. Batens and D. Provijn, *Pushing the search paths in the proofs. A study in proof heuristics*, ***Logique et Analyse***, vol. 173–174–175 (2001), pp. 113–134.

[2] J. Hintikka, ***Inquiry as inquiry: A logic of scientific discovery***, Kluwer, 1999.

► ALEXANDRE RADEMAKER, EDWARD HERMANN HAEUSLER AND LUIZ CARLOS PEREIRA, *On the proof theory of $\mathcal{ALC}$*.
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Description Logics is a family of formalisms used to represent knowledge of a domain. In contrast with others knowledge representation systems, Description Logics are equipped with a formal, logic-based semantics. In [2] we presented the system $\mathcal{SALC}$ a sequent calculus for $\mathcal{ALC}$ (Attributive Language with Complements) and proved that it is sound and complete. The first motivation for developing such system is the extraction of computational content of $\mathcal{ALC}$ proofs. So that, the present calculus is an intermediate step towards a Natural Deduction System for $\mathcal{ALC}$. Our Sequent Calculus, compared with other approaches [1], does not use individual variables (first-order ones) at all. The main mechanism in our system is based on labeled formulas. In this paper we prove that $\mathcal{SALC}$ has the desirable property of allowing the deterministic constructions of proofs, the *cut elimination*.

[1] A. Borgida, E. Franconi, I. Horrocks, D. McGuinness, and P. Patel-Schneider, *Explaining $\mathcal{ALC}$ subsumption*, ***Proceedings of the International Workshop on Description Logics***, pp. 33–36, 1999.

[2] A. Rademaker, F. N. do Amaral and E. H. Haeusler, *A sequent calculus for $\mathcal{ALC}$*, ***Monografias em Ciência da Computação 25/07***, PUC-Rio, 2007.

► TEÓFILO REIS AND MARCELO E. CONIGLIO, *Possible-translations covering of logics*.
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We present a new formalism of decomposition of logics, the *Possible-Translations Coverings* (in short *PTC*s), which constitute a formal version of Possible-Translations Semantics. We show how the adoption of a more general notion of propositional signatures morphism (using multifunctions instead of functions) allows us to define a category $\boldsymbol{Sig}_\omega$ in which the connectives enjoy of great flexibility. From $\boldsymbol{Sig}_\omega$ we construct the category $\boldsymbol{Log}_\omega$ of Tarskian logics and morphisms between them. We define in $\boldsymbol{Log}_\omega$ the notion of a *PTC* for a logic $\mathcal{L}$. We investigate the existence of products in $\boldsymbol{Sig}_\omega$, and point out a remark on the existence of products in the category ***Sig*** of signatures and *functional* morphisms—there is no product, as claimed in [1], but only a weak product. We show how *PTC*s generalize Possible-Translations Semantics, hence Avron's Non-Deterministic Semantics and, in particular, matrix semantics. We conclude indicating the next steps in the study of our formalism, including the possibility of defining a category of *PTC*s, the introduction of topological elements in the discussion and the study of the categories $\boldsymbol{Sig}_\omega$ and $\boldsymbol{Log}_\omega$ via representable functors in ***Sig***. Finally, we give concrete examples.

[1] J. Bueno-Soler, M. Coniglio and W. Carnielli, *Possible-translations algebraizability*, ***Handbook of paraconsistency*** (J.-Y. Béziau, W. Carnielli and D. Gabbay, editors), College Publications, London, 2007, pp. 321–340.

► WAGNER SANZ, *Preservation and the ZF comprehension principle*.
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Systems for falsity preservation derive only refutable formulas, their inferential rules preserve falsity and it has "antiaxioms", i.e., falsities. First Order Peano Arithmetic for Refutability is one example, all its formulas are obtained by an immediate translation from formulas of the system for provability, substituting all logical constants by their duals, excepting negation, of course, under extended De Morgan's Laws. Set Theory is another example; ZF First Order Set Theory for Refutability is obtained by the same substitution. In it, the Comprehension Schema under the substitution is a refutable formula. While the usual schema $\{x \in A \mid F(x)\}$ is understood as the set of all x's belonging to set A having property F, in the refutability system $\{x \notin A \parallel F^*(x)\}$ is the set of all x's for which it is false that x doesn't belong to A or x has property F^*, where $F^*(x)$ is the dual formula of $F(x)$ under the substitution.

► FRANK THOMAS SAUTTER, *The essence of categorical syllogism: a visual approach*.
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The systematization of categorical syllogistic by figures and moods produces logically irrelevant distinctions, for instance, CELARENT, CESARE, CAMESTRES and CAMENES, which are distinct expressions for the same valid categorical syllogism. There are only six distinct categorical syllogisms, which are valid without existential presupposition, and there are only five additional distinct categorical syllogisms, which are valid with existential presupposition. The traditional decision method by (unmutilated) Venn diagrams introduces a logically irrelevant order of representation of the premises in those cases in which the categorical syllogism is constituted by a universal premise and by a particular one. I devised a mixed decision method by mutilated Venn diagrams and by unmutilated ones. This method avoids the logically irrelevant elements mentioned above. The mutilated part of a Venn diagram corresponds to the middle term area, which does not overlap the areas of the other terms. Besides, this method offers an interpretation for the proofs by exposition (*ecthesis*), which were employed by Aristotle in the reduction from imperfect moods to perfect moods, and which have been subject of controversies concerning their correct interpretation. The valid categorical syllogisms, for which Aristotle employed proof by exposition, are exactly the ones that cannot be adequately represented by mutilated Venn diagrams, but only by unmutilated ones.

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Along the last decades, proofs with diagrams, traditionally perceived under suspicion, had their legitimacy reevaluated and defended. Even though diagrams are conceived by their defenders as signs, diagrammatic proofs could be seen as cases of heterogeneous inferences. According to this conception, these proofs would involve not only symbolic manipulation but also reasoning based on diagram visualization and, thus, would be differentiated from sentential proofs and calculus proceedings as, for example, truth tables. This thesis will not only be examined throughout the present research but its correction will be questioned as well. First, we will analyze Venn diagrams informal use in set-theoretical proofs, attempting to determine in which sense proofs with diagrams could be heterogeneous. As we can see, such proofs would supposedly involve visual reasoning in the sense that the validity of inferences would depend on visualizing characteristics of diagrams and not on derivation rules. Second, we will argue that the thesis which establishes that diagrammatic proofs involve essentially a visual element presents serious problems. These problems would be related to the fact that the essential properties of diagrams—those which can be legitimately used in a proof—do not depend on which properties diagrams really do have. In other words, the fact that the diagram may present a certain propriety does not mean that this is an essential propriety of the diagram, and similarly, we cannot also infer that, because a diagram may not present a certain propriety, it cannot be used legitimately in the proof. At the same time that visualized properties of diagrams are irrelevant to determine which their essential properties are, they are also irrelevant to validate or invalidate inferences with diagrams.

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To discuss the advantages and disadvantages of formalization like a suitably method to clarify philosophical concepts and problems is a metaphilosophical question treated from different points of view by contemporary thinkers like J. Hintikka and S. O. Hansson. In this article I will present some Hansson's ideas about the contributions of formal procedures in philosophy, trying to exemplify the topics of your approach through Hintikka's semantical approach to deontic logic.

► DUNJA ŠEŠELJA AND CHRISTIAN STRASSER, *An adaptive logic framework for abstract argumentation*.
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The paper presents an adaptive logic framework for abstract argumentation. It consists of a basic logic for abstract argumentation and various "enhancements" of it. These logics represent in an accurate sense the most common extensions defined in view of Dung's abstract argumentation system [1]. By "enhancements" of the basic system is meant, on the one hand, the addition of axioms, and on the other hand, adaptive logics having this logic as their lower limit logic. In this way we are able to gain logics, the models of which correspond exactly to specific extensions of given argument systems, and furthermore a handy proof theoretic notion of e.g., the so-called sceptical and credulous reasoner. The proposed system provides not just a strong unifying logical framework for the standard extensions of Dung's abstract argumentation system, but is also easily extensible to various generalizations, such as those allowing for joint attacks or the integration of preferences, audiences, and values.

[1] P. M. DUNG, *On the acceptability of arguments and its fundamental role in nonmonotonic reasoning, logic programming and n-person games*, ***Artificial Intelligence***, vol. 77 (1995), pp. 321–358.

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The purpose of this paper is to give a formal account of a kind of agency so far neglected in the field of philosophical modal logic of action: planning agency. Interestingly enough, planning agency is something to which philosophy of action and other fields of logic had traditionally paid a considerable amount of attention. We therefore present here a logic of planning agency. We follow the standard approach of modal logics of agency exemplified by the works of Belnap-Perloff and Chellas. Moreover, since there is a close relation between planning, time and indeterminism, we use the theory of branching time in the semantic characterization of our logic. We present the logic both syntactically and semantically, being the calculus sound and complete with respect to the semantics.

► CHRISTIAN STRASSER, *An adaptive logic for rational closure*.
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Lehmann and Magidor study a strong nonmonotonic, so-called *rational* consequence relation, which extends the preferential consequence relation by also validating the rule of rational monotonicity. Every rational consequence relation can be semantically represented by a specific preferential model, a ranked model, and vice versa. To answer for a conditional assertion $a \mid\sim b$ the question whether it is entailed by a set of conditional assertions K, it is not sufficient to check if it is derivable by the rules for rational consequence relations or, semantically, to check if it is valid in all ranked models of K, as it can be shown that the intersection of all ranked models is not in general a ranked model itself. The authors therefore define a semantic selection based on a preference order $\prec$ on the ranked models in order to obtain the so-called *rational closure*. For the large class of admissible knowledge bases a $\prec$-least ranked model exists. This model defines the rational closure of a given K. This paper will fill the syntactical gap by defining an adaptive logic **ARC** such that an assertion $a \mid\sim b$ is derivable from an admissible knowledge base K iff it is in the rational closure of K. Furthermore, if for a knowledge base K the preference order $\prec$ is well-founded, then $a \mid\sim b$ is derivable iff it is valid in all $\prec$-minimal ranked models of K and the models of **ARC** correspond in an appropriate sense to the $\prec$-minimal models.

► LEANDRO O. SUGUITANI AND ITALA M. LOFFREDO D'OTTAVIANO, *Tarski's relation algebra and "Börner's operator"*.
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In 1975 Alfred Tarski delivered two lectures at UNICAMP, Brazil, about Relation Algebra (RA). He was quite involved with the development of this theory, which could be seen as a branch of the so called *algebraic logic*. Tarski (like De Morgan, Peirce, Schröder and others, who worked with the theory of binary relations before him) was concerned about providing an apparatus for representing algebraically first order logic. It was shown, afterwards, that RA could not be such an apparatus. However, Tarski's axiomatization of RA was used by him and Givant to axiomatize Set Theory. Many people kept working on some open problems left by Tarski about RA. This work aims to analyze one specific problem that Tarski was concerned at the time of the lectures and, actually, was mistaken in his suspects. Tarski introduced RA with five primitive operators and thought that it would be possible to reduce these five operators to two operators only, but no less than this. In 1986, Ferdinand Börner, using the notion of clones, showed that RA could be defined with only one operator, still in terms of equations, as Tarski wanted. Börner's paper is not well known and the implications of this fact to the development of RA seems not to have been given much attention. In this work we analyze Börner's paper in the light of what was said by Tarski about the possibility of this operator, found by Börner, and the advantages that it would bring to the studies of RA.

► RAFAEL R. TESTA AND MARCELO E. CONIGLIO, *Solving normative conflicts using preference relations*.
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This article proposes a general strategy to overcome normative conflicts, namely, paradoxes represented in Standard Deontic Logic. This solution is based on preference relations between norms that circumvent situations of conflict. Moreover, these preference relations allow to define the notion of *argumentative relevance weight* $\mathtt{arw}(\Sigma_1, \Sigma_2)$ of a set Σ_1 compared to another set Σ_2 such that Σ_1 and Σ_2 are conflicting sets. The parameter $\mathtt{arw}$ can be seen as a measure of the relevance of the premises of Σ_1 with respect to Σ_2. Thus, if $\mathtt{arw}(\Sigma_1, \Sigma_2) > \mathtt{arw}(\Sigma_2, \Sigma_1)$ then the conclusions inferred from Σ_1 are preferable to those derived from Σ_2. The case $\mathtt{arw}(\Sigma_2, \Sigma_1) > \mathtt{arw}(\Sigma_1, \Sigma_2)$ is treated symmetrically. On the other hand, if $\mathtt{arw}(\Sigma_1, \Sigma_2) = \mathtt{arw}(\Sigma_2, \Sigma_1)$ then the inferences from Σ_1 and Σ_2 are equally relevant and so the normative conflict between both sets persist in this case. We believe that the technique of argumentative relevance weights could be analyzed behind the scope of normative conflicts, as a general tool in Argumentation Theory.

► BRUNO VAZ, *Proofs of impossibility and inexistence in geometry as syntax*.
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Wittgenstein's meetings with members of the Vienna's Circle between 1929 and 1932 can be seen as the beginning of a shift in many of the authorŠs earlier conceptions about philosophy and mathematics. This period of transition is characterized by a conception of mathematics strongly connected with the notion of calculus. Wittgenstein says that Euclidean Geometry must be seen as the syntax of a language. Its axioms and the figures that can be drawn according to them are to be, respectively, rules of grammar and genuine expressions belonging to that language. Therefore, the kind of proofs mentioned above are to be viewed as means to exclude from the realm of objects of Euclidean Geometry those figures whose construction showed to be impossible by means of ruler and compass. This is analogous to a situation in which one can erase a word from a vocabulary as it can't be created by following the rules of the language to which the vocabulary is purported for. The aim of this work is to shed some light on these new conceptions about geometric proofs whose goal is to demonstrate that the construction of a given figure is impossible by means of Euclidean Geometry.

► PETER VERDÉE, *The dialectical game structure of adaptive logics using the counting strategy*.
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I present an alternative proof format for adaptive logics called *dialectical adaptive logic games*, which are semantically equivalent to adaptive logics that use the *counting strategy*. The proofs reveal the dynamical structure of the adaptive logics with the counting strategy. They can be seen as two player logic games that turn out to be rather useful explications for discussion situations in which two discussing agents have to rely on conditional criticisms on each other's conditional statements, in the absence of relevant unconditional statements. Adaptive proofs have lines that contain a condition. A line is derived if it is not marked, and conditional lines may be marked only in view of unconditionally derived lines. As unconditional lines are added to the proof, lines can become marked or unmarked. So, a line may be conditionally derived, but the marking itself happens only in view of unconditional lines. In the presented logic games, also conditional lines can cause other lines to become marked. This way it becomes possible to deal with situations where a *criticism* to a line may be criticized by other criticisms. On their turn, the latter criticisms may also get marked by yet other criticisms. This process continues until finally an unconditional criticism is found. Technically speaking, the presented proofs are two player games in which a move consists of one or more lines of a usual adaptive proof. In such games, a consequence is finally derived if the player that wants to derive the consequence has a winning strategy for that consequence.

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The fundamental question of "What is a logic?" establishes an active field of research within Computer Science. In [1] we look at this problem from the point of view of "What mathematical structures lie underneath logics with indexed syntax and semantics on the level of abstraction given by specifications and model classes?". This is done by introducing the concept of an *indexed partial order frame* which provides an indexed general definition of Logics that takes natural transformations and adjunctions as built-in tools to formalize the relevant structures of a logical system. This concept abstracts the concepts of *institution* and *entailment system* and provides an elegant and natural account of the coherence axioms pertaining to these both logical systems. Besides, logical consequence (closure) operators are a well-established abstract concept to treat several aspects of syntax in Logics and it is well-known that they arise naturally from *Galois correspondences* between specifications and model classes. The categorical generalization of this connection between closure operators and Galois connections in the context of an indexed setting is established by the relationship between co-triples and adjoint pairs and it is named *indexed logical closure operator*. Finally, reminding that the co-Kleisli and co-Eilenberg constructions are two canonical ways to obtain out of a co-triple adjoint pairs, we show that *indexed partial order frames* and *indexed logical closure operators* are essentially the same.

[1] A. Martini, U. Wolter and E. H. Haeusler, *Fibred and indexed categories for abstract model theory*, ***Journal of the Interest Group in Pure and Applied Logic***, vol. 15 (2007), no. 5–6, pp. 707–739.

Abstracts of papers presented by title

► PATRICK BLACKBURN, *Hybrid logic: then and now*.
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Hybrid logic used to be regarded as a relatively esoteric branch of modal logic, but over the last decade it has become far closer to the modal mainstream, a trend which seems likely to continue. The main goal of this talk is to explain why this has happened. Two factors have played a key role. The first is that a number of metatheoretical results show that the basic ideas of hybridisation fit naturally with the classic metatheoretical results for modal logic (for example, the Hybrid Characterisation Theorem shows that hybrid logic plays the same role for first-order logic with equality that orthodox modal logic does for first-order logic without equality). A second factor is the ease with which the hybrid machinery lends itself to a wide range of applications, and links with standard knowledge representation formalisms such as description logic. In this talk I will discuss both factors. Moreover, I will do so in a way that places these ideas in historical context, for many of these themes (such as link with description logic) are turn out to be surprisingly old, dating back to the pioneering work of Arthur Prior in the late 1960s.

► OTÁVIO BUENO, *Second-order logic, once again*.
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Second-order logic has a number of attractive features, in particular the strong expressive resources it offers, and the possibility of articulating categorical mathematical theories (such as arithmetic and analysis). But it also has its costs. Five major charges have been launched against second-order logic: (1) It is not axiomatisable; as opposed to first-order logic, it is inherently incomplete. (2) It also has several semantics, and there is no criterion to choose between them (Putnam [1980]). Therefore, it is not clear how this logic should be interpreted. (3) Second-order logic also has strong ontological commitments: (i) it is ontologically committed to classes (Resnik [1988]), and (ii) according to Quine [1970], it is nothing more than "set theory in sheep's clothing". (4) It is also not better than its first-order counterpart, in the following sense: if first-order logic does not characterise adequately mathematical systems, given the existence of non-isomorphic first-order interpretations, second-order logic does not characterise them either, given the existence of different interpretations of second-order theories (Melia [1995]). (5) Finally, as opposed to what is claimed by defenders of second-order logic (such as Shapiro [1985]), this logic does not solve the problem of referential access to mathematical objects (Azzouni [1994]). In this paper, I argue that the second-order theorist can solve each of these difficulties. As a result, second-order logic provides the benefits of a rich framework without the associated costs.

► HÉRCULES DE A. FEITOSA, MAURI C. DO NASCIMENTO AND M. CLÁUDIA CABRINI GRÁCIO, *Algebraic elements for the notions of 'many'*.
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Natural languages present quantifiers that cannot be defined from the logical 'universal' and 'existential' quantifiers, but that may be investigated in formalized and mathematical contexts. Examples of these quantifiers are the expressions: many, almost all, too many individuals, among others. Sette, Carnielli and Veloso introduced in 1999 the *ultrafilter logic* aimed at formalizing propositions of the kind 'almost all' or 'generally'; and that has as models classical first-order structures $\mathcal{A}$, endowed with an ultrafilter defined over the universe of $\mathcal{A}$. So, [1] introduced the family of modulated logics and, among them, the *logic of 'many'* that shows the meaning of 'many' given by the concept of proper family of upper closed sets. In this work, we investigate the underlying algebraic structures which allow an algebraic version of the concept of 'many'. We call these algebraic structures *upper closed sets* and compare them with the algebraic version of ultra-filters in a lattice. Then, we introduce a modal propositional logic in which the modal operator corresponds to an algebraic operation that captures the concept of upper closed set in a Boolean algebra. Using algebraic tools, we show the soundness and completeness of this modal propositional logic.

[1] M. C. Cabrini Grácio, *Lógicas moduladas e raciocínio sob incerteza*, PhD Thesis (in Portuguese), State University of Campinas, Campinas, Brazil, 1999.

► JOSÉ IOVINO, *Cryptography, information theory, and non-standard analysis*.
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In cryptographic applications one would like to utilize cryptosystems that are perfect, i.e., theoretically unbreakable. Only one cryptosystem is known satisfy this property. However, it is mostly of theoretical interest, because the key must be as long as the text to be encoded; in practice, one must work with keys of prescribed length. I will discus how, combining ideas from information theory with infinitesimal methods, one can obtain cryptosystems that are asymptotically perfect, in the sense that they can be made as secure as desired, provided that the keys utilized are sufficiently long.

► ÁNGEL NEPOMUCENO AND FERNANDO SOLER, *Constructing inferential contexts*.
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Representation of *inferential contexts* may need logical systems that could be different from classical ones, particularly when the intention is to model how inferences are in concrete scientific practices. Such contexts will be represented by means of different consequence relations, the so called *consequence modulo X*, being X a set of formulas, a set of models or a set of additional rules, which are defined following (in part) Makinson method [1]. Structural rules of the classical relation leads us to consider a variety of contexts that share a closure relation, though compactness may fail and uniform substitution is not accomplished. Taking into account such inferential contexts, abduction could be tackled in two ways: by defining abductive problems in a given context or, transversely, by considering a class of possible contexts, then a modal framework could be proposed to interpret abductive processes. The first will be developed when a set of sentences is the modulo of the corresponding consequence relation, then the process of constructing inferential contexts is studied as the result of applying abductive norms. To define calculi that could be used to search abductive solutions, a criterion of compactness/completeness may be too much strong—model theory of finite structures and second order logic are common examples—, so requirements for a deductive calculus are reduced to be sound and verify *modus ponens*, *consequentia mirabilis*, *contradiction implies triviality* and the metatheorem of deduction. Then a framework to define abductive calculi is given.

[1] D. Makinson, *Bridges between classical and nonmonotonic logic*, ***Logic Journal of the IGPL***, vol. 11 (2003), no. 1, pp. 69–96.

► JUAN FRANCISCO OREA RETIF, *A Lindström theorem for topological languages and FOL self-reference*.

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We prove in this paper a Lindström theorem for Ziegler's L^t language for topological structures. Together with Ziegler's own Lindström theorem, we prove that all languages for topologies are first order definable. Using Lewitzka theorems for abstract logic topological properties and the topological definable properties we produce the form of self referential theorems for FOL.

► GLADYS PALAU AND CARLOS A. OLLER, *A sequent system for LP*.
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This paper presents a sequent system for Priest's three-valued paraconsistent logic LP. This sequent formulation, the SLP system, has some diferential properties with respect to standard Gentzen systems. The SLP system has no structural rules and includes non-standard axioms. It does not have the classical rules for negation, in order to block the derivation of the ECQ rule. It is not possible, either, to preserve the classical rules for the conditional connective, because the modus ponens rule is not valid in LP. Furthermore, the SLP rules for the negation and the conditional connectives differ from standard operational rules which introduce only one occurrence of a connective in its conclusion and do not display other occurrences of connectives in it. The last section of this paper is devoted to the discussion of some philosophical questions concerning the meaning of connectives posed by this kind of formulation of many-valued logics in general and of LP in particular.

► ELDA PICK, *About the Łukasiewicz implicative prealgebras*.
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In this note we revise Łukasiewicz implicative prealgebras, here called Łukasiewicz I-prealgebras. They were used by A. J. Rodríguez Salas in his doctoral thesis in 1980 [3]. These structures constitute a natural generalization of notion of I_3-prealgebra, introduced by Antonio Monteiro in 1968 with the purpose of studying the $\{\to\}$-fragment of the $\{\to, \sim\}$-trivalent propositional calculus of Łukasiewicz by means of algebraic techniques. The interest in the Łukasiewicz I-prealgebras lies in that it is possible to give, in a direct way, an elemental proof that the algebra of Lindenbaum–Tarski of the $\{\to\}$-infinite-valued implicative propositional calculus of Łukasiewicz is a residuated BCK-algebra in the sense of Berman and Blok [1]. This last result appeared without proof in [2] and it was only outlined in [3].

[1] J. Berman and W. Blok, *Free Łukasiewicz and Hoop residuation algebras*, ***Studia Logica***, vol. 77 (2004), no. 2, pp. 153–180.

[2] Y. Komori, *The separation theorem of the ω-valued Łukasiewicz propositional logic*, ***Reports of the Faculty of Sciences Shizuoka University***, vol. 12 (1978), pp. 1–5.

[3] A. J. Rodríguez Salas, ***Un estudio algebraico de los cálculos proposicionales de Łukasiewicz***, PhD Thesis, Universidad de Barcelona (1980).

► GRAHAM PRIEST, *Neighbourhood semantics for intentional operators*.
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Towards non-being [2] provides a semantics for intentional operators and predicates. The semantics deploy two central notions: (a) non-existent objects; (b) possible and impossible worlds. Semantically, intentional operators correspond to binary relations on worlds, as in standard Kripke semantics for normal modal logics. In the present paper I investigate a different semantics, based on neighbourhood semantics for modal logic (e.g., [1], [3]). Particular attention is paid to the various forms of logical omniscience, which must all fail for general intentional operators.

[1] B. Chellas, ***Modal logic***, Cambridge University Press, 1989.

[2] G. Priest, ***Towards non-being***, Oxford University Press, 2005.

[3] G. Waagbø, *Quantified modal logic with neighbourhood semantics*, ***Zeitschrift für Mathematische Logik und Grundlagen der Mathematik***, vol. 38 (1992), pp. 491–99.

► GEMMA ROBLES AND JOSÉ M. MÉNDEZ, *The concept of strong F-paraconsistency*.
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We shall consider propositional languages with a propositional falsity constant F. Following [1], a logic S could be defined as F-paraconsistent iff $F \vDash A$ is not a rule of S. This concept of paraconsistency is, however, too permissive because, according to it, minimal intuitionistic logic J_m, e.g., is then, a F-paraconsistent logic. But F-inconsistent J_m theories are quasi-trivial. The aim of this paper is to define the concept of strong F-paraconsistency (F-Sparaconsistency) and to define the basic constructive F-Sparaconsistent logics, as well as their extensions in the ternary relational semantics.

[1] G. Priest and K. Tanaka, *Paraconsistent logic*, ***The Standford encyclopedia of philosophy*** (E. N. Zalta, editor), Winter edition, 2004, http://plato.stanford.edu/archives/win2004/entries/logic-paraconsistent.

► EBERTH SANTOS AND ITALA M. LOFFREDO D'OTTAVIANO, *The Cantor's actual infinite like a mathematical revolution*.
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Cantor's set theory represents a landmark in the development of mathematics. The scientific debate that followed, as for instance the study of transfinite numbers, revived a quarrel that retraced old ontological disputes of the pre-Socratic philosophy, accurately topics like the being of the infinite. This quarrel is born in old Greece and crosses all the history of the occidental philosophical think, and Cantor gives a new form and impulse to the subject. Our aim is to show that Cantor's works are absolutely revolutionary. Based on Thomas Kuhn's conception, we conclude that the appearance of Cantor's set theory represents the disruption of one old philosophical-mathematical paradigm. Such a paradigm, that had its first logical and philosophical elaboration by Aristotle, had characterized the dominant way of thinking the concept of infinite. We have succeeded in detaching that some aspects pointed by Kuhn as symptomatic of a scientific revolution are present in Cantor's work and we also propose other ways to argue in favour of the revolutionary aspect of this work. In a more ample sense, we glimpse that the development of mathematics can also be understood by means of revolutions, whose more recent example seems to be Cantor's intellectual effort.

► JOHAN VAN BENTHEM, *Dynamic logic and intelligent interaction*.
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Logic was born in a setting of discussion and debate, and logical inference functions intertwined with many other information-driven processes of communication and interaction. We will show how modern dynamic logics deal with all this, leading to new connections with game theory and other formal social sciences. We will also discuss the double face of logic in all this: it is both a description of dynamics, but also, e.g., in game-theoretic interpretations of the logical constants, a fundamental dynamic activity in itself.

Besides the abstracts above, some other papers were presented during the event, as listed below. Some others were presented by title. The complete list of abstracts can be found at
`http://www.cle.unicamp.br/cle30-ebl-slalm/index.php?pag=abertura.php`

Other effectively presented papers

Elias Humberto Alves, *About the principle of identity*; Tomás Barrero, *Prometheus*: *myth, logic and paraconsistency*; Roderick Batchelor, *On some notions of intensional logic*; Carolina Blasio, Monalisa M. Lauro and Rodrigo C. L. Bigonha, *Contributions of Ryle's categorial analysis for the philosophy of mind*; Carlos Caleiro and Ricardo Gonçalves, *An algebraic perspective on valuation semantics*; Javier Castro Albano, *Bivalence, excluded middle and disquotation*; José Carlos Cifuentes and Ana Cristina Corrêa Munaretto, *Primary decomposition of Krull valuations*; Alexandre Costa Leite, *Combining knowledge and contingency*; Arelis Díaz and Carlos Uzcátegui, *Representation theorems for explanatory relations based on cumulative models*; Daniel Durante Pereira Alves and Maria da Paz Nunes De Medeiros, *Introduction to a proposal for simulating negation 'positively'*; Catarina Dutilh Novaes, *A quantificational approach to truth*; Oscar M. Esquisabel, *Leibniz's science of forms as a structural science and similarity as its central concept*; David Etlin, *Iterated Ramsey test conditionals*; Víctor L. Fernández, *Relativization in abstract logic*: *basic results*; Samuel Gomes da Silva, *A Topological assertion related to the principle of dependent choices*; Carlos G. González, *Density on boolean-valued spaces for clustering application*; Décio Krause, *Quantum definite descriptions*; Juliano S. A. Maranhão, *Conservative contraction*; Marcio Moretto Ribeiro and Renata Wassermann, *On the relation between remainder sets and kernels*; Alejandro Petrovich, *An alternative definition of quantifier in three-valued Łukasiewicz algebras*; Maria Eunice Quilici Gonzalez, *Information and meaning*: *a systemic self-organizing approach*; Ricardo Pereira Tassinari, *Operative logic and the genesis of the logical structuration of the real*; Araceli Velloso, *The identity and the paradox of analysis*; Renata Wassermann, *Inclusion versus recovery in belief base dynamics*.

Other papers presented by title

Alessandro Bandeira Duarte, *Is Frege's arithmetic analitic*?; Jonas Becker, *Finite quasi-cardinals in the theory of quasi-sets*; N. C. A. da Costa, F. A. Doria and M. Doria, *On Formal treatments for general relativity*; F. A. Doria, *H6*: *Hilbert's 6th problem and the axiomatization of general relativity*; Abel Lassalle Casanave, *Symbolic knowledge in Hilbert's program*; Roman Murawski, *Philosophy of mathematics in the Warsaw school of mathematical logic*: *Tarski and Mostowski*; Verónica A. Quiroga, *A Topological duality for bounded Fidel structures*; Marco Ruffino, *Context*, *quantifiers and propositional content*.