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PHILOSOPHY AND NON-CLASSICAL LOGICS

Invited talks

Contributed talks

INVITED TALKS

▶ NICOLAS CLERBOUT, *The dialogical study of non-classical logics: dialogical pluralism in hindsight.*
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The dialogical approach to logic is born at the end of the fifties from the work of P. Lorenzen. Inspired by Wittgenstein's meaning as use approach and mathematical game theory, the framework provides an alternative to the more widespread model-theoretical and proof-theoretical approaches. Initially, it was introduced in the context of constructive mathematics and logic. During the 90s and the 2000s, the framework has been developed and used for the study, comparison and combination of various logical systems [2]. These developments led to the formulation of what has been called dialogical pluralism [3, 1]. But in recent years this philosophical stance has received less attention, as the focus has shifted on other topics related to constructive approaches.

The main topic of the talk is to present and discuss a reformulation, as well as a new start, for dialogical pluralism. The discussion will start with a presentation of the general features of the dialogical framework and how they are involved in this particular kind of pluralism. In particular we will be interested in how these features are involved in the study of non-classical logics. Some elements on the scope and limits of dialogical pluralism will also be discussed.

[1] Laurent Keiff. ***Le Pluralisme Dialogique***, PhD. Thesis, University of Lille (France), 2007.

[2] Laurent Keiff, *Dialogical logic*, ***Stanford Encyclopedia of Philosophy***, online, 2009 (accessed June 2019).

[3] Shahid Rahman and Laurent Keiff, *On how to be a dialogician*, ***Logic, Thought and Action*** (Daniel Vanderveken, editor), Springer, Dordrecht, 2005, pp. 359–408.

▶ EDUARDO ALEJANDRO BARRIO, *Substructural logics and matainferences.*
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Since the Tarskian paradigm became the standard to characterize what a logical system is, there have been different attempts to generalize it appropriately. Multiple-conclusions, non-contractive, non-monotonic, non-reflexive and even non-transitive accounts of what a consequence relation might be, are only some of the directions in which these investigations have been headed. In this talk I discuss the extent to which the very existence of substructural logics puts the Tarskian conception of logical systems in jeopardy. In order to do this, I highlight the importance of the presence of different levels of entailment in a given logic, looking not only at inferences between collections of formulae but also at inferences between collections of inferences—and more. I call to this type of entailment *a meta-inference*. I discuss appropriate refinements or modifications of the usual Tarskian identity criterion for logical systems, and propose an alternative of our own. Further, I propose to focus on a *meta-inferential* version of Explosion, i.e. which is concerned with inferences. In doing so, I will offer a new characterization of paraconsistency by means of which a logic is paraconsistent if it invalidates *either* the inferential or the meta-inferential notion of Explosion. After that, I consider a number of objections to our account and evaluate a substantially different approach to the same problem.

[1] Barrio, E., Rosenblatt, Tajer, D., *The Logics of Strict-Tolerant Logic*, ***Journal of Philosophical Logic*** (2015) DOI 10.1007/s10992-014-9342-6.

[2] Barrio, E., Pailos, F. Szmuc, D., *A Hierarchy of Classical and Paraconsistent Logics*, ***Journal of Philosophical Logic*** (2019) https://doi.org/10.1007/s10992-019-09513-z

CONTRIBUTED TALKS

▶ LUIS FELIPE BARTOLO ALEGRE, *On falsifying empirical contradictions.*
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The possibility of testing contradictory statements about the factual world has been suggested but barely discussed in the relevant literature. In what seems to be the only paper on the subject, Priest proposes that "if a theory entails $\beta \wedge \neg\beta$, where β is some observation statement, then if such a contradiction is not observed, the theory cannot be correct" ([1]: p. 125). This presupposes that it is possible to falsify contradictory observation statements. The method proposed, though, is not adequate. In normal scientific practice, theories and other statements are falsified because of negative empirical evidence and not just for lack of positive empirical evidence, as implied by Priest's proposal. In this lecture I argue that although it may be possible to empirically verify contradictory observation sentences, it is logically impossible to empirically falsify them in any relevant way. If my argument is correct, the extension of the dialetheist programme into empirical science is, thus, non advisable since we want to avoid statements that are logically impossible to falsify.

[1] Priest, Graham, *Inconsistency and the Empirical Sciences*, ***Inconsistency in Science*** (Meheus, Joke, editor), Springer, Dordrecht, 2002, pp. 119–28.

▸ PEDRO ZAMBRANO AND LEONARDO CANO, *A natural semantics for the pullback of fiber bundles of structures.*
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Sheaves of structures on topological spaces correspond to the semantics of Intuitionism (see [Cai95]), located in between of Kripke semantics and topoi logic. This is a paradigm of truth continuity (continuidad veritativa, according to [Cai95]), which means that if a statement is true in a point therefore it continues being true in a neighborhood of that point. There are other similar approaches of sheaves of structures in several logics (e.g., Continuous Logic -[OV16]-), where the key idea is still preserving the truth of statements in a neighborhood of a point. This idea was generalized to sheaves based on some special kind of lattices extending the lattice of open-sets of a topology (e.g., locales and quantales, [Joh02, BvdB86]), which still keeps some geometry behind them and correspond to variants of intuitionism and links topoi and quantum logic. We intend to extend this idea to fiber bundles. The pullback does not behave well with respect to forcing. Given that the pullback of a fiber bundle is a natural geometric operation, a natural question is to find a semantics which is compatible with it. To do this, we use connections on fiber bundles to define the notion of parallel semantics. We find out that parallel semantics is a compatible semantics with the pullback of fiber bundles. In this semantics, the continuity of the truth is defined via curves that play the role of observers moving in space (spacetime). Parallel semantics allows to distinguish three new aspects associated to truth conti- nuity: space-time stability (truth continuity a‘ la Caicedo), preservation of truth of statements through the observer movement in space-time (during a time interval) and stability of the experimental measure made by the observer.

[1] F. Borceux and G. van-den Bossche. *Quantales and their sheaves.* ***Order****, 84C:288-301, 2017.*

[2] X. Caicedo. *Lo?gica de los haces de estructuras.* ***Rev. Acad. Colomb. Cienc****, 19 (74):569586, 1995.*

[3] L. A. Cano and P. Zambrano. *A natural semantics for the pullback of fiber bundles of structures.* ***preprint.*** *arXiv:1811.11271. Submitted.*

[4] P. T. Johnstone. *Sketches of an elephant: a topos theory compendium.* ***Oxford Logic Guides.*** *Vol. 1, volume 43, The Clarendon Press, Oxford University Press, New York, 2002.*

[5] M. Ochoa and A. Villaveces. *Sheaves of metric structures.* ***23rd International Workshop*** *WoLLIC 2016, 2016.*

▶ J.-MARTÍN CASTRO-MANZANO, *Numerical term logic tableaux.*
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Murphree's Numerical Term Logic (NTL) [1] is a logic capable of representing and performing inference with numerical quantifiers by modifying Sommers and Englebretsen's Term Functor Logic (TFL) [2, 3]. By using and adapting NTL, we offer a tableaux method for a family of term logics comprising TFL, Intermediate TFL, and NTL. Hence, as a result, we obtain tableaux for a family of Sommersian logics. Additionally, we sketch some metalogical features and we address some philosophical issues related to these logics.

[1] MURPHREE, W.A., *Numerical term logic*, ***Notre Dame J. Formal Logic***, vol. 39 (1998), no. 3, pp. 346–362.

[2] Sommers, F. ***The Logic of Natural Language***, Oxford University Press, New York, 1982.

[3] Englebretsen, G. ***Something to Reckon with: The Logic of Terms***, University of Ottawa Press, 1996.

▶ J.-MARTÍN CASTRO-MANZANO, PANIEL-O. REYES-CÁRDENAS, *Distribution trees*.
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The concept of distribution is a notion from traditional logic that is applied when a term appears under the scope of a universal quantifier. So, for example, in the sentence *All humans are mortal* the term *humans* is distributed but the term *mortal* is not. Within traditional logic, this notion of distribution works as a technique for determining validity. However, specially since Geach's criticism [1], distribution—and traditional logic—is seemingly out of favor. Nevertheless, since distribution serves a logical purpose (cf. [2, 3]), in this contribution we adapt Sommers and Englebretsen's Term Functor Logic [4, 5] in order to develop distribution trees that work as general tests of validity, thus refreshing, somehow, some features of traditional logic.

[1] Geach, P. ***Reference and Generality***, Cornell University Press, 1962.

[2] Williamson, C., *Traditional Logic as a Logic of Distribution-Values*, ***Logique et Analyse***, vol. 14 (1971), no. 56, pp. 729–746.

[3] Sommers,F., *Distribution Matters*, ***Mind***, vol. 84 (1975), no. 333, pp. 27–46.

[4] Sommers, F. ***The Logic of Natural Language***, Oxford University Press, New York, 1982.

[5] Englebretsen, G. ***Something to Reckon with: The Logic of Terms***, University of Ottawa Press, 1996.

► PENÉLOPE CORDERO, *Subdirectly irreducible complex c-PBL-algebras.*
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Joint work with Busaniche, M. and Rodriguez, R.O..

Because of the success of the propositional system BL [4], the modal fuzzy logics whose semantics is given by frames over BL-algebras (the algebraic counterpart of BL) are an interesting problem addressed by many people. Particularly, for the case of the fuzzy analogue of the modal system KD45, unlike the classical cases, the standard methods to give an axiomatization fail. For this reason, we take an algebraic approach defining the class of Pseudomonadic BL-algebras (PBL-algebras) [2].

Considering the previous related works, we show that Pseudomonadic Boolean algebras coincide with the algebraic counterpart of classical KD45 [1], while the Gödel PBL-algebras correspond with the class of bi-modal Gödel algebras studied in [3].

On the other hand, we prove that given a possibilistic BL-frame, its associated complex algebra is a special case of PBL-algebra (c-PBL-algebra). Thus, the complex c-PBL-algebras allow to establish a connection between relational and algebraic semantics. Since our aim is to show that the class of PBL-algebras is equivalent to the semantics given by Kripke BL-frames, we focus on the study of complex c-PBL-algebras. We characterize the subdirectly irreducible elements in this class.

[1] Bezhanishvili, N., *Pseudomonadic algebras as algebraic models of doxastic modal logic*, ***MLQ Math. Log. Q.***, vol. 48 (2002), no. 4, pp. 624–636.

[2] Busaniche, M., Cordero,P., Rodriguez, R.O., *Pseudomonadic BL-algebras: an algebraic approach to possibilistic BL-logic*, ***Soft Computing***, vol. 23 (2019), no. 7, pp. 2199–2212.

[3] Caicedo, X., Rodriguez, R.O., *Bi-modal Gödel logic over* $[0, 1]$*-valued Kripke frames*, ***J. Logic Comput.***, vol. 25 (2015), no. 1, pp. 37–55.

[4] Hájek, P., ***Metamathematics of fuzzy logic***, Trends in Logic Studia Logica Library, Kluwer Academic Publishers, Dordrecht, 1998.

► LILIAN CRUZ AND YURI POVEDA, *Categorical equivalence between PMV_f-product algebras and semi-low f_u-rings.*
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An explicit categorical equivalence is defined between a proper subvariety of the class of PMV-algebras, as defined by Di Nola and Dvurečenskij, to be called PMV_f-algebras, and the category of semi-low f_u-rings. This categorical representation is done using the prime spectrum of the MV-algebras, through the equivalence between MV-algebras and l_u-groups established by Mundici, from the perspective of the Dubuc-Poveda approach, that extends the construction defined by Chang on chains.

[1] Chang, C. C, *A new proof of the completeness of the Lukasiewicz axioms*, ***Transactions of the American Mathematical Society***, vol. 93 (1959), no. 1, pp. 74–80.

[2] Cruz, L. J., and Y. A. Poveda, *Categorical equivalence between PMV_f-product algebras and semi-low f_u-rings*, ***Studia Logica***, vol. 0 (2018), no. 0, pp. 00–00.

[3] Di Nola, A., and A. Dvurecenskij, *Product MV-algebras*, ***Multiple-Valued Logics***, vol. 6 (2001), no. 6, pp. 193–215.

[4] Dubuc, E. J., and Y. A. Poveda, *On the Equivalence Between MV-Algebras and l-Groups whit Strong Unit*, ***Studia Logica***, vol. 103 (2015), no. 4, pp. 807–814.

▶ AMÍLCAR ARROYO MEDINA AND SANDRA DOLORES CUENCA, *Dos críticas al monismo sobre la noción de consecuencia.*
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El monísmo lógico puede expresarse como la postura que acepta que distintos sistemas formales pueden calificar como lógicas siempre que cumplan alguna característica en común, por ejemplo, siempre que tengan una relación de consecuencia. Pero esto inmediatamente despierta la pregunta sobre si existen algunas condiciones mínimas que una relación deba cumplir para ser considerada como una relación de consecuencia, y si sólo hay una o varias nociones de consecuencia. En [Jasso 2018] se afirma que lo mínimo que una relación de consecuencia debe cumplir para ser considerada como tal, es *reflexividad, transitividad, monotonía, compacidad y formalidad.* En lo siguiente sostendremos que aceptar el monismo presenta, por lo menos, dos problemas; en primer lugar, la propia historia de la lógica muestra que el desarrollo de la noción de consecuencia está ligado a la solución de problemas que no son puramente lógicos. De modo que, si esto es correcto, podría afirmarse que de haber un conjunto mínimo de propiedades que definan la noción de consecuencia, tal conjunto podría ser considerado únicamente como suficiente pero no como necesario. En segundo lugar, si la relación de consecuencia puede ser rescatada mediante $\Gamma \models \alpha$ *sii no hay valuación posible tal que* $(V)\Gamma = D^+$ *y* $(V)\alpha \neq D^+$, entonces es posible tener en cuenta, por lo menos, dos relaciones de consecuencia distintas, a saber, $\Gamma \models \alpha$ *sii no hay valuación posible tal que* $(V)\Gamma \neq D^-$ y $(V)\alpha \neq D^+$; y $\Gamma \models \alpha$ *sii no hay valuación posible tal que* $(V)\Gamma = D^+$ *y* $(V)\alpha = D^-$; i.e. los casos de consecuencia desarrollados por Malinowski y Frnakowski a partir de las críticas de Suszko hacia las lógicas multivaluadas.
Palabras clave: Consecuencia lógica, monismo, pluralismo, multivalencia, semántica, lógicas no clásicas.

▶ SEBASTIAN E. FERRANDO, *Preferencias imprecisas como modelos neighborhood.* Facultad de Filosofía y Humanidades, Universidad Nacional de Córdoba, Argentina. *E-mail*: ferrandose@gmail.com.

Preferences are a consequence of the comparison between alternatives of different types: results, actions, or situations. These comparisons are normally associated with an order in which it is indicated that one alternative is "better" than another. For example, when playing chess or other games, choosing a move α_1 instead of α_2 is largely determined by reflecting on the results that lead to α_1 and α_2. In game theory and decision theory, individual preferences are used to predict the behavior of rational agents. In this framework, the logic of preferences studies the abstract properties of different comparative structures. In the literature it has traditionally been considered that preferences are precise, that is, that the agent is certain about his preferences. But there are times when an agent can not specify their preferences between different alternatives, without these giving the same or without this being indifferent between them. The objective of the following work is to formally model the concept of an imprecise preference or "it is preferable that" or "to prefer more or less than". For this we will use a class of Kripke models called neighborhood models. The idea behind these models is that the agent can determine that what he prefers is realise in a set of situations better than the current one without being able to determine an individual situation. Specifically, this will allow us to study the general properties that structurally govern these models and determine the inferential relationships behind imprecise preferences.

[1] S. O. Hanson, *Preference logic*, ***In D. Gabbay and F. Guenthner (Eds.), Handbook of philosophical logic (2nd ed.), Deventer: Kluwer***, vol. 4 (2001), chap. 4, pp. 319–393.

[2] Eric Pacuit, *Neighborhood Semantics for Modal Logic*, ***Springer International Publishing*** (2017), DOI: 10.1007/978-3-319-67149-9.

[3] G. H. Von Wright, *The logic of preference reconsidered*, ***Theory and Decision***, vol. 3 (1972), pp. 140–169.

▸ JOSÉ DAVID GARCÍA, *Test modality as a connexive operator.*
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In *Propositional Dynamic Logics*, *test* operator is a dynamic modality taking as program a formula of the logical language. Its syntax is $[\varphi?]$ ($\langle\varphi?\rangle$ in its dual case), and its intuitive meaning is "test φ; proceed if true, fail if false" [5, p. 166]. If we allow that all formula could be a *test*, we are facing the *richest* version of PDL [5, p. 165]. *Test* semantics is presented in a standard way as an identity relation [5, p. 168].

On the other side, connexive logics are a family of logics that are neither subsystems nor extensions of classical logics with more or less partial characteristics, but that in general are identified by validate *Aristotle's thesis*, *Boethius' thesis* and non-symmetry of conditional[1].

In this talk we present a connexive modal logic[2] with a *test*-like operator, that means that it validates connexive theorems. This allows us to study from another perspective the concept of conditionality and the connexion of antecedent and consequent in terms of *testing*. This logic has several sources of inspiration. On the one hand it is inspired by connexive logics based on Routley-Meyer ternary relation [8], keeping some elements of the standard definition of *test*. In addition, the definition of *test* is an extension of the MRS^P semantics defined in [3] and analyzed in [4]. Finally, an important element in this logic is negation, whose definition comes from the mixture of MRS^P semantics and Routley star. Here we present the main elements of this logic.

Let L be a propositional language defined as usual and extended with two modalities (and its respective duals): $[\pi_n]$ and $[\varphi?]$. The collection of truth values is $V = \{\top, *, \bot\}$, while designated and antidesignated values are distributed in the collection $D^+ = \{\top\}$ and $D^- = \{*, \bot\}$, preserving the following order: $\bot < * < \top$. Semantics, therefore, lies in standard conditions for classical connectives plus the following conditions:

$$v_i([\varphi?]A) = \begin{cases} -v_j(A), \text{ if } \forall j \in I \ Rij, \ v_i(\varphi) = \top \\ \\ -*, \text{ otherwise} \end{cases}$$

$$v_i(\neg A) = \begin{cases} -\bot, \text{ if } \exists i^* \in I, \ v_{i^*}(A) = \top \\ \\ -\top, \text{ if } \exists i^* \in I, \ v_{i^*}(A) \in D^- \end{cases}$$

The plan of the talk is as follows. In the first part we will briefly talk about *test* operator and some basic properties; likewise, we will present some general results in connexive logics. Later, we will present our connexive logic with test modality and we will explain the definitions presented above. Finally, we will discuss the main results, among which are the following: a) the programs **skip** and **fail** [5, p. 167] undergo modifications because the concepts of logical truth and logical falsity must be modified in many-valued logics and also by our definition of *test*; b) due to the fact that we have defined *test* as an intensional (conditional) connective, we can study the concept of conditionality via modal axioms; and finally, c) we can study classical laws such as De Morgan or double negation, and its relevance in connexive modal logics.

[1] R. Bradshaw, *A propositional logic with subjunctive conditionals*, ***Journal of Symbolic Logic***, vol. 27 (1962), no. 3, pp. 327–343.

[1] See for example [1], [2], [6], [7], [10]. Other nuances can be added to present subminimal systems [4], but in this work we will concentrate only on minimal systems. We will omit this discussion leaving it for future work.

[2] This logic varies a lot from the logic defined by Wansing in [9], although it retains some elements, such as considering normal modalities.

[2] J. Cantwell, *The logic of conditional negation*, ***Notre Dame Journal of Formal Logic***, vol. 49 (2008), no. 3, pp. 245–260.

[3] L. Estrada, *Weakened semantics and the traditional square of opposition*, ***Logica Universalis***, vol. 2 (2008), no. 1, pp. 155–165.

[4] L. Estrada and E. Ramrez, *A comparison of connexive logics*, ***IfCoLog Journal of Logics and their Applications***, vol. 3 (2016), no. 3, pp. 341–355.

[5] D. Harel, D. Kozen and J. Tiuryn, ***Dynamic Logic***, The MIT Press, Cambridge Massachussets, 2000.

[6] S. McCall, *A history of connexivity*, ***Handbook of the History of Logic*** (Dov Gabbay and Franz Guenthner, editors), Elsevierr, Amsterdam, 2012, pp. 415–449.

[7] C. Mortensen, *Aristotle's thesis in consistent and inconsistent logics*, ***Studia Logica***, vol. 43 (1984), no. 12, pp. 107–116.

[8] R. Routley, *Semantics for Connexive Logics. I*, ***Studia Logica*** vol. 37 (1978), pp. 393–412.

[9] H. Wansing *Connexive Modal Logic*, ***Advances in Modal Logic***, (R. Schmidt et al., editors), vol. 5, King's College Publications, London, 2005, pp. 367–383.

[10] H. Wansing, *Connexive Logic*, ***The Stanford Encyclopedia of Philosophy***, (Edward N. Zalta, editor), URL = <https://plato.stanford.edu/archives/spr2016/entries/logic-connexive/>.

▸ PATRICIO DÍAZ VARELA AND NOEMÍ LUBOMIRSKY, *The lattice of subvarieties of the variety of BL-algebras generated by* $[0,1]_{MV} \oplus [0,1]_G$.
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BL-algebras were introduced by Hájek (see [5]) to formalize fuzzy logics in which the conjunction is interpreted by continuous t-norms over the real interval $[0,1]$. These algebras form a variety, usually called $\mathcal{BL}$. In this work we will concentrate in the subvariety $\mathcal{MG} \subseteq \mathcal{BL}$ generated by the ordinal sum of the algebra $[0,1]_{\mathbf{MV}}$ and the Gödel hoop $[0,1]_{\mathbf{G}}$, that is, generated by $\mathbf{A} = [0,1]_{\mathbf{MV}} \oplus [0,1]_{\mathbf{G}}$. Though it is well-known that $[0,1]_{\mathbf{G}}$ is decomposable as an infinite ordinal sum of two-elements Boolean algebra, the idea is to treat it as a whole block. The elements of this block are the dense elements of the generating chain and the elements in $[0,1]_{\mathbf{MV}}$ are usually called regular elements of $\mathbf{A}$. The main advantage of this approach, is that unlike the work done in [3] and [1], when the number n of generators of the free algebra increase the generating chain remains fixed. This provides a clear insight of the role of the two main blocks of the generating chain in the description of the functions in the free algebra: the role of the regular elements and the role of the dense elements.

We have a functional representation for the free algebra $Free_{\mathcal{MG}}(n)$. To define this functions we need to decompose the domain $\mathbf{A}^n = ([0,1]_{\mathbf{MV}} \oplus [0,1]_{\mathbf{G}})^n$ in a finite number of pieces. In each piece a function $F \in Free_{\mathcal{MG}}(n)$ coincides either with McNaughton functions or functions of $Free_{\mathcal{G}}(n)$.

Using [2] and [4] we give a description of the elements in the lattice of subvarieties of the variety $\mathcal{MG}$ and the equational characterization of them.

[1] S. Aguzzoli and S. Bova, *The free n-generated BL-algebra*, ***Annals of Pure and Applied Logic***, vol. 161 (2010), pp. 1144–1170.

[2] P. Agliano and F. Montagna, *Varieties of BL-algebras I: general properties*, ***Journal of Pure and Applied Algebra***, vol. 181 (2003), pp. 105–129.

[3] S. Bova, ***BL-functions and Free BL-algebra***, PhD thesis, University of Siena, 2008.

[4] A. Di Nola and A. Lettieri, *Equational Characterization of All Varieties of MV-Algebras*, ***Journal of Algebra***, vol. 2 (1999), pp. 463–474.

[5] P. Hájek, ***Metamathematics of Fuzzy Logic***, Kluwer, 1998.

▶ MIGUEL MARCOS, *The twist structure of Nelson-type algebras.*
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This is a joint work with M. Busaniche.

Nelson's constructive logic with strong negation (N3) was introduced as an alternative to intuitionistic logic (see [3]). Unlike the latter, the negation $\sim$ satisfies that provability of a formula $\sim (\phi \wedge \psi)$ implies that either $\sim \phi$ or $\sim \psi$ are provable in N3. Nelson's paraconsistent logic (N4) was introduced later on, omitting the explosion axiom $\sim p \to (p \to q)$ from the axioms of N3.

Nelson algebras and N4-lattices are the algebraic models of N3 and N4 respectively. In turn, Nelson residuated lattices are a variety of residuated lattices that are termwise equivalent to Nelson algebras, and the same applies to the variety of NPc-lattices and eN4-lattices, the expansion of N4-lattices by a constant e. Thus both N3 and N4 logics can be studied within the framework of substructural logics (see [1, 2]).

Algebras in both varieties can be obtained via *twist-products* of Heyting algebras or generalized Heyting algebras, but the substructure of the full twist-product representing them differs for each case.

We define the variety of Nelson-type algebras, containing both Nelson residuated lattices and NPc-lattices, and provide a common framework for their representation as twist-products based on the work of Sendlewski.

[1] Busaniche, M., Cignoli, R., *Residuated lattices as an algebraic semantics for paraconsistent Nelson logic*, ***Journal of Logic and Computation***, vol. 19 (2009), pp. 1019–1029.

[2] ——— *Constructive logic with strong negation as a substructural logic*, ***Journal of Logic and Computation***, vol. 20 (2010), pp. 761–793.

[3] Odintsov, S. P., *On the embedding of Nelson's logics*, ***Bulletin of the Section of Logic***, vol. 31 (2002), pp. 241–248.

► ALBA MASSOLO, *Pluralism and normativity in logic.*
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In recent years, there has been much critical discussion about logical pluralism [5]. One of the biggest problems arising from these discussions was the apparent conflict between logical pluralism and logical normativity [4]. This conflict, briefly expressed, shows that if there is more than one correct logic and, at the same time, logic establishes how we ought to reason, those different correct logics make conflicting suggestions about how we ought to reason. Hence, which normative guidance should we follow?

The aim of this work is to apply the philosophical method of reflective equilibrium [2] in order to argue in favour of a pluralist and normative account of logic. Firstly, we endorse an approach of logic normativity related to public practices of reasoning and argumentation [1] . Secondly, we characterize a version of logical pluralism closed to the perspective of logic-as-model [3]. Thirdly, we examine the relation between logical models and informal public practices of reasoning in terms of adjusting both of them until equilibrium is reached. We defend that this proposal can juggle pluralism and normativity about logic.

[1] DUTILH-NOVAES, C. *A Dialogical, Multi-agent Account of the Normativity of Logic*, ***Dialectica***, vol. 69 (2015), no. 4, pp. 589–609.

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► RODRIGO MENA GONZÁLEZ, *Sobre la traducibilidad de bases deductivas.*
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Al presentar algoritmos que permiten efectuar traducciones entre deducciones naturales tipo Jaskowski y tipo Gentzen, o entre deducciones naturales y axiomáticas, von Plato (2013; 2017) da un paso más allá de las tradicionales demostraciones que garantizan la equipotencia de todos estos métodos de representación de sistemas lógicos, iniciadas por el propio Gentzen (1969). La mera posibilidad de verter las operaciones lógicas derivables en uno cualquiera de estos métodos, en otro, sugiere que es igualmente posible describir un mismo sistema intercambiando, hasta cierto punto, axiomas por reglas de inferencia tal como lo sugiriera Carnap (2001: 21). Con todo, establecer qué axiomas son intercambiables por qué reglas de inferencia es algo problemático: pocos axiomas pueden relacionarse con una única regla de este tipo. Un ejemplo de ello resulta de comparar la base deductiva de Hilbert-Bernays para la Lógica Clásica y la de Gentzen (1969): el primero emplea tres axiomas para describir el comportamiento del condicional en circunstancias en que el segundo posee apenas dos reglas, una de introducción y otra de eliminación, para el mismo conectivo. Esto se explicaría porque las reglas de inferencia permiten interpretar el uso de cada conectivo lógico en una forma más flexible que la que puede expresarse de manera esquemática por un axioma.

El propósito de esta presentación consiste en mostrar que es posible generalizar la concepción de las reglas de inferencia como instrucciones aplicadas a expresiones oracionales (Wojcicki, 1984; 1988), para extenderla también a los axiomas de un sistema axiomático. En efecto, en estos últimos, es posible concebir a la unión de axiomas y modus ponens (o la regla que resulte aplicable en su lugar), como instrucciones equivalente a las que resultan de otras reglas de inferencias. Para ello, basta definir la mentada equivalencia como una entre operaciones que asigna una misma expresión oracional a un mismo conjunto de premisas.

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▶ ERIC PEZOA, *¿Monismo o pluralismo en el anti excepcionalismo sobre la lógica?*. Universidad de Chile, Santiago, Chile.

Dentro de la literatura reciente en la filosofía de la lógica, el Anti - Excepcionalismo [Hjortland(2017), Williamson(2013)] ha surgido como una postura contraria a la visión tradicional frente a la naturaleza de la lógica, a saber, que la lógica es a priori y sus verdades analíticas. Por el contrario, este movimiento propone que la lógica no es especial y que ésta se encuentra en un continuum con los métodos de la ciencia.

Sin embargo, lo que parece como algo innovador trae un problema. El llamado problema sobre la elección de teoría. Cómo deberíamos elegir una teoría? [Priest(2016)] propone el Modelo Racional para Elección de Teorías. Este consiste en que una determinada teoría debe satisfacer un conjunto de criterios tales como (i) adecuación a los datos, (ii) simplicidad, (iii) consistencia, (iv) poder, (v) evitar elementos ad hoc, entre otros. No obstante, no basta con sólo mencionar los criterios para contrastar teorías rivales. Priest asigna al conjunto de criterios una escala convencional dentro del intervalo X de los reales que puede ser entre el -10 al $+10$, donde a cada criterio se le asigna un valor, además como cada criterio no tiene la misma importancia, a cada criterio se le asigna un peso. No obstante, Priest argumenta que este criterio favorecería a la lógica paraconsistente frente a la lógica clásica, algo contrario a lo que se ha llamado Pluralismo Lógico [Beall & Restall(2006)], esto es, que existen al menos dos formas de caracterizar a la consecuencia lógica igualmente correctas. En el presente trabajo, se buscará indagar sobre si el Anti-Excepcionalismo es monista o pluralista.

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► YURI POVEDA, AND ALEJANDRO ESTRADA, *Mvw-rigs and product mv-algebras.*
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We introduce the variety of Many-Valued-Weak rigs, MVW-rigs. We provide an axiomatization and establish, in this context, basic properties about ideals, homomorphisms, quotients and radicals [3]. This new class containing the class of Product MV-algebras presented by Di Nola and Dvurečenskij in 2001 [2] and by Montagna in 2005 [4]. The main result is the compactness of the prime spectrum of this new class, endowed with the co-Zariski topology as the defined by Dubuc and Poveda in 2010 [1].

By [2, Theorem 4.2], it follows that every PMV-algebra is isomorphic to $\Gamma(R, u)$ with R an l_u-ring where $u^2 \leq u$ and the latter is an MVW-rig. This class is contained strictly, for example, every MV-algebra with the product defined by the infimum of the MV-algebra is an MVW-rig, that in general is not a PMV-algebra.

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▶ RAMON JANSANA AND HERNÁN SAN MARTÍN, *On the free frontal implicative semilattice extension of a frontal Hilbert algebra.*
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Frontal Heyting algebras were introduced by Esakia in [3] as the algebraic models of the modalized Heyting calculus mHC. They are Heyting algebras expanded with a unary operation with the algebraic properties of the co-derivative operator of a topological space when it is applied to the Heyting algebra of its open sets. In [1] frontal operators were generalized to Hilbert algebras, and hence to implicative semilattices.

Our main goal is to present an explicit description of a left adjoint functor to the forgetful functor from the category of frontal implicative semilattices to the category of frontal Hilbert algebras, thus providing for every frontal Hilbert algebra a specific construction of its free extension to a frontal implicative semilattice. In order to make it possible, we use an explicit description given in [2] of a left adjoint to the forgetful functor from the category of implicative semilattices to the category of Hilbert algebras.

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▶ SANDRA VISOKOLSKIS, *Analogical proportion-based inferences within non-classical logic: historical variants of Aristotelian argumentative strategies.*
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The paper proposes a logical systematical reconstruction of a historical philosophical classification of rhetorical figures, through which it will become a non-classical logical typology of several analogical inferences. This inferential reconstruction would cover a wide range of strategies introduced by Aristotle that, at present, would respond to types of non-deductive argumentation. The first known works about proportion-based reasoning, a specific form of analogical inference, were made under the pretension of subsuming this type of inference to classical logic [1]. However, several papers and entire lines of research recently emerged around non-classical logics [2, 3, 4, 5]. Thus, this logical reconstruction not only adapts to non-deductive reasoning within a classical logical theory, but it is better represented in the framework of non-classical logics.

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▶ ANYA YERMAKOVA, *Non-classical logics of the late Russian Empire.*
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In this talk we dissect a set of experiments in non-Aristotelian logic of the late Russian empire, uniting various characters previously studied in isolation via their common 1) questioning of the Law of Excluded Middle in understanding validity, and 2) interest in logic's role for dynamic processes (epistemological and phenomenological, as well as physical and metaphysical). The following logics are considered: "imaginary logic" of Nikolai Aleksandrovich **Vasiliev** (1890-1940), "creative logic" of Nikolai Yakovlevich **Grot** (1852-1899), "non-binary logic" of Nikolai Nikolayevich **Lange** (1858-1921), logic of antinomies of Pavel Aleksandrovich **Florensky** (1882-1937), as well as logic for foundations of algebra of Samuil Osipovich **Shatunovsky** (1859-1929).

First we present an exposition of various syntactical and semantic structures developed by these characters, focusing on the two uniting elements mentioned above. While Vasiliev?s imaginary logic has been previously related to paraconsistent logics [1] and logic of (im)possible worlds [2], we make an attempt to situate the others. For example, we compare Grot's heavily diagrammatic logic, with an ambitious structure and capability for nested claims and dynamic inferences, to Dynamic Epistemic Logic.

Then, we present an argument for the formation and development of constructive mathematics (Orlov, Glivenko, A.A.Markov Jr) in the USSR as a continuation of this pre-revolutionary activity. In particular, we note the concerns of compatibility, legibility, as well as the relevance of logic within the socially extended fields like methodology of science and theory of learning.

We conclude with a discussion about non-classical formal logic as a category and problematize the origins narrative of foundations of mathematics. That is, these early 20th century Russian authors, while aware of and in conversation with Frege, Russell and others, were also responding to different problems and developing a conception of formal logic distinct from Western contemporaries, despite the echoes in the resulting frameworks.

[1] Valentin Bazhanov, ***N.A. Vasil'ev i Ego Voobrazhaemaia Logika: Voskreshenie Odnoi Zabytoi Idei [N.A. Vasil'ev and his imaginary logic: Revival of one forgotten idea]***, Kanon+, Reabilitatsiia, 2009.

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