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THE 19TH LATIN AMERICAN SYMPOSIUM ON MATHEMATICAL LOGIC OF THE ASSOCIATION FOR SYMBOLIC LOGIC XIX SIMPOSIO LATINOAMERICANO DE LÓGICA MATEMÁTICA

Universidad de Costa Rica

San José, Costa Rica

July 26–31, 2022

SLALM 2022, the 19th Latin American Symposium on Mathematical Logic of the Association of Symbolic Logic, was held at the Universidad de Costa Rica, July 26–31, 2022. It was hosted by the Faculty of Sciences. The conference was attended by a total of 71 participants.

Funding for the conference was provided by the Association for Symbolic Logic, the International Math Union, the Universidad de Costa Rica, Consejo Nacional de Rectores (CONARE), the Universidad Nacional de Costa Rica, the Universidad Nacional Autonoma de Mexico, the Embassy of Spain, and the Embassy of France.

The success of the meeting owes a great deal to the enthusiasm and hard work of the Local Organizing Committee composed of Samaria Montenegro Guzmán and Rafael Zamora Calero, with administrative support from María Luisa González Campos, Jessica Pérez Aguilar, Felipe Escalante Guido, and Juliana Valverde Brenes, all part of Center for Research in Pure and Applied Mathematics (CIMPA) of the Universidad de Costa Rica.

The Program Committee was chaired by Carlos Di Prisco (Universidad de los Andes, Bogotá) and consisted of Alf Onshuus (Universidad de los Andes, Bogotá), Antonio Montalban (University of California Berkeley), Eduardo Barrio (Universidad de Buenos Aires), Enrique Casanovas (Universitat de Barcelona), Hugo Mariano (Universidade de São Paulo), Samaria Montenegro (Universidad de Costa Rica), Vera Fischer (Universität Wien), and Valentina Harizanov (George Washington University).

The program included a panel on the situation of Latin American women in logic, 4 tutorial courses, 8 plenary lectures, 16 invited lectures in six special sessions (computability, computer science, model theory, non-classical logics/algebraic logic, philosophy of logic, and set theory), 23 contributed talks, and 2 contributed posters. The following tutorial courses were given.

Darío García (Universidad de los Andes, Bogotá), *Model theory of pseudofinite structures.*

Osvaldo Guzmán (Universidad Nacional Autonoma de Mexico), *An introduction to construction schemes.*

Damian Szmuc (Universidad de Buenos Aires), *Substructural approaches to logical consequence.*

Linda Westrick (Penn State University), *Borel sets and reverse mathematics.*

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The following invited plenary lectures were presented.

Christina Brech (Universidade de São Paulo), *Rigidity and homogeneity in combinatorial Banach spaces.*

Mirna Dzamonja (Université de Paris), *Towards another vision of effectiveness at* $\aleph_1$.

Lluís Godo (IIIA-CSIC, Barcelona), *de Finetti's three-valued conditionals and Boolean algebras of conditionals: two sides of the same coin.*

Matthew Harrison-Trainor (University of Michigan), To what extent do structural properties and computational properties coincide?

Deirdre Haskell (McMaster University), *Analytic functions on an ordered valued field.*

Omar Leon Sanchez (University of Manchester), *Recent interactions between representation theory (of algebras) and model theory.*

Luiz Carlos Pereira (Pontificia Universidade Católica do Rio de Janeiro), *Revisiting disjunctive syllogism and ex falso.*

Elaine Pimentel (University College London), *A tour on ecumenical systems.*

Abstracts of invited and contributed talks given in person or by title by members of the Association follow.

For the Program Committee
CARLOS DI PRISCO

Abstract of invited tutorials

► DARÍO GARCÍA, *Model theory of pseudofinite structures.*
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A structure M is said to be *pseudofinite* if every first-order sentence that is true in M has a finite model, or equivalently, if M is elementarily equivalent to an ultraproduct of finite structures. For these kinds of ultraproducts, the fundamental theorem of ultraproducts (Łos' theorem) provides a powerful connection between finite and infinite structures, which can be used to prove qualitative properties of large finite structures using combinatorial methods applied to non-standard cardinalities of definable sets. Also, in the other direction, quantitative properties in classes of finite structures often induce desirable model-theoretic properties in their ultraproducts.

The idea is that the counting measure on a class of finite structures can be lifted using Łos' theorem to give notions of dimension and measure on their ultraproduct. This allows ideas from geometric model theory to be used in the context of pseudofinite theories, and potentially we can prove results in finite combinatorics (of graphs, groups, fields, etc.) by studying the corresponding properties in the ultraproducts.

This approach was used by Hrushovski and Wagner in [10], but was better explored in his striking papers [8, 9], where he applies ideas from geometric model theory to additive combinatorics, locally compact groups, and linear approximate subgroups. On the other hand, Goldbring and Towsner developed in [6] the Approximate Measure Logic, a logical framework that serves as a formalization of connections between finitary combinatorics and diagonalization arguments in measure theory or ergodic theory that have appeared in various places throughout the literature. Using this, Goldbring and Towsner gave proofs of the Furstenberg's correspondence principle, Szemerédi's Regularity Lemma, the triangle removal lemma, and Szemerédi's theorem: every subset of the integers with positive density contains arbitrarily long arithmetic progressions.

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More recently there has been an increasing interest in applications of model-theoretic properties to combinatorics, starting with the Regularity Lemma for stable graphs due to Malliaris and Shelah (see [12]) and including several versions of the regularity lemma in different contexts: the algebraic regularity lemma for sufficiently large fields [14], regularity lemmas in distal structures [3], and the stable regularity lemma for groups (see [4,15]).

In the other direction, we have the concept of asymptotic classes of finite structures, defined by Macpherson and Steinhorn in [11] as classes of finite structures that satisfy strong conditions on the sizes of definable sets. The most notable examples are the class of finite fields, the class of cyclic groups, or the class of Paley graphs. The infinite ultraproducts of asymptotic classes are all supersimple of finite SU-rank, but recent generalizations of this concept (known as *multidimensional asymptotic classes*, or m.a.c.) are more flexible and allow the presence of ultraproducts whose SU-rank is possibly infinite (cf. [1,16]).

In this series of lectures I will recall some model-theoretic results regarding ultraproducts of finite structures, and review some of the applications that can be derived from them. On the model-theoretic side, we will study the so-called "pseudofinite dimension" (cf. [9]) and its relationship with the forking and model-theoretic dividing lines in pseudofinite structures as presented in [5]. We will also introduce the concept of multidimensional asymptotic classes having as a motivating example the theory of the *everywhere infinite forest*, which is the theory of an acyclic graph G such that every vertex has infinite degree, a well-known example of an ω-stable theory of infinite rank.

On the applications to combinatorics we will see a proof of Szemerédi's Regularity Lemma using ultraproducts of finite structures (cf. [6]), as well as some improvements of this result under the assumption of stability due to Malliaris and Shelah. This last approach was used by Chernikov and Starchenko in [2] to obtain some progress in the study of the Erdős–Hajnal conjecture.

[1] S. Anscombe, D. Macpherson, C. Steinhorn, and D. Wolf, *Multidimensional asymptotic classes and generalised measurable structures*, in preparation.

[2] A. Chernikov and S. Starchenko, *A note on the Erdős–Hajnal property for stable graphs*. ***Proceedings of the American Mathematical Society***, vol. 146 (2018), pp. 785–790.

[3] ———, *Regularity lemma for distal structures*. ***Journal of the European Mathematical Society***, vol. 20 (2018), no. 10, pp. 2437–2466.

[4] G. Conant, A. Pillay, and C. Terry, *A group version of stable regularity*. ***Mathematical Proceedings of the Cambridge Philosophical Society***, vol. 168 (2020), no. 2, pp. 405–413.

[5] D. García, D. Macpherson, and C. Steinhorn, *Pseudofinite structures and simplicity*. ***Journal of Mathematical Logic***, vol. 15 (2015), no. 1, Article no. 1550002, 41 pp.

[6] I. Goldbring and H. Towsner, *An approximate logic for measures*. ***Israel Journal of Mathematics***, vol. 199 (2014), no. 2, pp. 867–913.

[7] D. Haskell, A. Pillay, and C. Steinhorn, editors, ***Model Theory, Algebra and Geometry***, Mathematical Sciences Research Institute Publications, vol. 39, Cambridge University Press, Cambridge, 2000.

[8] E. Hrushovski, *Stable group theory and approximate subgroups*. ***Journal of the American Mathematical Society***, vol. 25 (2012), pp. 189–243.

[9] ———, *On pseudo-finite dimensions*. ***Notre Dame Journal of Formal Logic***, vol. 53 (2013), nos. 3–4, pp. 463–495.

[10] E. Hrushovski and F. Wagner, *Counting and dimensions*. ***Model Theory with Applications to Algebra and Analysis: Volume 2*** (Z. Chatzidakis, D. Macpherson, A. Pillay, and A. Wilkie, editors), London Mathematical Society Lecture Note Series, vol. 350, London Mathematical Society, London, 2008, pp. 161–176.

[11] D. Macpherson and C. Steinhorn, *One-dimensional asymptotic classes of finite structures*. ***Transactions of the American Mathematical Society***, vol. 360 (2008), no. 1, pp. 411–448.

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[12] M. Malliaris and S. Shelah, *Regularity lemmas for stable graphs*. ***Transactions of the American Mathematical Society***, vol. 366 (2014), pp. 1551–1585.

[13] A. Pillay, *Strongly minimal pseudofinite structures*, preprint, 2014, arXiv:1411.5008.

[14] T. Tao, *Expanding polynomials over finite fields of large characteristic, and a regularity lemma for definable sets*. ***Contributions to Discrete Mathematics***, vol. 10 (2014), no. 1, pp. 22–98.

[15] C. Terry and J. Wolf, *Stable arithmetic regularity in the finite-field model*. ***Bulletin of the London Mathematical Society***, vol. 51 (2019), no. 1, pp. 70–88.

[16] D. Wolf, *Multidimensional asymptotic classes of finite structures*, Ph.D. thesis, University of Leeds, 2016.

► OSVALDO GUZMÁN, *An introduction to construction schemes.*
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Construction/Capturing schemes are a powerful combinatorial tool introduced by Stevo Todorcevic. The point is to build uncountable structures by performing careful amalgamations on its finite structures. Using these schemes it is possible, for example, to build a Hausdorff gap or an Aronszajn tree in just countably many steps. The construction of some uncountable structures becomes easier when using construction schemes. This mini course will be a short introduction to Construction and Capturing schemes. We will survey some previously known results and present some new ones, which are part of a Joint work with Stevo Todorcevic and Jorge Cruz Chapital.

► DAMIAN SZMUC, *Substructural approaches to logical consequence.*
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In this mini course, we will present a family of logical systems that do not take for granted all the structural features usually attributed to logical consequence, especially as conceived through the Tarskian tradition. Discussion of Monotonicity, Contraction, and Exchange will be held, but special attention will be devoted to the slew of systems rejecting Reflexivity and Transitivity that were at the center of some vivid debates during the past decade. Particularly, we will analyze the families of three-valued valuations that, together with a non-transitive understanding of logical consequence, render the same valid inferences that Classical Logic. In connection with these, we will study different sequent calculi where the Cut rule is admissible, hoping to draw a connection between its underivability and the resulting system's substructurality.

► LINDA WESTRICK, *Borel sets and reverse mathematics.*
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Theorems about Borel sets are sometimes proved by recursing along the structure of the Borel sets, but more often they are proved via measure or category. It is natural to wonder if these are essentially different proofs. Reverse mathematics provides a way to formalize this kind of question. We analyze the statements "Every Borel set has the property of Baire" and "Every Borel set is measurable" to show that category arguments and measure arguments are strictly less powerful than arguments which recurse directly on the structure of a Borel set. This framework can then be applied to query the necessity of measure and category methods in various theorems about Borel sets, especially in descriptive combinatorics. The results presented are joint with subsets of Astor, Dzhafarov, Flood, Montalbán, Solomon, Towsner, and Weisshaar in various combinations.

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Abstracts of invited plenary lectures

► CHRISTINA BRECH, *Rigidity and homogeneity in combinatorial Banach spaces*.
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The rigidity of an object is related to the existence of few automorphisms of it. The notion of homogeneity goes in the opposite direction, frequently allowing different "parts" of the object to be moved one to the other through automorphisms. Important homogeneity results in combinatorics come from Ramsey theory. A classical rigidity result in Banach space theory is the Banach–Stone theorem, which says that any linear bijective isometry between two $C(K)$ spaces is induced by a homeomorphism between the compact spaces. In our talk, we will discuss these notions in the context of combinatorial Banach spaces, which are sequence spaces whose norms are induced by combinatorial families.

► MIRNA DZAMONJA, *Towards another vision of effectiveness at* $\aleph_1$.
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The first uncountable cardinal does not easily mend itself to methods inherited from the countable. We know this through a whole list of failures of properties such as compactness and Ramsey theorems. Similarly, the descriptive set theory at this level is very different from the classical descriptive set theory and does not really seem to give as much of an idea of effectiveness. We shall propose to look at the effectiveness at $\aleph_1$ from the point of view of automata theory and generalized decidability. In so doing, we shall introduce new classes of automata and consider MSO of trees.

► LLUÍS GODO, *de Finetti's three-valued conditionals and Boolean algebras of conditionals: two sides of the same coin.*
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Conditionals play a key role in different areas of logic and probabilistic reasoning, and they have been studied and formalised from different angles. Bruno de Finetti was one of the first who put forward an analysis of conditionals beyond the realm of conditional probability theory arguing that they cannot be described within the bounds of classical logic. He called them trievents: a conditional $(a \mid b)$ is a basic object to be read "a given b" that turns out to be true if both a and b are true, false if a is false and b is true, and void if b is false. This approach, has been further developed by Gilio and Sanfilippo (see, e.g., [3]) by interpreting conditionals as numerical random quantities with a betting-based semantics, and where the third value is a conditional probability.

On the other hand, following a more logico-algebraic approach, it has been recently shown in [2] that, in a finite setting, conditional events can be endowed with a structure of Boolean algebra and that an (unconditional) probability measure on the initial algebra of plain events can be canonically extended to an (unconditional) probability measure on the Boolean algebra of conditionals which is in fact a conditional probability.

In this talk we will show that how the apparent contradiction between the above two perspectives, one that looks at three-valued conditionals as random quantities and the Boolean algebraic perspective on conditionals, actually dissolves once we precisely set at which level the numerical and the symbolic representation intervene. In doing so, we pave the way to build a bridge between the long-standing tradition of three-valued conditionals and the more recent proposal of looking at conditionals as elements from suitable Boolean algebras.

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This is based on a joint work with Tommaso Flaminio, Angelo Gilio, and Giuseppe Sanfilippo [1]

[1] T. Flaminio, A. Gilio, L. Godo, and G. Sanfilippo, *Compound conditionals as random quantities and Boolean algebras*, ***19th International Conference on Principles of Knowledge Representation and Reasoning, KR 2022*** (Haifa, Israel) (G. Kern-Isberner, G. Lakemeyer, and T. Meyer, editors), 2022, pp. 141–151.

[2] T. Flaminio, L. Godo, and H. Hosni, *Boolean algebras of conditionals, probability and logic*. ***Artificial Intelligence***, vol. 286 (2020), p. 103347.

[3] A. Gilio and G. Sanfilippo, *Conditional random quantities and compounds of conditionals*. ***Studia Logica***, vol. 192 (2014), no. 4, pp. 709–729.

► MATTHEW HARRISON-TRAINOR, To what extent do structural properties and computational properties coincide?
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Given a countable structure A, we distinguish between two types of properties: structural properties and computational properties. Think of a structural property of A as a property of the isomorphism type of A, for example, the sentences it satisfies, the types it realizes, or other properties such as (if A is a group) being torsion-free. On the other hand a computational property of A is a property of the different presentations (isomorphic copies with domain $\mathbb{N}$) of A. For example, it might be that every presentation of A can compute a set X. Many of the most celebrated results of computable structure theory show the equivalence between a structural property and a computational property. I will talk about a few of these and also some interesting examples of computational properties which do not seem to be equivalent to any structural property.

► DEIRDRE HASKELL, *Analytic functions on an ordered valued field.*
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Model theory has had great success in establishing properties of sets defined by restricted analytic functions on an ordered field. Here restricted is defined using the ordering, and analytic function means the power series is convergent in the sense of the ordering. Similar ideas have been used for the study of restricted analytic functions on a valued field, where restricted and convergent are now understood in the sense of the valuation. If a field has both an ordering and a valuation, which interact in a nice way, it is not so clear which of the relations should be considered primary in order to choose the functions to study. In this talk, I will explain the model-theoretic questions one might ask, review some of the past results, and discuss another collection of functions that one can study on an ordered valued field. I will do my best to define all the technical terms in this abstract (and more!).

► OMAR LEON SANCHEZ, *Recent interactions between representation theory (of algebras) and model theory.*
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In the last decade, a new crossroad between representation theory and model theory emerged. The specific programme (in representation theory) is called the Dixmier–Moeglin equivalence. This programme aims at characterizing the primitive ideals of an algebra over a field. Model theory had an appearance in the context of algebras of differential operators, and also in the context of Poisson algebras. In this talk, I will give a survey of past and present results.

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► LUIZ CARLOS PEREIRA, *Revisiting disjunctive syllogism and ex falso.*
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The relation between ex falso and disjunctive syllogism, or even the justification of ex falso based on disjunctive syllogism, is an old topic in the History of Logic (see [3, 4, 5]). This old topic reappears in contemporary Logic since the introduction of Minimal logic by Johansson (see [8, 1, 6]). The disjunctive syllogism seems to be part of our general non-problematic inferential practices and superficially it doesn't seem to be related to or to depend on our acceptance of the ex falso rule; on the other hand, the general validity of the ex falso has been subjected to dispute. We know that the acceptance of the ex falso is a sufficient condition for the acceptance of the disjunctive syllogism and that the acceptance of the Disjunctive-syllogism rule implies the acceptance of the ex falso, as the following simple derivations in an intuitionistic natural deduction system (see [2, 7]) extended with the Disjunctive-syllogism rule show:

$$\dfrac{(A \vee B) \qquad [A]^1 \qquad \dfrac{\dfrac{[B]^2 \qquad \neg B}{\perp}\,\neg_{Elimination}}{A}\,\perp_i}{A}\,\vee_{Elimination}\ {}^{1,\,2}$$

$$\dfrac{\dfrac{A}{(A \vee B)} \qquad \neg A}{B}\ \text{Disjunctive-syllogism rule}$$

The interesting question is: is the ex falso really a necessary condition for the acceptance of the disjunctive syllogism? The aim of the present paper is to discuss some possible ways to define systems that combines the preservation of the disjunctive syllogism with the rejection of the ex falso. In the final part of the paper we discuss some interesting similarities and differences between our approach and Neil Tennant's relevantist approach [8]–[11] to the same topic.

[1] M. van Atten, *On the hypothetical judgement in the history of intuitionistic logic*, ***Logic, Methodology and Philosophy of Science, Proceedings of the Thirteenth International Congress*** (C. Glymour, W. Wei, and D. Westersthul, editors), College Publications, London, 2009, pp. 122–136.

[2] G. Gentzen, *Investigations into logical deduction*, ***The Collected Papers of Gerhard Gentzen*** (M. Szabo, editor), North-Holland, Amsterdam, 1969, pp. 228–238.

[3] D. Laertius, ***Lives of the Eminent Philosophers*** (R. D. Hicks, translator), Loeb Classical Library, Heinemann, London, 1925.

[4] C. Martin, *William's machine*. ***The Journal of Philosophy***, vol. 83 (1986), no. 10, pp. 564–572.

[5] B. Mates, ***Stoic Logic***, University of California Press, Berkeley and Los Angeles, 1953.

[6] T. van der Molen, ***The Johansson/Heyting Letters and the Birth of Minimal Logic***, Technical Notes Series, ILLC Publications, 2016.

[7] D. Prawitz, ***Natural Deduction—A Proof Theoretical Study***, Almqvist & Wiksell, Stockholm, 1965.

[8] N. Tennant, *Entailment and proofs*. ***Proceedings of the Aristotelian Society***, vol. 79 (1978–79), pp. 167–189.

[9] ———, *Natural deduction and sequent calculus for intuitionistic relevant logic*. ***The Journal of Symbolic Logic***, vol. 52 (1987), no. 3, pp. 665–680.

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[10] ———, *Intuitionistic mathematics does not need ex falso quodlibet*. ***Topoi***, vol. 13 (1994), pp. 127–133.

[11] ———, ***Core Logic***, Oxford University Press, Oxford, 2017.

► ELAINE PIMENTEL, *A tour on ecumenical systems.*
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Some questions naturally arise with respect to ecumenical systems: what (really) are ecumenical systems? What are they good for? Why should anyone be interested in ecumenical systems? What is the real motivation behind the definition and development of ecumenical systems?

Based on the specific case of Prwaitz ecumenical system [5, 4] that puts classical logic and intuitionist logic coexisting in peace in the same codification, we would like to propose three possible motivations for the definition, study, and development of ecumenical systems.

– *Philosophical motivation*. Logical inferentialism is the semantical approach according to which the meaning of the logical constants can be specified by the rules that determine their correct use. There are some natural (proof-theoretical) inferentialist requirements on admissible logical rules, such as harmony and separability. We will start by discussing such requirements in the view of Prawitz' ecumenical system.

– *Mathematical/computational motivation*. Dowek [1] has this very interesting remark:

"Which mathematical results have a classical formulation that can be proved from the axioms of constructive set theory or constructive type theory and which require a classical formulation of these axioms and a classical notion of entailment remains to be investigated."

The second part of the talk is devoted to discuss ecumenical axiomatizations of mathematics.

– *Logical motivation*. In a certain sense, the logical motivation naturally combines certain aspects of the philosophical motivation with certain aspects of the mathematical motivation. According to Prawitz, one can consider the so-called classical first-order logic as "an attempted codification of a fragment of inferences occurring in [our] actual deductive practice." Given that there exist different and even divergent attempts to codify our (informal) deductive practice, it is more than natural to ask about what relations are entertained between these codifications.

Our claim is that ecumenical systems may help us to have a better understanding of the relation between classical logic and intuitionistic logic. Maybe we can resume the logical motivation in the following (very simple) sentence:

Ecumenical systems constitute a new and promising instrument to study the nature of different (maybe divergent!) logics.

We will finish the talk by explaining how all this discussion can be lifted to the case of modal logics [2, 3].

This is a joint work with Luiz Carlos Pereira, Sonia Marin, Valeria de Paiva, and Emerson Sales.

[1] G. Dowek, *On the definition of the classical connectives and quantifiers*, ***Why Is This a Proof? Festschrift for Luiz Carlos Pereira*** (E. H. Haeusler, W. de Campos Sanz, and B. Lopes, editors), Tributes, vol. 27, College Publications, London, 2015, pp. 228–238.

[2] S. Marin, L. C. Pereira, E. Pimentel, and E. Sales, *Ecumenical modal logic*, ***Dynamic Logic. New Trends and Applications Third International Workshop, DaLí 2020 (Prague, Czech Republic, October 9–10, 2020)*** (M. A. Martins and I. Sedlár, editors), Lecture Notes in Computer Science, vol. 12569, Springer, Cham, 2020, pp. 187–204.

[3] ———, *A pure view of ecumenical modalities*, ***Logic, Language, Information, and Computation. 27th International Workshop, WoLLIC 2021 (Virtual Event, October 5–8, 2021)***

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(A. Silva, R. Wassermann, and R. J. G. B. de Queiroz, editors), Lecture Notes in Computer Science vol. 13038, Springer, Cham, 2021, pp. 388–407.

[4] E. Pimentel, L. C. Pereira, and V. de Paiva, *An ecumenical notion of entailment*. ***Synthese***, vol. 198 (2021), no. 22, pp. 5391–5413.

[5] D. Prawitz, *Classical versus intuitionistic logic*, ***Why Is This a Proof? Festschrift for Luiz Carlos Pereira*** (E. H. Haeusler, W. de Campos Sanz, and B. Lopes, editors), Tributes, vol. 27, College Publications, London, 2015, pp. 15–32.

Abstracts of invited talks in the Special Session on Computability Theory

► EKATERINA FOKINA, *Classification problem for effective structures.*
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In this talk we will review several approaches to study the complexity of classifying effective structures up to isomorphism or another equivalence relation. Calculating the complexity of the set $E(K)$ of pairs of indices corresponding to equivalent computable structures from a fixed class K is one of the approaches. One can use one-dimensional or two-dimensional versions of m-reducibility to establish the complexity of such index sets. According to this approach, a class is nicely classifiable if the set $E(K)$ has hyperarithmetical complexity (provided the class K itself is hyperarithmetical). Another approach is to classify structures on-the-fly. We call a class classifiable in this sense if we can uniquely (up to a fixed equivalence relation) identify each structure from the class after observing a finite piece of the structure.

► LUCA SAN MAURO, *Classifying equivalence relations in the natural numbers.*
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This is joint work with Uri Andrews.

The study of the complexity of equivalence relations has been a major thread of research in diverse areas of logic. A reduction of an equivalence relation E on a domain X to an equivalence relation F on a domain Y is a function $f : X \to Y$ which induces an injection on the quotient sets, $X/_E \to Y/_F$. In the literature, there are two main definitions for this reducibility.

- In descriptive set theory, *Borel reducibility* is defined by assuming that X and Y are Polish spaces and f is Borel.
- In computability theory, *computable reducibility* is defined by assuming that X and Y coincide with the set of natural numbers and f is computable.

Despite the clear analogy between the two notions, for a long time the study of Borel and computable reducibility were conducted independently. Yet, a theory of computable reductions which blends ideas from both computability theory and descriptive set theory is rapidly emerging. In this talk, we will discuss differences and similarities between the Borel and the computable settings as we provide computable, or computably enumerable, analogs of fundamental concepts from the Borel theory (such as dichotomy results, orbit equivalence relations, and the Friedman–Stanley jump).

Abstracts of invited talks in the Special Session on Computer Science

► FAVIO E. MIRANDA-PEREA, *A modal sequent calculus for notions of encapsulated computation.*

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Modal logic, originated in Mathematics and Philosophy, plays nowadays an important role in Computer Science. For instance in the theory of programming languages, where modal formulas of the form $\Box A$, can be considered as types designating enhanced or encapsulated values, in contrast to ordinary values of type A. The encapsulation feature can be interpreted in several ways, for instance as run-time generated code that computes values of type A, useful in staged computation; or as the type of mobile code of type A in distributed computing.

In this talk I present a programming language prototype for encapsulated computation where the typing is controlled by a sequent-calculus whose cut elimination process generates an operational semantics related to the so-called A-normal form, an essential transformation in the compilation of functional languages.

Acknowledgments. This is joint work with Lourdes González-Huesca. This research is being supported by UNAM-DGAPA-PAPIIT grant IN119920.

► DANIEL VENTURA, *Node replication: a logic-based optimisation in computation.*
Department of Mathematics, University of Brasília, Brasília, Brasil.
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Connections between logical systems and term calculi are unveiled by the so-called Curry–Howard isomorphisms, where different logical proof normalisation procedures correspond to different methods in implementing substitutions. In this sense, normalisation in Natural Deduction is related to full substitution, while cut elimination in Proof-Nets corresponds to partial substitution. Replication of nodes, where substitutions of terms are executed constructor by constructor, is based on a Curry–Howard interpretation of Deep Inference.

In this talk, a term calculus implementing higher-order node replication is introduced where, besides the implementation of a full node replication, two evaluation strategies were investigated: call-by-name and fully lazy call-by-need. Skeletons are the key notion behind such strategies and its extraction is internally codified in the calculus. Observational equivalence between strategies is then proved through a standard non-idempotent intersection type system.

Abstracts of invited talks in the Special Session on Model Theory

► ALEXANDER BERENSTEIN *, CHRISTIAN D'ELBEE, AND EVGUENI VASSILIEV,
Expansions of vector spaces with a generic submodule.
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We study the expansions of a vector space $\mathbb{V}$ over a field $\mathbb{F}$, possibly with extra structure, with a generic submodule over a subring of $\mathbb{F}$. We show that these expansions preserve tame model theoretic properties such as stability, NIP, NTP_1, NTP_2, and NSOP_1.

► JOHN GOODRICK, *Sets definable in ordered abelian groups of finite burden.*
Departamento de matemáticas, Universidad de los Andes, Cra. 1#18a-12, Bogotá, Colombia.
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We will present some new results on the properties of sets definable in expansions of ordered abelian groups under the hypothesis that the theory has finite burden (inp-rank).

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The notion of "burden" measures the combinatorial complexity of sets definable in the theory, and corresponds to dp-rank in NIP theories and weight in stable theories. We obtain new structure results for discrete sets definable in finite-burden OAGs, which in the dp-rank 2 case turn out to be very close to being finite unions of arithmetic sequences intersected with intervals. As for the topological properties of definable sets, in a dp-rank 2 OAG there cannot be both an infinite definable discrete set and a definable set which is dense and codense in some interval. All these results are joint work with Alfred Dolich.

► SILVAIN RIDEAU-KIKUCHI, *Enriching stably embedded sets and expansions of the integers.*
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This all started with a question on the possible unary expansions of the group of integers: all of the known stable examples are superstable of rank omega and strictly simple examples use highly non-trivial results in number theory. As it turns out, that was all just a coincidence and any graph can be interpreted in some enrichment of (Z,+) by a single unary predicate. The main tool to build these examples is that adding structure to a stably embedded set does make it much more complicated (classification wise) than the initial structure or the added structure were. These resplendence phenomenons were implicit in work of Chernikov and Hils on NTP_2 and were later made explicit in work on Jahnke and Simon on NIP. In this talk I will explain how these results extend to other classes, among which are stability, superstability, simplicity, and NSOP_1. And I will explain how this relates to the (apparently unrelated) initial question!

► MARIANA VICARIA, *Elimination of imaginaries in multivalued henselian valued fields.*
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One of the most striking results in the model theory of henselian valued fields is the Ax–Kochen theorem, which roughly states that the first-order theory of a henselian valued field of equicharacteristic zero, or of mixed characteristic, unramified and with perfect residue field is determined by the first-order theory of the residue field and its value group.

A model-theoretic principle follows from this theorem: any model-theoretic question about the valued field can be reduced into a question to its residue field, its value groups, and their interaction in the field. A fruitful application of this theorem has been applied to describe the class of definable sets in a valued field, for example, Pas proved elimination of field quantifiers relative to the residue field and the value group once we add an angular component in the equicharacteristic zero case. One can therefore ask the following question: Can one obtain an Ax–Kochen style theorem to eliminate imaginaries in a henselian valued field?

Following the Ax–Kochen principle, it seems natural to look at the problem in two orthogonal directions: one can either make the residue field extremely tame and understand the problems that the value group brings naturally to the picture, or one can assume the value group to be very tame and study the issues that the residue field would contribute to the problem.

In this talk we will address the first approach. I will present how to eliminate imaginaries in henselian valued fields of equicharacteristic zero with residue field algebraically closed. The results obtained are sensitive to the complexity of the value group. I will start by introducing the problem of imaginaries in ordered abelian groups according to their combinatorial complexity. Once the picture has been clarified for this setting, we will present how to solve the question for valued fields.

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Abstracts of invited talks in the Special Session on Philosophy of Logic

► EDUARDO BARRIO, *Substructural paraconsistency.*
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Metainferences have recently come into focus as a useful way of analyzing substructural properties of logical consequences, as a new way to characterize a logic, as a way to analyze the debate between global and local validity, and as a toolkit for understanding abstract features of consequence relations. In this talk, I am going to discuss what are the connections between valid inferences and their valid metainferences. I will explore the notions of external and internal logical consequences in the context of mixed Many-Valued Consequences. Then, I present some substructural paraconsistent features that are part of some non-transitive logics. There are some paraconsistent elements that connect Priest's Logic of Paradox (LP) and the Strict-Tolerant approach ST: giving up Cut in the latter has as a consequence the loss of other metainferences, closely connected with Modus Ponens and Explosion labeled as Meta-modus Ponens and Meta-explosion. This feature can be generalized elaborating a new notion of paraconsistency.

► LUIS ESTRADA-GONZÁLEZ, *Possibility, triviality, and invalidity.*
Instituto de Investigaciones Filosóficas, Universidad Nacional Autónoma de México, Mexico City, México.
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In this talk I show that taking $\Diamond A$ as logically valid is not as damaging as it is usually thought; in particular, I show that its combination with S5 principles does not necessarily lead to triviality. One of the easiest ways to have $\Diamond A$ as logically valid is by having a trivial index in the relational semantics. Zach Weber has recently put forward some reticence to include such a world on the basis that it would lead to the invalidity of all arguments. I will show that the invalidity of all arguments is something that a committed dialetheist, like Weber himself, has to live with anyway, regardless of the inclusion of a trivial world in the semantics.

► MAX FREUND, *A sortalist approach to Aristotelian assertoric ayllogistic.*
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As widely recognized, one of the important problems surrounding Aristotelian (assertoric) syllogistic theory concerns the logical role that singular propositions might play in this theoretical framework. This presentation will initially focus on this problem. We'll show first that Aristotle's work doesn't provide an unambiguous answer to the problem. Then, we'll consider post-Aristotelian solutions, which assimilate singular propositions to categorical propositions. Although these solutions partially hit the target, we'll see that they lack a full semantic grounding. This grounding is required to constitute philosophically adequate elucidations of the issue. An attempt to fill the above semantic gap might be conducted along the lines of Nino Cocchiarella's interpretation of singular propositions. His theory constitutes a sortalist approach to proper names and would provide the semantic foundation lacking in the post-Aristotelian proposals. However, as we'll point out, a Cocchiarellan-inspired solution wouldn't conform to the Aristotelian truth conditions for singular propositions. Moreover, this solution and, in general, any attempt to interpret singular propositions as categorical might conflict with Aristotle's view of universals. The above difficulty leads us to explore the alternative of extending Aristotle's syllogistic to singular propositions, instead of attempting to assimilate them to categorical propositions. For this purpose, we'll propose

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two formal sortal logics that will capture such a syllogistic theory as extended to singular propositions. One of the systems is an axiomatic system, and the other a natural deduction system. We'll show that Aristotelian intuitions ground both systems.

► ALBA MASSOLO, *Logic, reasoning, and normativity.*
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According to a robustly settled idea in the philosophical tradition, logic plays a normative role in human thought or reasoning, i.e., in order to reason correctly, an agent should follow logical laws. Nevertheless, in recent years, the normativity thesis has faced attacks from two fronts: Harman's sceptical challenge [2] and the accusation of committing a naturalistic fallacy [4].

To restore the normative status of logic for reasoning, one line of response has proposed the formulation of bridge principles that link logical facts to normative constraints on reasoning that these facts give rise to [7]. Although bridge principles can satisfy adequacy criteria to deal with Harman's sceptical challenge, they are not enough to justify why a logical fact imposes obligations on beliefs. If logical laws are descriptive and it is possible to derive normative constraints on beliefs, this derivation must be based on other kinds of norms, namely, general epistemic norms. Otherwise, that argument inflicts Hume's law. Therefore, without other kinds of norms, logic seems unable to impose constraints on reasoning.

My proposal to cope with these two fronts of attack against the normativity thesis is grounded in an externalist conception of reasoning and normativity [1]. I consider reasoning a social institution [3], i.e., as a process of linguistic interactions among agents. From this characterization of reasoning, logic will be understood as a system of rules that prescribes which of those linguistic interactions are appropriate and which are not. To support the externalist conception, I advance two main arguments: an empirical one based on the function of reasoning in human evolution and a philosophical one grounded on the pragmatics of linguistic interactions.

To respond to accusations of committing a naturalistic fallacy, I elaborate a response along the lines of John Searle's argument about how it is possible to derive a statement about obligations from statements about facts [5, 6]. In this sense, my argument is based on defining reasoning as a social institution. From there, I show that this type of linguistic interaction among agents involves the acceptance of certain constitutive rules that entail obligations. I propose a characterization of logical facts as institutional facts. Therefore, normative consequences of logic are not derived from brute facts, but from logical facts, i.e., institutional facts.

[1] C. Dutilh-Novaes, ***The Dialogical Roots of Deduction***, Cambridge University Press, Cambridge, 2021.

[2] G. Harman, ***Change in View: Principles of Reasoning***, MIT Press, Cambridge, 1986.

[3] J. Mackenzie, *Reasoning and logic*. ***Synthese***, vol. 79 (1989), no. 1, pp. 99–117.

[4] G. Russell, *Logic isn't normative*. ***Inquiry***, vol. 63 (2020), nos. 3–4, pp. 371–388.

[5] J. Searle, *How to derive "ought" from "is"*. ***Philosophical Review***, vol. 73 (1964), no. 1, pp. 43–58.

[6] ———, *How to derive "ought" from "is" revisited*, ***Revisiting Searle on Deriving "Ought" from "Is"*** (P. Di Lucia and E. Fittipaldi, editors), Palgrave Macmillan, Cham, 2021, pp. 3–16.

[7] F. Steinberger, *Consequence and normative guidance*. ***Philosophy and Phenomenological Research***, vol. 98 (2019), no. 2, pp. 306–328.

► ELISÁNGELA RAMÍREZ, *A relating semantics for Nelson's connexive logic.*
Instituto de Investigaciones Filosóficas, Universidad Nacional Autónoma de México, Mexico City, México.
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The main topic for this talk is Everett Nelson's connexive logic. First, we will go through a brief overview behind the philosophical motivations for this system, including the various views Nelson held with regard to the validity of some well-known logical principles. Then, we will go over a relational semantics for the axiomatic system. We will find that a relational semantics reveals a clear picture of the behavior of the compatibility relation between propositions without being loaded with technical details, as it sometimes happens with possible worlds semantics.

Abstracts of invited talks in the Special Session on Set Theory

► DOMINIQUE LECOMTE, *Continuous 2-colorings and discrete dynamical systems.*
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We consider various classes of graphs, from the most general ones to those induced by a function. The basic concern in this work is to understand when a graph has a continuous coloring in two colors. We compare the graphs with the quasi-order associated with either injective continuous homomorphisms, or continuous homomorphisms. We present structural properties of these quasi-orders. We will see that discrete dynamical systems are very useful to do that. This analysis also provides information about the quasi-order of Borel reducibility on the class of analytic equivalence relations, in particular about the relation of conjugacy of minimal homeomorphisms of the Cantor space.

► DIANA CAROLINA MONTOYA, *Maximal almost disjoint families and singulars.*
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Throughout the last years, many generalizations from classical cardinal characteristics of the Baire space have been studied. Particularly, special interest has been given to the study of the combinatorics of the generalized Baire spaces κ^κ when κ is an uncountable regular cardinal (or even a large cardinal). In this talk, I will present some results regarding a generalization to the context of singular cardinals of the concept of maximal almost disjointness. The first known result in this area is due to Erdös and Hechler in [1], who introduced the concept of almost disjointness for families of subsets of a singular cardinal λ and proved many interesting results: for instance, if λ is a singular cardinal of cofinality $\kappa < \lambda$ and there is an almost disjoint family at κ of size γ, then there is a maximal almost disjoint family at λ of the same size. The main result of this talk is the construction of a generic extension in which the inequality $\mathfrak{a}(\lambda) < \mathfrak{a}$ holds for λ a singular cardinal of countable cofinality. The model combines the classical technique of Brendle to get a model in which $\mathfrak{b} < \mathfrak{a}$ together with the use of Příkrý type forcings which change the cofinality of a given large cardinal κ to be countable and, at the same time control the size of the power set of this given cardinal.

[1] P. Erdös and S. H. Hechler, *On maximal almost-disjoint families over singular cardinals*, ***Infinite and Finite Sets: Vol. I (Proceedings of a Colloquium Held at Keszthely, June 25–July 1, 1973, Dedicated to P. Erdös on His 60th Birthday)*** (A. Hajnal, R. Rado, and V. T. Sós, editors), Colloquia Mathematica Societatus János Bolyai, vol. 10, North-Holland, Amsterdam, 1975, pp. 597–604.

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► TODOR TSANKOV, *Maximally highly proximal flows of locally compact groups.*
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The notion of a highly proximal extension of a flow generalizes the one of an almost one-to-one extension (injective on a dense G_δ set), which is an important tool in topological dynamics. The existence of maximal such extensions was proved by Auslander and Glasner in the 70s for minimal flows using an abstract argument, and a concrete construction using near-ultrafilters was recently given by Zucker for arbitrary flows. When the acting group is discrete, the maximal highly proximal (MHP) extension is nothing but the Stone space of the Boolean algebra of the regular open sets of the space. We give yet another construction of the MHP extension for arbitrary topological groups and prove that for MHP flows of a locally compact group G, the stabilizer map $x \mapsto G_x$ is continuous (for general flows, this map is only semi-continuous). This is a common generalization of a theorem of Frolík that the set of fixed points of a homeomorphism of a compact, extremally disconnected space is open and a theorem of Veech that the action of a locally compact group on its greatest ambit is free. This is joint work with Adrien Le Boudec.

Abstract of Contributed Talks

RONALD BUSTAMANTE MEDINA*, ZOÉ CHATZIDAKIS, AND SAMARIA MONTENEGRO, *Groups definable in partial differential fields with an automorphism.*
Centro de Investigación en Matemática Pura y Aplicada (CIMPA), y Escuela de Matemática, Universidad de Costa Rica, San José, Costa Rica.
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This is a joint work with Zoé Chatzidakis and Samaria Montenegro.

In this talk we will study, from the model-theoretic point of view, simple groups definable in differential and difference fields. A differential field is a field with a set of commuting derivations and a difference-differential field is a differential field equipped with an automorphism which commutes with the derivations.

Cassidy studied definable groups in differentially closed fields, in particular she studied Zariski dense definable subgroups of simple algebraic groups and showed that they are isomorphic to the rational points of an algebraic group over some definable field. In this talk study Zariski dense definable subgroups of simple algebraic groups, and show an analogue of Phyllis Cassidy's result for partial differential fields.

► JULIÁN CAMILO CANO RAMOS, *Topological games in Ramsey spaces.*
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Topological Ramsey theory was originally proposed by Carlson and Simpson in 1990, and further developed by Todorcevic in 2010. Its purpose is to study a class of combinatorial topological spaces, called topological Ramsey spaces, that characterize and unify essential features appearing in those combinatorial frames where the Ramsey property is equivalent to Baire property, such as the Ellentuck space. In this talk, we will present a general overview on the combinatorial structure of topological Ramsey spaces, analyzing their main features and studying some representative examples, where we will propose an alternative proof of abstract Ellentuck theorem. Also, we will give a generalization of Kastanas game in Ellentuck space, constructing topological games that characterize Baire property for a large family of topological Ramsey spaces. This is joint work with Carlos Di Prisco.

[1] J. C. CANO AND C. A. DI PRISCO, *Topological games in Ramsey spaces, preprint*, arXiv:2305.09611.

[2] T. Carlson and S. Simpson, *Topological Ramsey theory*, ***Mathematics of Ramsey Theory*** (J. Nešetřil and V. Rödl, editors), Springer, Berlin, 1990, pp. 172–183.

[3] E. Ellentuck, *A new proof that analytic sets are Ramsey*. ***The Journal of Symbolic Logic***, vol. 39 (1974), no. 1, pp. 163–165.

[4] I. Kastanas, *On the Ramsey property for sets of reals*. ***The Journal of Symbolic Logic***, vol. 48 (1983), no. 4, pp. 1035–1045.

[5] S. Todorcevic, ***Introduction to Ramsey spaces***, Princeton University Press, Princeton, 2010.

► NICOLAS CHAVARRIA, *Continuous stable regularity.*
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We will discuss recent work with G. Conant and A. Pillay regarding a version of the Malliaris–Shelah stable regularity lemma realized in the context of continuous logic, which allows us to speak about the structure of stable functions of the form $f : V \times W \to [0, 1]$, where we think of V and W as the parts of a "weighted" bipartite graph. In the process, we will also mention some results about the structure of local Keisler measures in this setting.

► SANDRA D. CUENCA* AND LUIS ESTRADA-GONZÁLEZ, *Genuinely non-traditional logics.*
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Let N be some negation and let $\otimes$ be some conjunction. According to Béziau and Franceschetto [2], a logic $\mathbf{L}$ is *genuinely paraconsistent* if and only if it satisfies the following two conditions:

$$\text{(GPcons1)} \not\models_{\mathbf{L}} N(\alpha \otimes N\alpha),$$
$$\text{(GPcons2)}\ \alpha \otimes N\alpha \not\models_{\mathbf{L}}.$$

Initially, Béziau and Franceschetto used the term "strong paraconsistent logics"; later, in [1], Béziau renamed these logics as *genuinely paraconsistent*. Building upon Béziau and Franceschetto's example, Hernández-Tello, Borja, and Coniglio define a *genuinely paracomplete* logic as one meeting the following two conditions:

$$\text{(GPcomp1)}\ N(\alpha \oplus N\alpha) \not\models_{\mathbf{L}},$$
$$\text{(GPcomp2)} \not\models_{\mathbf{L}} (\alpha \oplus N\alpha),$$

where N is again some negation and $\oplus$ is some disjunction.

Genuine paraconsistency and genuine paracompleteness are, so to speak, extreme rejections of the traditional laws of non-contradiction and excluded middle, respectively. But, traditionally, those two principles are not alone, they are in company of Identity: $\alpha > \alpha$, with $>$ some conditional. Then, investigating non-reflexivity (of the conditional) is but the next natural step.

We will say that a logic $\mathbf{L}$ is *genuinely non-reflexive* if and only if it satisfies the following two conditions:

$$\text{(GNR 1)} \not\models_{\mathbf{L}} \alpha > \alpha,$$
$$\text{(GNR 2)}\ N(\alpha > \alpha) \not\models_{\mathbf{L}}.$$

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In this paper we define the notion of *genuinely non-traditional logic*, i.e., a logic that is genuinely paraconsistent, genuinely paracomplete, and genuinely non-reflexive. We further show that **FDE** is an example of such a logic. Since some might find the (definable) arrow in **FDE** unsuitable to play the role of a conditional, even for a non-reflexive logic, we consider some expansions of **FDE** with connectives satisfying more properties usually expected from conditionals.

The structure of the paper is as follows. In Section 1 we present a Dunn semantics for **FDE**. In Section 2, we show that **FDE** is a logic that satisfies the necessary properties to be a genuinely non-traditional logic. In Section 3, we consider some expansions of **FDE** with connectives whose conditional nature is, we think, more apparent, even if they are non-reflexive. (Research supported by the PAPIIT project IG400422.)

[1] J.-Y. Béziau, *Two genuine 3-valued paraconsistent logics*, ***Towards Paraconsistent Engineering*** (A. Seiki, editor), Springer, Cham, 2016, pp. 35–47.

[2] J.-Y. Béziau and A. Franceschetto, *Strong three-valued paraconsistent logics*, ***New Directions in Paraconsistent Logic*** (J.-Y. Béziau, M. Chakraborty, and S. Dutta, editors), Springer, New Delhi, 2015, pp. 131–145.

[3] V. Borja Macías, M. E. Coniglio, and A. Hernández-Tello, *Genuine paracomplete logics*. ***Logic Journal of the IGPL***, forthcoming.

[4] A. Hernández-Tello, V. Borja-Macías, and M. E. Coniglio, *Paracomplete logics dual to the genuine paraconsistent logics: The three-valued case*. ***Electronic Notes in Theoretical Computer Science***, vol. 354 (2020), pp. 61–74.

► NICOLÁS CUERVO OVALLE, *Schröder–Bernstein property on separable randomizations.*
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At theory T has the *Schröder–Bernstein property*, or simply the *SB-property*, if any pair of elementarily bi-embeddable models are isomorphic. This property has been extensively studied for first-order theories (e.g., [2, 3]), but it remains unexplored in continuous context.

This work is a first study of the SB-properties on continuous theories. Examples of complete continuous theories that have this property include Hilbert spaces and atomless probability spaces. Using a characterization of separable randomizations given by Andrews and Keisler in [1] we prove that if a first-order theory T with $\leq \omega$ countable models has the SB-property, then its randomization theory T^R has the SB-property for separable randomizations. This give us as a corollary that, a first order theory T with $\leq \omega$ countable models has the SB-property for countable models if and only if T^R has the SB-property for separable randomizations.

[1] U. Andrews and H. J. Keisler, *Separable models of randomizations*. ***The Journal of Symbolic Logic***, vol. 80 (2015), no. 4, pp. 1149–1181.

[2] J. Goodrick and M. C. Laskowski, *The Schröder–Bernstein property for weakly minimal theories*. ***Israel Journal of Mathematics***, vol. 188 (2012), pp. 91–110.

[3] ———, *The Schröder–Bernstein property for a-saturated models.* ***Proceedings of the American Mathematical Society***, vol. 142 (2014), no. 3, pp. 1013–1023.

► DIEGO FERNANDO GAMBOA HIGUERA, *Reconstruction of colorings from its homogeneous sets.*
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Let $\varphi : [X]^2 \to 2$ be a coloring on a countable (or finite) set X. A subset H of X is called homogenous for φ if φ is constant on $[H]^2$. We denote $\hom(\varphi)$ the collection of homogeneous sets for φ, and consider the problem of finding the colorings ψ such that $\hom(\psi) = \hom(\varphi)$. A coloring φ is called reconstructible if the only ψ as above are φ and $1 - \varphi$.

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The present work is a continuation of the work of Piña and Uzcátegui [1]. In particular, we answer a question that was left there of whether a reconstructible coloring necessarily has infinitely many reconstructible initial segments, i.e., $\varphi|n$ is reconstructible for infinitely many n. We call such colorings strongly reconstructible. The purpose of the talk is to describe some properties about the reconstruction of colorings.

[1] C. Piña and C. Uzcátegui, *Reconstructions of a coloring from its homogeneous sets*. ***Graphs and Combinatorics***, vol. 39 (2023), no. 1, Article no. 6, 26 pp.

► SHAY LOGAN, *Semantics for second-order relevant logic.*
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As Kit Fine showed in the 1980s, quantification in relevant logics is trickier than it looks. It turns out that going second order has its own tricks too. In this talk I will provide a semantic theory for second-order relevant logics, explain the main difficulty in providing such, and give a philosophical explanation of what's at the root of the phenomenon. As time allows, I will also gesture at the interesting parts of the soundness and completeness proofs for the "Henkin" fragment of the logic.

► RUSSELL MILLER, *Relativizing computable structure theory.*
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Computability theorists have learned that an arbitrary Turing program must be treated essentially as a black box. The undecidability of the Halting Problem, along with related results such as Kleene's Recursion Theorem, simply makes it impossible to predict what that program will do on a given input: the only way to find the answer is to run the program and wait to see whether it ever halts and gives an output.

This being the case, it makes sense to broaden computable structure theory to include noncomputable structures as well. The atomic diagram of a noncomputable structure, given to a Turing functional as an oracle, can be treated by that functional using exactly the same techniques used for the atomic diagram of an arbitrary computable structure. Indeed, generalizing in this way has resulted in a number of very pleasing results, including the relative version of the Ash–Nerode theorem, the syntactic equivalent of relative computable categoricity, and the recent theorem of Csima and Harrison-Trainor on degrees of categoricity of countable structures. We will present these results and note that, in addition to being cleaner and more direct than the corresponding results on computable structures, they also tend to have simpler proofs. The broad intention is to encourage further investigation of computable structure theory using these relativized procedures.

► JOACHIM MUELLER-THEYS, *The Refutation of Alternativeism.*
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Let $L \neq \emptyset$, $\phi, \psi, \ldots \in L$, $\Phi, \ldots \subseteq L$; $\vee\colon L \times L \to L$. Furthermore, $\vdash \subseteq \wp(L) \times L$ be such that $\phi \in \Phi$ implies $\Phi \vdash \phi$. By the rules of $\vee$-introduction, $\Phi \vdash \phi$ or $\Phi \vdash \psi$ becomes a sufficient condition for $\Phi \vdash \phi \vee \psi$.

Now we proof-theoretically specify the intuitionist view that the "truth" of an alternation requires some proof of some of its components. We call $\vdash$ *alternativeist* iff $\Phi \vdash \phi$ or $\Phi \vdash \psi$ is a necessary condition for $\Phi \vdash \phi \vee \psi$.

Let us now assume that there is sound semantics with interpretations $\mathcal{I}, \mathcal{J}, \ldots$ such that $\mathcal{I} \models \phi \vee \psi$ iff $\mathcal{I} \models \phi$ or $\mathcal{I} \models \psi$, $\Phi \models \phi$:iff for all $\mathcal{I}$: $\mathcal{I} \models \Phi$ implies $\mathcal{I} \models \phi$, and $\Phi \vdash \phi$ implies $\Phi \models \phi$.

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We call $\phi \vee \psi$ *essential* iff neither $\phi \vee \psi \models \phi$ nor $\phi \vee \psi \models \psi$. *If there is some essential alternation,*$\vdash$*is not alternativeist.* Proof. We have $\phi_0 \vee \psi_0 \not\models \phi_0, \psi_0$ for some ϕ_0, ψ_0. $\Phi_0 := \{\phi_0 \vee \psi_0\}$. Anyway, $\Phi_0 \vdash \phi_0 \vee \psi_0$; by soundness, $\Phi_0 \nvdash \phi_0, \psi_0$.

ϕ, ψ are called *(logically) dependent*:iff $\phi \models \psi$ or $\psi \models \phi$. *If* ϕ, ψ *are independent,* $\phi \vee \psi$ *is essential, and vice versa.*

Having essential alternations is a standard property. Assume, e.g., that L contains $p \neq q$ with $\mathcal{I}(p), \mathcal{J}(q) \in \{1, 0\}$. Then $p \vee q$ is essential, whence $\vdash$*is not alternativeist*.

It may be concluded particularly that *classically sound derivabilities like intuitionistic ones are not alternativeist*.

Notes. This essay introduces the concept of alternativeism and connects it with an older idea on alternations. That happened in the days after a partly polemical talk by Antonino Drago on February 9, 2022 at the *Logica Universalis Webinar*, organized by Jean-Yves Beziau. The elaboration has been joint work with Wilfried Buchholz, who explored the connection to logical independence. After we had used $p \vee q$, Peter Maier-Borst has alleged $a > 10$ or $a < 20$.

We recently specified constructive existence, another intuitionist issue, within first-order logic as *concrete*or *named existence*: $(\mathcal{M}, V) \models \widehat{\exists} x\, \phi$:iff there is a closed term t such that $(\mathcal{M}, V^x/_{t^{\mathcal{M}}}) \models \phi$ (cf. Long Program for 2022 ASL-APA Winter Meeting (Chicago), pp. 3–4; to appear in BSL).

Thanks. “Peana Pesen,” A. & H. Haltenhoff, W. Bornemann-von Loeben, et al.

► AGUSTIN NAGY, *Modal weak Godel algebras.*
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An algebra $\langle A, \wedge, \vee, \rightarrow, 0, 1\rangle$ of type $(2, 2, 2, 0, 0)$ is said to be a weak Heyting algebra (WH-algebra for short) if $\langle A, \bigwedge, \vee, 0, 1\rangle$ is a bounded distributive lattice and the following conditions are satisfied for every $a, b, c \in A$:

(1) $a \rightarrow a = 1$.
(2) $a \rightarrow (b \bigwedge c) = (a \rightarrow b) \bigwedge (a \rightarrow c)$.
(3) $(a \vee b) \rightarrow c = (a \rightarrow c) \bigwedge (b \rightarrow c)$.
(4) $(a \rightarrow b) \bigwedge (b \rightarrow c) \leq a \rightarrow c$.

The class of WH-algebras is a variety, which will be denoted by **WH**. The variety **WH** and some of its subvarieties were studied in [2]. In this talk we are interested in the following subvarieties of **WH**: **RWH** = **WH**+{R} and **SRL** = **RWH**+{T}, where (R): $a \bigwedge (a \rightarrow b) \leq b$ and (T): $a \rightarrow b \leq c \rightarrow (a \rightarrow b)$. The members of **RWH** are called RWH-algebras and the members of **SRL** are called subresiduated lattices. The variety of Heyting algebras is a proper subvariety of **SRL**, and the last one is a proper subvariety of **RWH**.

Let $\langle A, \bigwedge, \vee, \rightarrow, 0, 1\rangle$ be an RWH-algebra. An unary operator $\Box$: $A \rightarrow A$ is said to be a modal operator if the following conditions are satisfied for every $a, b \in A$:

(1) $\Box(1) = 1$.
(2) $\Box(a \bigwedge b) = \Box(a) \bigwedge \Box(b)$.
(3) $\Box(a \rightarrow b) \leq \Box(a) \rightarrow \Box(b)$.

The identities (2) and (3) are equivalent in the framework of Heyting algebras which satisfy the condition (1). However, this property is not valid in general in the framework of subresiduated lattices. The identity (3) is known as the normality identity for modal operators and it is denoted by (K). Motivated by the previous fact, an algebra $\langle A, \bigwedge, \vee, \rightarrow, \Box, 0, 1\rangle$ of type $(2, 2, 2, 1, 0, 0)$ is said to be a KRWH-algebra (KSRL-algebra) whenever its $\{\bigwedge, \vee, \rightarrow, 0, 1\}$-reduct is an RWH-algebra (subresiduated lattice) and the identities (1)–(3)

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are satisfied. We write **KRWH** and **KSRL** to denote the varieties of KRWH-algebras and KSRL-algebras, respectively.

In this talk we will present some results of [3]. More precisely, we shall study the lattice of congruences of **KRWH** and **KSRL**. Besides we shall study principal congruences, simple algebras, subdirectly irreducible algebras, and compatible functions, providing a generalization of results given in. Finally, we shall study the subvariety of **KRWH** generated by its totally ordered members.

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► DAVID REYES AND PEDRO H. ZAMBRANO*, *A characterization of continuous logic by using quantale-valued logics.*
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In this talk, we will talk about a generalization of Continuous Logic [1] where the distances take values in suitable co-quantales (in the way as it was proposed in [2]). By assuming suitable conditions (e.g., being co-divisible, co-Girard, and a V-domain), we provide, as test questions, a proof of a version of the Tarski–Vaught test and Łos's theorem in our setting. Iovino proved in [3] that there is no any logic extending properly (equivalent logics to) Continuous Logic satisfying both Countable Tarski–Vaught Chain Theorem and Compactness Theorem. Since [0, 1] satisfies all of the assumptions given above, we get new logics by dropping any of those assumptions.

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In this paper I examine the validity of the product/exponential adjunction from a logical perspective. A *product* in a category **C** is an object $A \times B$ whose elements are all the pairs

(a, b) such that a is an element of A and b is an element of B, while an *exponential* is an object B^A whose elements are all the morphisms from A to B. An *adjunction* is, roughly, an equivalence relation between two kinds of morphisms in a given category. In particular, the product/exponential adjunction expresses that every morphism $f : A \times B \longrightarrow C$ in the category $\mathbf{C}$ is a morphism $g : A \longrightarrow C^B$, and vice versa.

To every category corresponds a higher-order typed language. In general terms, every object corresponds to a proposition; in particular, a product $A \times B$ corresponds to a conjunction $\phi \wedge \psi$, and an exponential corresponds to an implication $\phi \Rightarrow \psi$. On the other hand, morphisms amount to deducibility relations. It follows that a morphism of the form $A \times B \longrightarrow A$ corresponds to an instance of Conjunction Elimination, that is, $\phi \wedge \psi \vdash \phi$, while a morphism of the form $A \longrightarrow B^A$ corresponds to $\phi \vdash \psi \Rightarrow \phi$. From the product/exponential adjunction it follows that $\phi \wedge \psi \vdash \phi$ iff $\phi \vdash \psi \Rightarrow \phi$, which is an instance of *Residuation (of the conditional, to the left, using a conjunction)*.

Nevertheless, in relevance logic there are objections to the equivalence between $\phi \wedge \psi \vdash \phi$ and $\phi \vdash \psi \Rightarrow \phi$. In particular, the left side is considered valid, but the right side is considered a *fallacy of relevance*. So, if there are reasons to reject *Residuation*, then there are reasons to reject the product/exponential adjunction. The aim of this talk is to present these reasons, and the implications in categories where this adjunction holds.

Some implications are as follows: in the category of sets, for instance, the product/exponential adjunction is valid. Then, it is natural to ask what kind of category is obtained in its place when this adjunction does not hold, and whether from the features of such a category additional arguments could be drawn to the relevantists against *Residuation*, or whether, as in logic of relevance, more subtle and sophisticated forms of *Residuation* need to be expressed.

The structure of this paper is as follows: in the first part, I formally define in categorical terms what a product, an exponential, and an adjunction are; in the second part, I show the logical counterpart of the product/exponential adjunction and some logical objections to its validity; in the third one, I present the mentioned categorical implications of these objections.

► DAVID VALDERRAMA* AND ANDRÉS VILLAVECES, *About $(\mathcal{L}, n)$-models.*
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The method of $(\mathcal{L}, n)$-models was developed originally by Shelah as a model theoretic way of proving the Paris–Harrington theorem and to find a true Π^1_0-sentence not provable in the Peano arithmetic (PA). In this talk, we will review the basic notions of the method, but we will present a different definition from the original. The reason for this change is due to technical issues that will be explained in the talk; however, we are going to show that the theory developed, with respective adjustments, remains with the new definition.

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► ALEXANDER VAN ABEL, *Tame pseudofinite theories with wild dimensions.*
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In their 2014 paper "Pseudofinite Structures and Simplicity," authors Garcia, Macpherson, and Steinhorn present a number of results showing that if an ultraproduct of finite structures

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satisfies various conditions on Hrushovski's fine pseudofinite dimension, then the theory of that structure satisfies various tameness conditions, such as stability and simplicity. They prove that these results do not reverse directly, by presenting tame pseudofinite structures where the dimension conditions are not satisfied. In this talk, we strengthen these counterexamples, by giving two tame pseudofinite theories such that no ultraproducts satisfying these theories satisfy the dimension conditions. We also discuss some stronger tameness conditions which do admit such reversals, where either some pseudofinite model of the theory or every pseudofinite model of the theory satisfies the dimension conditions.

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Deep disagreements are usually understood as those kinds of disputes where there is a clash of fundamental principles. Fogelin (1985) holds that there exist deep disagreements and that these disputes are immune to rational resolution. However, it has been difficult to find decisive examples to support both claims. Recently, Martin (2019) offers an argument for the idea that logic is a good place to find examples of deep disagreements. Unlike the examples proposed by Fogelin (1985) taken from ethics and politics, the example used by Martin arguably allows him to hold that there is at least a particular kind of deep disagreement that is rationally resoluble. Such an example is taken from the debate between dialetheists and classical logicians. In this work I show, first, that there is a tension between the argument that Martin offers for the idea that logic is a good place for searching deep disagreements and the kind of debate that he takes in consideration. Second, I propose other ways of understanding both logical disputes and deep disagreements. On the one hand, I precise the kinds of debates that we find in logic based on how logicians characterize logical theories and the criteria that they use to choose among such theories. In particular, I consider the characterization of classical and dialetheistic logic from a metainferential point of view. Besides, I discuss the reasons that have been offered in favor (and against) these theories. On the other hand, I propose to address the notion of deep disagreement from the fundamental epistemic principle theory point of view (Lynch 2016). I hold that only from this kind of epistemology some debates about logical theories could be understood as deep disagreements.

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The development of Stability Theory in the context of Abstract Elementary Classes (AECs) has been steady and robust, up to the stable zone, and including a bit of simplicity as well, more recently. Canonicity of non-forking, a robust study of superstability, several applications to the model theory of modules in recent work, attest to this assertion. The study of *dependent* AECs is now beginning to bloom. I will describe earlier results of mine (with Grossberg and VanDieren; the spectrum of generic pairs) and recent results in dependent AECs, joint with Shelah (extraction of indiscernibles in various dependent contexts) and Nájar (definable types in dependent AECs).

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