ABSTRACTS
A3.1 Computational Logic and Applications of Logic

Procedural specification of beta-conversion

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Though beta-conversion is the fundamental computational rule of lambda-calculi and functional programming languages, it is underspecified by the commonly accepted rule \x C(x)(A) I- C(A/x). The problem is this. Procedure of applying the function \x C(x) to the argument presented by A can be executed in two different, mutually non-equivalent ways, to wit (a) by value or (b) by name. If by name then procedure A is substituted for all the occurrences of x into C. In this case there are two problems. First, conversion of this kind is not guaranteed to be an equivalent transformation as soon as partial functions are involved. Second, it may yield loss of analytic information of which function has been applied to which argument. The idea of conversion by value is simple. Execute the procedure A first, and only if A does not fail to produce an argument value on which C is to operate, substitute this value for x. This way logical equivalence is preserved and there is no loss of analytic information. Moreover, in practice it is more efficient. The efficiency is guaranteed by the fact that procedure A is executed only once, whereas if this procedure is substituted for all the occurrences of the lambda-bound variable it can subsequently be executed more than once. The notion of reduction strategy in lambda-calculi is similar to the evaluation strategy in programming languages. Only purely functional languages such as Clean and Haskell use call-by-name. For instance, Java does not pass arguments by reference, but by value. My novel contribution amounts to a specification of an evaluation strategy by-value as adapted to Transparent Intensional Logic, TIL. My proposal of the substitution method operating on procedures is similar to Chang & Felleisen (2012)'s call-by-need reduction by value. But their work is couched in an untyped lambda-calculus. TIL, by contrast, is a hyperintensional, partial typed lambda-calculus.

Logics for Collective Reasoning

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In this paper, we discuss the approach based on Social Choice Theoryand Judgment Aggregation to the definition of collective reasoning. We shallmake explicit the aggregative nature of the notion of collective reasoning that is defined in the Judgment Aggregation account and we shall stress that the notion of logical coherence plays a fundamental role in defining collective

attitudes.Unfortunately, as several results in Judgment Aggregation show, coherence is not compatible with fair aggregation procedures.For instance, the majority rule does not guarantee consistent outcomes, as soon as we assume that individuals are capable of very simple logical reasoning.This fact has been generalised to an impossibility theorem by List and Pettit that proves that no aggregation function that satisfies a number of reasonable fairness properties can guarantee rational outcomes.

On closer inspection, the notion of coherence that is jeopardized by Judgment Aggregation is based on classical logic.In this work, we propose to revise the standard view of rationality ofJudgment Aggregation by exploring the realm of non-classical logics. in particular, we will present possibility results for substructural logics. Those logics, we argue, provide a viable notion of collective reasoning.

In particular, we will endorse a proof-theoretical view of logic and we shall analyse which inference rules are responsible of inconsistencies at the collective level.

Modeling decision-making under ignorance and uncertainty

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The traditional approach to decision theory has a very limited application. According to the traditional model of decision-making in order to judge a decision (to perform an action) of a given agent as rational we need to have a set of all possible outcomes (Omega), an agent's utility function (u: Omega → R) and a probability measure, which specifies the probability of certain outcome occuring given that the agent performs a certain action. However in most of everyday decisions (certain gambling games being the exception) we have none of the above elements. Our aim is to model human reasoning in relatively broad range of problems involving decision making. In our talk we will present a framework for decision-making with limited information (decision- making under ignorance) and uncertainty about agent's goals and preferences. We will also allow for the revision of goals and preferences. In this framework we will define the notion of rationality and present decision criteria for making a rational decision relative to the agent's knowledge. We will then show that the traditional approach to decision-making is a special case of our more general, qualitative approach. In the second part of the talk we will set our framework in the context of propositional dynamic logic with epistemic and deontic operators and discuss certain possible axioms regarding qualitative decision making with reference to the abovementioned notions and criteria.