Reasoning & analytic methods

27–28 April 2017
Book of Abstracts
Conference Program

Comenius University in Bratislava · 2017

REASONING & ANALYTIC METHODS

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THURSDAY 27 APRIL (ROOM G140)

09:30 – 10:00	Registration
10:00 – 10:05	Conference Opening
10:05 – 11:05	**Miloš Arsenijević** *The Post-Cantorian Era: Two Inter-related Concepts of Points and Continua in Non-Archimedean Spaces*
LUNCH	
13:00 – 14:00	**Duško Prelević** *The Chalmers Trilemma Re-Examined*
COFFEE BREAK	
14:15 – 15:15	**Vladan Djordjević** *Assumptions, Hypotheses, and Antecedents*
COFFEE BREAK	
15:30 – 16:30	**Paweł Łupkowski** *IEL-based Formal Dialogue System for Tutorials*
COFFEE BREAK	
16:45 – 17:45	**Mariusz Urbański, Natalia Żyluk** *Sets of situations, topics, and question relevance*
COFFEE BREAK	
18:00 – 19:00	**Daniela Glavaničová** *Type-theoretic analysis*
DINNER	

FRIDAY 28 APRIL (ROOM G140)

09:30 – 10:30 **Szymon Chlebowski, Andrzej Gajda**
*Abductive Question-Answer System for minimal logic of formal inconsistency mbC**

COFFEE BREAK

10:45 – 11:45 **Andrej Jandrić**
Aboutness, Content Extraction, and Ontological Commitments

LUNCH

14:00 – 15:00 **Vladimír Marko**
Arguments based on conditional promise

COFFEE BREAK

15:15 – 16:15 **Miloš Kosterec**
On Inverse Analytic Methods

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THE POST-CANTORIAN ERA: TWO INTER-RELATED CONCEPTS OF POINTS AND CONTINUA IN NON-ARCHIMEDEAN SPACES

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In the last decade of nineteenth century, the Italian mathematicians Veronese and Levi-Civita introduced infinitesimals in the analysis of the continuum, while Hilbert dealt with the systems of geometry that are both non-Archimedean and non-Euclidian. In the first half of twentieth century, the results of Löwenheim, Skolem and Gödel made it possible to prove the non-categoricalness and incompleteness of the formal theory of numbers and the theory of the continuum based on Cantor's set theory. All this enabled more mathematicians in the second half of twentieth and the beginning of twenty first century (like Abraham Robinson, John Conway, Philip Ehrlich and others) to construct closely related non-Archimedean systems, by extending the Cantorian field of real numbers up to the field of real and surreal numbers, on the basis of which the theory of the so-called absolute continuum was built. Now, the differently answerable question concerning points is: Are *points* in these systems extended (like Robinsonian monads) or unextended (like spatial elements corresponded to Conway's real or surreal numbers)? Even if the answer turns out to be a matter of terminological fact, the clarification of the two usages is of a great interest, since it will illuminate not only the relation between the concept of *point* and the concept of *continuum*, but also

the difference between the two corresponding concepts of *continuum* themselves.

THE CHALMERS TRILEMMA RE-EXAMINED

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According to A Priori Scrutability, which plays a crucial role in David Chalmers's *Constructing the World*, there is a compact class of truths (the scrutability base) from which all truths are a priori derivable. The Continuum Hypothesis is a potential counterexample to such a thesis, since one might argue that it is a mathematical formula with determinate truth-value inscrutable from standard Zermelo-Fraenkel set theory plus the Axiom of Choice. Moreover, Gödel's First Incompleteness Theorem suggests that the Continuum Hypothesis is just one example of a proposition inscrutable with respect to the assumed base, and that we can always expect to find new sentences that are inscrutable. Chalmers's three-part answer to this problem (which I call the "Chalmers trilemma") runs as follows: either the Continuum Hypothesis is indeterminate; or adding a new axiom will settle the issue, or, if these two options do not work, we should simply add the Continuum Hypothesis to the scrutability base. In this paper, I argue that Chalmers's answer is contentious. The first horn of the trilemma is either ad hoc under the most plausible interpretation, or it shares the same problems with two other horns. The second horn at best shows that there are no absolutely undecidable propositions, but from this it does not follow that there is the set of axioms from which all formulae might be proven, which is exactly what Chalmers's constructing-the-world project requires. The third horn of the trilemma might be defended by the cost of making Chalmers's project empty, since we do

not know which interpretation of the Continuum Hypothesis is true in our world, and, unlike some other model-dependent formulae (such as Euclid's Fifth Postulate), we have no clue at all how the empirical evidence might be relevant for making the choice.

ASSUMPTIONS, HYPOTHESES, AND ANTECEDENTS

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The distinction between the three notions from the title is about the difference between arguments and conditionals (premises and antecedents) and about a further difference between two kinds of arguments (two kinds of premises – assumptions and hypotheses). The difference is easily made in artificial languages, and we are familiar with it from our first logic courses (although not necessarily under those names, since there is no standard terminology for the distinction). I will claim that there are ordinary language counterparts of the three notions, and I will propose definitions for them in pragmatic terms. Then I will apply the definitions to try to explain away some philosophical problems or paradoxes: the direct argument, a standard argument for fatalism, McGee's counterexample to modus ponens, the Ramsey + Moore = Good argument, the miner's paradox, and a recent counterexample to modus tollens.

IEL-BASED FORMAL DIALOGUE SYSTEM FOR TUTORIALS

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In this paper I present a formal dialogue system DL(IEL)T with underlying Inferential Erotetic Logic (hereafter IEL) concepts of erotetic inferences validity. The aim of this system is to model certain behaviours related to the use of questioning agendas that may be observed in tutorial dialogues. IEL [6, 8] is a logic which focuses on inferences whose premises and/or conclusion is a question, and which gives criteria of validity of such inferences. Thus it offers a very useful and intuitive framework for analyses of the questioning process and it is a natural point of departure for the proposed approach. The dialogue logic (see [2]) overlay is used here in order to grasp linguistic phenomena and dialogue dynamics in a precise manner. My approach shares the main intuition with systems presented in [1, 3], namely of using a logic in the background of a formal dialogue system in order to check the correctness of certain dialogue moves.

I am especially interested in the way questions may be used by a tutor in a tutorial dialogue. As we may read in [5, p. 1]: "A tutor often faces the decision of whether to just tell the student an explanation or to try to elicit the explanation from the student via a series of questions." The most natural way of thinking about such a questioning process is that a tutor will have certain agenda of questioning, which will allow for checking, whether a student really understand an issue under

discussion. I present how a questioning agenda may be modelled with the use of erotetic search scenarios ([7], a tool developed within IEL). I propose two strategies for a tutor in teaching situation—for sufficient and for necessary conditions of understanding adopted by tutor. I also provide a dialogue logic overlay for these strategies presenting allowed locution types, tutor–student interaction rules and commitment store rules. With the use of the DL(IEL)T I model examples retrieved from The Basic Electricity and Electronics Corpus (BEE) [4], which consists of tutorial dialogues from electronics courses and present how certain dialogical behaviours may be generated with the use of this system.

KEYWORDS

Questions, tutorials, inferential erotetic logic, erotetic implication, erotetic search scenario.

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SETS OF SITUATIONS, TOPICS, AND QUESTION RELEVANCE

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Our research provides formal tools for analyses of inferential question processing involved in solutions to a specific class of abductive problems. We model this processing in terms of relations of sifting and funneling. Definitions of these relations employ logic of questions, situational semantics, and topic relevance.

We devised materials for this research on the basis of "Mind Maze" tasks. This is a game in which a gamemaster describes a strange story and the players must determine why and how it happened. Solution of each of the tasks is dependent on discovering key pieces of information (which are known to the gamemaster only) by asking auxiliary simple yes-no questions. Thus the task of the player is to process a sequence of questions, posed on the basis of a story's content and subsequent answers of the gamemaster, in order to reach an abductive solution.

We analysed 38 gameplays, which lasted from 5 to 38 minutes. All of the solutions consisted of two general phases. They correspond to Stenning and van Lambalgen's distinction of reasoning to vs reasoning from an interpretation. In the first phase the subjects established interpretation of a problem. In modelling this phase we employ elements of Gabbay and Woods' formal schema of abductive reasoning and Kubiński's logical theory of numerical questions. In the second phase,

in which the subjects actually solved the puzzles, their information processing can be adequately modelled by means of some extensions of situational semantics, incorporating the concepts of topic and question relevance.

Interpreting the concept of topic in terms of situational semantics as a subset of the model's universe we follow general lines proposed by Van Kuppevelt. We consider topics w.r.t. some situational model M, which is an ordered pair $\langle U, v \rangle$ such that U is the model's universe and v is a function assigning to each formula of the considered language a set of situations, in which this formula holds. We also employ the concept of a situational relevance model N of a topic Ω w.r.t. a model M, based on partial assignments of sets of situations to formulas. We define the relations of sifting and funneling for simple yes-no questions, and with respect to certain situational relevance models. Thus the questions $?A_1, \ldots, ?A_n$ are sifting w.r.t. a topic Ω of a certain relevance model N iff the sets of situations assigned to $A_1, \ldots, A_n$ are partitioning Ω, albeit these partitioning need not to be exhaustive. A question $?A$ funnels a topic Ω w.r.t. a certain relevance model N iff A narrows down Ω, and analogously in the case of funneling holding between questions. As we show on the basis of "Mind Maze" gameplays, and on some toy-examples of 20 questions game, relations of sifting and funneling defined with respect to questions and topics account well for empirical data. They also allow for a comparative analysis of the ways in which different subjects solve such kind of abductive problems.

TYPE-THEORETIC ANALYSIS

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My talk will be about type-theoretic analysis as it is understood in Transparent Intensional Logic (TIL). Type-theoretic analysis is a conceptual method that consists in assigning types to some pre-theoretical notions. These types can be atomic or functional. Atomic types are primitive entities. For instance, the type of possible worlds is usually treated as primitive. The same holds for the type of individuals, or truth-values. Functional types are constructed from atomic types. For instance, there is a type of functions from individuals to truth-values (this is the type of the set of individuals). But can type-theoretic analysis be informative? And if yes (as I hold), how exactly? I will suggest one answer to this question, taking some inspiration from the founder of TIL, Pavel Tichý (mainly his understanding of explication). Another question I will try to answer is this one: What restricts the possibilities that one has in providing type-theoretic analysis? I will explain that there are some restrictions relative to the chosen basis, but also some principal restrictions. The last question I will try to answer in the talk is the question of assessing respective suggestions for the appropriate type-theoretic analysis of some pre-theoretical notions. In other words, can we distinguish between better and worse candidates for a type-theoretic analysis, and if yes, how?

KEYWORDS

Basis, conceptual methods, informativeness, Transparent Intensional Logic, types.

ABDUCTIVE QUESTION-ANSWER SYSTEM FOR MINIMAL LOGIC OF FORMAL INCONSISTENCY MBC*

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From the algorithmic point of view [1] products of abductive reasoning (abductive hypotheses [3, 4]) can be described as an additional information H which extends the initial database Γ in such a way that the formula Δ unprovable from Γ becomes provable from $\Gamma' = \Gamma \cup H$. We propose a framework named Abductive Question-Answer System (AQAS) for a minimal logic of formal inconsistency (mbC system) which can be used to generate abductive hypotheses according to the above-mentioned approach. AQAS is based on Wisniewski's Inferential Erotetic Logic (IEL) [5]. The abductive problem is treated as abductive question and transformed into auxiliary questions which are simpler. We introduce abductive rules for construction of partial hypotheses (answers to the auxiliary questions) together with restrictions for those rules. If partial hypotheses are constructed in accordance with the restrictions, then the abductive hypothesis (which consists of partial hypotheses linked with the conjunction and can be treated as an answer to the initial abductive question) is consistent with the database and significant, i.e. the information which was supposed to be derived from the database is not derivable from the abductive hypothesis alone. Such procedure differs from the most common approaches to the problem of abductive hypotheses generation. The

reason is that AQAS constructs "good" hypothesis in one step, while in procedures like [2] firstly a huge number of abductive hypotheses is generated and "trimmed" according to the chosen criteria afterwards.

KEYWORDS

Abduction, logics of formal inconsistency, paraconsistent logic, inferential erotetic logic, erotetic calculi.

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ABOUTNESS, CONTENT EXTRACTION, AND ONTOLOGICAL COMMITMENTS

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In his recently published book *Aboutness* Stephen Yablo has proposed a new strategy for defending nominalism. Instead of engaging in the hard work of paraphrasing a scientific theory which presupposes numbers (or other abstract entities) in a nominalistically acceptable way, nominalists are, according to Yablo, entitled to accept the theory as true, while denying the existence of numbers (or other abstract entities), if from the theory's content the presupposition that there are numbers (or other abstract entities) can be subtracted away, yielding thus the content remainder completely about concrete objects. Perfect extractability, i.e. extractability in every possible world, of a number-free content remainder from any content apparently involving numbers is, in Yablo's view, sufficient to make the existence of numbers moot: he believes that perfect extractability of a nominalistic content remainder would show that no true content expressed by a sentence with a numerical singular term is really about numbers, and that, therefore, recognizing such contents as true does not commit one to the existence of numbers. In my presentation I will argue against Yablo that perfect extractability of a presupposition-free content remainder fails as a criterion of ontological mootness, just as non-catastrophic presupposition failure in Yablo's earlier attempts to espouse nominalism did: it is sufficient neither for establishing that the question of the

existence of numbers (or other abstract entities) has no determinate answer nor for proving that numbers (or other abstract entities) do not exist, since there are nominalistically acceptable objects, positively known to exist, such that every content involving these objects can be, to use a Wittgensteinian phrase, “divided through” by them.

ARGUMENTS BASED ON CONDITIONAL PROMISE

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The talk is devoted to the presentation of the conditional promise arguments – to their structure and proper nature. These arguments are based on the notion of conditional promise, usually interpreted in legal practice as a promise that is subject to the occurrence of an event before the promisor is obligated to perform. Philosophers and lawyers had been attracted by this kind of arguments from ancient times, usually used to deal with those r extreme forms that lead to insoluble arguments or paradoxes. With developing of finer tools for their analysis, today we have probably better way for their analysis and understanding. Several traditional familiar arguments will be presented and compared according to their structure. Also, some modern attempts suggesting mechanisms of their interpretation, in philosophy and legal practice, will be exposed. Applying the schema of interpreting the conditional promise as essentially of dynamical structure (with embodied periods and their succession, based on compliance with the deadline and with different time points of reference), will be proposed as a way of their more successful reading and also as a more effective candidate for interpreting and solving traditional paradoxes based on the conditional promise.

ON INVERSE ANALYTIC METHODS

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In our model, a method is modeled as an ordered set of instructions for actions that aims to solve some problem. Scientific method is just a method used in science to solve some problem of actual cognitive interest. At least in the case of conceptual methods, i.e. methods whose primary objects are concepts, a problem is usually solved by change in the explicit knowledge state. The knowledge state is supposed to raise a problem before the use of a method. Problem is usually a question that does not have an explicit answer within the initial knowledge state. The use of a method changes the knowledge state in order to solve the problem. In other words, new knowledge state should contain an explicit answer to the problem. Analytic method is suggested to be a method that does not cross some type of logical closure of initial explicit knowledge state.

During our research of supposed analytic methods (such as explication, definition, conceptual analysis, idealization and abstraction, all taken as sets of instructions) we discovered inherent underdetermination of these methods. These methods in their ideal form often contain some point of choice, outcome of which cannot be predicted and is not determined. Therefore, the results of use of these methods can vary. Therefore it is not sound to consider methods as functions over knowledge states but rather as relations over the set.

One of the presuppositions of the use of scientific analytic method seems to be that it enriches the explicit knowledge state. In my talk I want to elaborate on the idea of analytic methods that tend to be doing the opposite – they tend to reduce the explicit knowledge base. If we model the methods as relations over the knowledge space, and we pick some method as analytic according to the suggested definition, then we can consider whether its inverse relation over the space is not a model of an analytic method as well.

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Book of Abstracts

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Call for Papers: The Department of Logic and Methodology of Sciences (Comenius University in Bratislava) announces a conference dedicated to reasoning and analytic methods that are used in philosophy and other humanities and social sciences.

The aim of the conference is to enhance understanding of various conceptual and analytic tools or methods used across disciplines, including different forms of cognitively relevant non-deductive arguments.

Those interested in this topic are encouraged to submit contributions concerning some of the following (or related) issues:

- abductive reasoning as a logic of discovery/justification
- evaluation of inductive arguments
- 'possible worlds' as conceptual instruments
- argumentation schemes
- physics, metaphysics and (non-)classical logics
- conceptual methods in philosophy
- thought experiments and armchair methodology

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