Preface

11th International Tbilisi Symposium on Logic, Language and Computation

Hansen, Helle Hvid; Murray, Sarah E.; Sadrzadeh, Mehrnoosh; Zeevat, Henk

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Preface

The Eleventh International Tbilisi Symposium on Logic, Language and Computation was held at the Tbilisi State University in Tbilisi, Georgia, during 21-26 September 2015. The symposium was organized by the Centre for Language, Logic and Speech at the Tbilisi State University, the Georgian Academy of Sciences, and the Institute for Logic, Language and Computation (ILLC) of the University of Amsterdam. The biennial conference series and the proceedings are representative of the aims of the organizing institutes: to promote the integrated study of logic, information and language. While the conference is open to contributions from any of the three fields, it aims to foster interaction among them by achieving stronger awareness of developments in the other fields, and of work that embraces more than one field or belongs to the interface between fields. The scientific program consisted of tutorials, invited lectures, contributed talks, and two workshops.

The symposium offered three tutorials, given on each of the three major disciplines of the conference and aimed at students as well as researchers working in the other areas. The tutorial speakers were Brunella Gerla, Lisa Matthewson, and Joel Ouaknine. Six invited lectures were delivered at the symposium: two on logic by Melvin Fitting and George Metcalfe, two on language by Rajesh Bhatt and Sarah Murray, and two on computation by Helle Hvid Hansen and Mehrnoosh Sadrzadeh. The workshop on How to Make Things Happen in the Grammar: the Implementation of Obligatoriness, organized by Rajesh Bhatt and Vincent Homer featured invited talks by Omer Preminger and Ivy Sichel as well as six contributed talks. The workshop on Automata and Coalgebra was organized by Helle Hvid Hansen and Alexandra Silva and featured invited talks by Bartek Klin, Clemens Kupke, and Stefan Milius.

This volume contains the abstracts for the tutorials and the invited lectures followed by 18 papers that were selected after a rigorous, two-stage refereeing process during which each paper was reviewed by at least two anonymous referees. Here we give a brief overview of their contributions.

Rusiko Asatiani contributes to the semantics of the Georgian verbal morphology by specifying an algorithm for deciding between the active and passive voice. In Georgian, voice has semantic consequences that however do not boil down to a simple semantics of voice. The algorithm predicts on the basis of input cognitive features which voice to choose and consequently also predicts which features can be relevant on a given occasion.

Anja Goldschmidt, Thomas Gamerschlag, Wiebke Petersen, Ekaterina Gabrovska and Wilhelm Geuder investigate the semantics of the German verb *schlagen* (to hit, to beat) using modification by manner adverbs to discover more about the force component in the meaning and agent-oriented adverbs for interactions between force and agentivity. The investigation leads to an analysis of the verb *schlagen* in Frame Semantics.

Justyna Grudzińska and Marek Zawadowski show how a version of dependent type theory can give a more uniform account of the many readings of the indefinite in examples like: *Not every linguist studied every solution that some problem might have*. The diversity of the many readings is a challenge to the traditional generalised quantifier account.

Petr Homola presents a novel method for translating Hobbs approach to interpretation as abduction into answer set programming. This approach overcomes the weaknesses of previous approaches to abduction, which did not allow for automatically rejecting the inconsistent proofs. The current translation pairs abduction with an inference system, where inconsistent proofs are automatically rejected and search space is naturally reduced.

Dawei Jin gives an account of weak and strong intervention effects for *why*-questions in Chinese, based on a distinction between monotone decreasing quantifiers (strong effects) and quantifiers that are indefinite plurals (weak effects).

Liana Lortkipanidze, Nino Amirezashvili, Anna Chutkerashvili, Nino Javashvili and Liana Samsonadze document the design and implementation of their syntactic annotation of the Georgian Literary Corpus. The program tools offer modules for the morphologic, syntactic and semantic levels. The paper gives the description of the automatic syntactic analyser.

Sebastian Löbner extends the frame formalism and its model-theoretic semantics by first-order comparators. These are two-place attributes that capture basic comparison relationships between objects of the same type. The extension is used for giving a general frame decomposition for punctual verbs of change and a number of special cases of such verbs, using a direct implementation of Allen's calculus of temporal intervals.

Ralf Naumann and Wiebke Petersen use logical systems for default reasoning and belief revision to capture semantic prediction and for discarding faulty interpretational hypotheses. The paper thereby gives a logical account of the neurophysiological research findings in which sentence comprehension relies strongly on semantic prediction and, as a result of this, on the retraction of errors.

Peter Sutton and Hana Filip solve the problem of variation between mass and count conceptualisation for the same nouns by distinguishing 4 classes: prototypical count (bird), compound artefacts (furniture), granular (sand) , and substance (mud). These are compared from two perspectives: individuation and consistency, where the context forces one to take priority over the other. This leads to variation for the compound artefacts and the granular nouns.

Henk Zeevat defines a direct semantic interpretation of (augmented) dependency graphs, using ideas from Frame Semantics and from Discourse Representation Theory. Dependency graphs as conceived in the paper are thereby not just useful for evaluating stochastic parsers, but can also be used for disambiguation by semantic methods.

Richard Zuber provides an algebraic characterisation of the so-called reflexive and anaphoric determiners (as in: *John admires most linguists, including himself* or *John and Mary like no authors, except each other*. Such determiners turn out

to be substantially different from ordinary determiners in the algebraic approach to NL semantics going back to Keenan and Faltz.

Alexandru Baltag, Nick Bezhanishvili, Aybüke Özgün and Sonja Smets generalise their previous topological semantics for belief by interpreting belief as the interior of the closure of the interior operator. Their resulting belief logic is strictly stronger than KD4 and strictly weaker than KD45. They encode in these spaces the semantics for conditional beliefs and updates. Relevant soundness and completeness theorems are proved.

Nick Bezhanishvili, Dick de Jongh, Apostolos Tzimoulis and Zhiguang Zhao provide a universal model for the positive fragment of intuitionistic logic. A representation for characterising positive formulae is presented and the universal model is formulated using this characterisation. An alternative proof of a theorem by Jankov is provided, where it is shown that the intermediate logic KC, the logic of weak excluded middle, is maximal with regard to intuitionistic propositional calculus.

Pietro Codara and Diego Valota use formal concept analysis to provide an intuitive semantics for the Gödel-Dummett many-valued logic. The connecting point is the use of a Heyting algebra, which provides a a basis for formal concept analysis and an algebraic variety for the class of Gödel-Dummett logics. A characterisation of Gödel implication and negation is developed in terms of concepts, and a Gödel algebra of concepts is presented.

Zoltán Ésik (RIP) provides a representation theorem for stratified lattices. These are lattices endowed with a certain sequence of preorder relations, representing infinite supplies of truth values, and they have been developed as a framework for solving fixpoint equations of non-monotone operators. The representation theorem is based on the inverse limits of continuous lattices, and has as a corollary that fixpoints of certain weakly monotone functions exist.

Christian Fermüller and Ondrej Majer relate Hintikka's game semantics of Independence Friendly (IF) logic to Giles's game developed as semantics for Lukasiewicz logic. The results are based on interpreting the expected payoffs of IF games as the fuzzy truth values from the interval [0,1]. It is shown that any rational number is the value of a propositional IF Logic formulae and a logic with both fuzzy and IF connectives is developed.

Melvin Fitting provides a new algorithm for connecting modal logics to justification logics. The first such algorithm was developed by Artemov. The current algorithm differs from that of Artemov in two ways. First, it works on the steps of the proof rather than the proof as a whole. Second, the algorithm has two parts, one of which is specific to the modal logic in consideration, in this case S4, the other general to all modal proofs. This two stage process is novel in the literature. The process is automated in Prolog.

Dick De Jongh and Fatemeh Shirmohammadzadeh Maleki develop a Hilbert-style proof system for the basic sub-intuitionistic logic F, introduced by Corsi and Restall, and prove weak and strong completeness theorems. This provides an alternative to the Kripke semantics of logic F, whose frames lack certain fun-

damental properties. Further, the authors show that Intuitionistic Propositional is conservative over the logic F and also over Visser's basic logic.

TbiLLC 2015 was extra special since during the symposium week, Professor Dick de Jongh (University of Amsterdam) and Professor Matthias Baaz (Vienna University of Technology) were awarded honorary doctorates of the Ivane Javakhishvili Tbilisi State University in recognition of their contributions to the Georgian school of logic, mathematics and linguistics over the past two decades. In particular, they have both been instrumental in the success of the TbiLLC symposium series and the Tbilisi Summer School in Logic and Language not only through their scientific contributions, but also by organising and promoting these events, and by obtaining funding to ensure their continuity. The award ceremony took place on 25 September 2016, and it was attended by the symposium participants as well as numerous local staff and students. The opening words were spoken by David Gabelaia (TSU Razmadze Mathematical Institute), followed by speeches by the Rector of the University and member of the Georgian Academy of Sciences, Vladimer Papava, by the renowned Georgian linguist, member and former president of the Georgian Academy of Sciences, Thamaz Gamkrelidze, and by Nick Bezhanishvili, scientific descendant of Dick de Jongh, currently assistant professor at the ILLC, University of Amsterdam. The ceremony concluded with the acceptance speech by Dick de Jongh. A full transcript of all speeches and photos from the ceremony can be found via the TbiLLC 2015 website.

This proceedings volume has the sad honour to contain one of the last papers by Zoltán Ésik, who was a well known and respected member of the theoretical computer science community. We learned the shocking news of Zoltán's passing during the refereeing phase. As both reviewers recommended acceptance and remarked that the manuscript was "written with extreme care" and could be "published virtually as is", we very much wanted to include it in the volume. We are thankful to his widow and son who kindly provided us with their consent to publish the paper. We are also grateful to Dexter Kozen (Cornell University) who solved the practical issue of obtaining the LaTeX source from the PDF manuscript. The preface is followed by a short essay by Dexter Kozen in commemoration of Zoltan Ésik.

We would like to thank all the authors for their contributions, and the anonymous reviewers for their high-quality reports. We would also like to express our gratitude to the organizers of the symposium, who made the event an unforgettable experience for all of its participants. The Tbilisi symposia are renowned not only for their high scientific standards, but also for their friendly atmosphere, and heartwarming Georgian hospitality, and the eleventh symposium was no exception. Finally, we thank the ILLC (University of Amsterdam), Sebastian Löbner and Johan van Benthem for their generous financial support for the symposium.

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Helle Hvid Hansen
Sarah Murray
Mehrnoosh Sadrzadeh
Henk Zeevat