What do we accept after an announcement?

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The concept of collective acceptance has been studied in the philosophical domain in opposition to group attitudes such as common belief (and common knowledge), that are popular in artificial intelligence and theoretical computer science [2, 6]. The main difference between these two concepts is that the collective acceptance by a set of agents $C$ is based on the identification of the agents in $C$ as members of the same group (or team, organization, institution, etc.) and on the fact that the agents in $C$ recognize each other as members of the same group. Common belief (and common knowledge) does not necessarily entail this aspect of mutual recognition and identification with respect to a social context. In this sense, according to [5, 7], collective acceptance rather than common belief is more appropriate to characterize a proper notion of group belief.

Our starting point is the logic of acceptance proposed in [3]. It has modal operators $A^C_x$, where $C$ is a set of agents and $x$ is a social context. The formula $A^C_x \varphi$ reads ‘agents in $C$ accept that $\varphi$ while functioning together as members of $x$’. Contrarily to standard epistemic and doxastic logic a set of agents’ acceptances is not necessarily consistent (even in the same context). The formula $A^C_x \bot$ simply means that the agents in $C$ are not functioning together as members of $x$: they do not identify themselves with group $x$, they are not part of the organization $x$, etc. The logic of acceptance has a standard possible worlds semantics with an accessibility relation $\mathcal{A}^C_x$ associated to each group-context pair $(C, x)$.\footnote{The accessibility relations have to satisfy constraints of positive and negative introspection, as well as an inclusion principle: when $B \subseteq C$ then either $\mathcal{A}^C_x(w) = \emptyset$, or $\mathcal{A}^B_x(w) \subseteq \mathcal{A}^C_x(w)$, for every possible world $w$. They also have to satisfy a principle of unanimity: if $w' \in \mathcal{A}^C_x(w)$ then $w' \in \mathcal{A}^i_x(w')$ for some $i \in C$.}

Here we present an extension of the logic of acceptance by two kinds of dynamic operators. The first are announcements of the form $x!\psi$, meaning that $\psi$ is announced in the context $x$: the members of $x$ learn that $\psi$ is true in that context, while the other agents do not learn anything. In terms of Kripke models, all agents eliminate $x$-arrows to those worlds where $\neg \psi$ holds from their possibilities. These announcements are similar to private announcements of dynamic epistemic logic [1, 4].

In our logic the formula $A^i_x p \rightarrow [x!\neg p]A^i_x \bot$ is valid: if $i$ accepts $p$ in context $x$, and subsequently learns that $\neg p$ is the case in that context, then the agent is no longer part of the social context $x$. Agents can revise their acceptances in order to (re)enter a social context. To model this we consider
announcements of the form \( i \leftarrow C : x \), meaning that agent \( i \) adopts \( C \)'s acceptances in context \( x \). In terms of Kripke models, the accessibility relation \( \mathcal{A}_{i,x} \) is identified with \( \mathcal{A}_{C,x} \).

The resulting logic has a complete axiomatization in terms of reduction axioms for both dynamic operators. Those for \( x! \psi \) are similar to reduction axioms of dynamic epistemic logic. Those for \( i \leftarrow C : x \) are as follows:

\[
\begin{align*}
[i \leftarrow C : x] A_B y \phi & \iff A_C x [i \leftarrow C : x] \phi & \text{if } x = y, i \in B \text{ and } B \subseteq C \\
[i \leftarrow C : x] A_B y \phi & \iff \top & \text{if } x = y, i \in B \text{ and } B \not\subseteq C \\
[i \leftarrow C : x] A_B y \phi & \iff A_B y [i \leftarrow C : x] \phi & \text{else}
\end{align*}
\]

Other kinds of retraction operations can be devised, and will be discussed in the presentation. For example, we will consider the operation of creating a supergroup \( D \) of a given group \( C \), where \( D \) takes over all of \( C \)'s acceptances. The logical form of such an operation is \([D := C : x]\varphi\). This allows in particular to express that the agents in \( D \) start to function as members of \( x \), i.e. to move from \( A_{D,x} \bot \) to \( \neg A_{D,x} \bot \).

Note that our logic differs from dynamic epistemic logic, where no reduction axiom for announcements followed by the common belief operator exist. Intuitively, it means that \( C \)'s common belief may appear ‘out of the blue’: it was not foreseeable by \( C \) that common belief would ‘pop up’. Reduction axioms for group acceptances can be justified by its constitutive aspects of mutual recognition and identification with respect to a social context. Therefore, our logic of acceptance and announcements provides a simple, elegant and effective way of integrating a revision mechanism into the logic of acceptance. This contrasts with other approaches where a lot of machinery had to be added to dynamic epistemic logics in order to integrate a revision mechanism [8].

References