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Logics of context for multiagent systems

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The concept of context turned out to be fruitful for the analysis of multiagent systems. The logics proposed by McCarthy et al. and Giunchiglia et al. provide a formal tool to reason about such contexts. These logics are close to modal logics of knowledge and belief: agent i 's belief that p can be identified with truth of p in the context of i 's beliefs. More generally, logics of context allow to implement agents with mental attitudes, alias BDI agents. (Precise formal links between these two frameworks were established by Massacci, Bouquet, Serafini and Roelofsens.)

We push further the analysis of multiagent systems using contexts. We focus on the notion of viewpoint, and on the notion of acceptance in context. We focus on the following aspects.

- While Hintikka's standard logic of belief adopts an external, objective viewpoint (in other terms, it allows to reason *about* contexts), it has been argued by Giunchiglia et al. that the design of agents requires reasoning *in context*: one has to adopt the internal, subjective viewpoint of a particular agent. We show how the standard logic of belief can be adapted to account for that viewpoint. An immediate benefit is the straightforward extension of Alchourrón, Gärdenfors and Makinson's (subjective) belief revision theory to the multiagent case.
- The standard notion of belief is absolute by nature, and does not depend on the context. In opposition, the mental attitude of acceptance is contextual by nature: whether an agent accepts a proposition or not typically depends on the context, be it that of an argument in a conversation, that of role in an organization or institution, ... For example, in the context of his role, a lawyer may accept his client's innocence while privately believing the contrary; an agent may accept that it is forbidden to kill as a member of the Catholic Church, while accepting that it is allowed to kill as a member of the army; etc. This is related to Minsky's notion of

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frame of mind as studied by Fagin and Halpern. Based on the existing body of work in philosophy of the social sciences by Gilbert, Tuomela and others we define and investigate the logic of acceptance in context. We show that individual acceptance can be straightforwardly extended to group acceptance, and that the latter is different from common belief.

- We argue that the logic of individual and group acceptance provides an appropriate semantics for agent communication languages, combining thus the adequacy of commitment-based approaches with the power of mental states based approaches.
- Within this logic we investigate an agent's identification with a group, providing thus an analysis (ontology) of informal institutions.
- We also show how (part of) the ontology of formal institutions can be built within the logic of acceptance, by means of an embedding of Searle's "counts-as" operator as studied by Jones and Sergot and Grossi et al.
- Finally, we add dynamics to contextual acceptance: we extend the logic by public and private announcements in the style of Plaza's public announcements and event models as proposed by Baltag, Moss, van Benthem, Gerbrandy, van Ditmarsch and others. We show that contrarily to common belief, group acceptance allows for a complete axiomatization by means of reduction axioms.