Social Contexts and Social Pragmatics

(Extended Abstract)

Matteo Baldoni and Cristina Baroglio
Università di Torino, Italy

Amit K. Chopra
Lancaster University, UK

Munindar P. Singh
North Carolina State University, NC, USA

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1. INTRODUCTION

We consider the social relationships between autonomous principals, assuming that each principal is represented in a computational multiagent system via a unique agent. Work on commitment protocols [1, 7] has shown that the meaning of interactions may be expressed in terms of (social) commitments [3]: $C^p(x, y, p, q)$ represents an expectation of y (creditor) that x (the debtor) will bring about q (consequent) if p (the antecedent) holds.

Further, we consider a decentralized setting where only the local states of the participating principals are available. Each local state reflects what the corresponding principal has observed, and carries the intuition of being a local projection of a notional global state. This raises the question of alignment: given that each agent is confined to its local view, but the commitments are interagent artifacts, how can we ensure that the agents remain in a coherent social state? For instance, when delivery relies on a courier, it will not be directly observable by the shopkeeper. The commitment to the delivery of the goods to the client, taken by the shopkeeper, is satisfied when the courier completes delivery. The client will see such a commitment as satisfied. Absurdly, the shopkeeper, who is not situated to observe this event, will not be able to do so.

In human society, the problem is tackled by relying on the concerned parties making suitable claims to one another. We enhance social states in a way that is inspired by such human mechanisms. We adopt the distinction between *practical* and *dialectical* commitments [5]. The latter are traditionally used in dialog theory to record the positions taken by the interlocutors. Instead, we adopt a conception that introduces an indirection from objective reality to a commitment by an agent about the reality, $C^d(x, y, r, p)$ being a claim from x to y about p. We adopt the commitments life-cycle from [6]. Practical and dialectical commitments can show subtle linkages. Some philosophers recognized, on the one hand, the importance of declarations in influencing behavior, and on the other hand, that the authority of observations derives from rules of use that reflect tendencies (dispositions) attributed in specific social settings.

We formalize the social state of an interaction as the set of the social relationships holding in an interaction context, which we consider as a set of principals together with the interactive actions by which they create and manipulate social relationships. Our work tackles how to progress the social state of a context when some events that are relevant to some *practical commitments* are not observable in the context. To this end: (1) we use *dialectical commitments* as *claims* concerning the occurrence of events in other contexts; (2) we define *pragmatic rules* that the agents of a context may share: such rules exploit the normative value of dialectical commitments and enable the progress of commitments to non-observable events.

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2. SOCIAL CONTEXTS

We enhance the formalization in [2] to incorporate dialectical commitments. We express dialectical commitments on *temporal expressions* in *precedence logic* [4]. A principal refers to an active social entity such as a person. An event is either a basic (physical) event, its complement, or an operation on a dialectical or practical commitment. Below, let $\mathcal{P}$ be a nonempty, finite set of principals. Let $\mathcal{B}$ be a nonempty set of events. Let $\mathcal{E}$ be event temporal expressions generated from $\mathcal{B}$. Let $\mathcal{C} = \{C(x, y, r, u) : x, y \in \mathcal{P} \text{ and } r, u \in \mathcal{E}\}$, be the set of possible commitments. Let $\mathcal{S}$ be the set of possible operations on commitments. Let $\mathcal{A} = \mathcal{E} \cup \mathcal{S}$ be a set of events. A *(social) context* relates principals with the events they generate in that context.

DEFINITION 1. *A* context *is a tuple* $X = \langle \alpha, C \rangle$ *where* α *is a partial function* $\alpha : \mathcal{P} \mapsto 2^{\mathcal{A}}$ *that associates a principal with a set of events and* $C \subseteq \mathcal{C}$ *is a set of commitments (over* $\mathcal{P}$ *and* $\mathcal{E}$*). A principal* $p \in \mathcal{P}$ acts in *a context* α *iff* $\alpha(p) \neq \emptyset$*. An event* $a \in \mathcal{A}$ arises in *a context* X *iff* $(\exists p \in \mathcal{P} : a \in \alpha(p))$*. A context is* nonempty *when* $\alpha \neq \emptyset$ *and* $C \neq \emptyset$*.*

C is the set of the commitment specifications for the context. An action $e \in \mathcal{E}$ is *relevant to* a commitment $C(x, y, r, u) \in \mathcal{C}$ iff one of the following holds: $r/e \not\equiv r$, $r/\overline{e} \not\equiv r$, $u/e \not\equiv u$, or , $u/\overline{e} \not\equiv u$. In words, e is relevant to $C(x, y, r, u)$ when e is involved either in r or u. So, e is significant in the expiration, violation, discharge, detachment, or progression of the commitment. A context X is *closed* iff for every

commitment $c \in C$ every event $a \in \mathcal{A}$ that is relevant to c arises in X. A context that is not closed is *open*.

Let $X = \langle \alpha, C \rangle$ be a context. For an event $a \in \mathcal{A}$, the *observers* of a in X, $obs(a) \subseteq \mathcal{P}$, is a set of principals who can observe the occurrence a. Events that amount to operations on commitments are always observed by all principals. A context X is *social* iff for every $a \in \mathcal{A}$, that arises in the context, $obs(a) \supseteq \mathcal{P}$.

Let $X = \langle \alpha, C \rangle$ be a social context. Let τ be a run where, for each event a_k, either a_k arises in X or there is a commitment $c \in C$ such that a_k is relevant to c, and let $p \in \mathcal{P}$ be a principal of the context. Let $\tau|_p$ be the run obtained from τ by considering only those a_k such that $p \in obs(a_k)$. Then, the *projection* $\pi(\tau, i, p)$ is the set $\{c \in C : \tau|_p \models_i c\}$.

Proposition 1 (Alignment for Closed Contexts). *Let X be a closed social context. Let τ be a run. For any pair of principals $p', p'' \in \mathcal{P}$ and index k, $\pi(\tau, p', k) \equiv \pi(\tau, p'', k)$.*

Proposition 1 does not generally hold in open contexts. We now show how dialectical commitments can be used to provide testimonies about relevant events that are not observable within an open context.

Definition 2 (Context closed under claim). *A social context $X = \langle \alpha, C \rangle$ is said to be* closed under claim *when for every* practical commitment $c \in C$*, for every event $a \in \mathcal{A}$ that is relevant to c but which does not arise in X, there is an event $create(C^d(x, Y, a)) \in \mathcal{A}$, that arises in X, where $x \in \mathcal{P}$, $x \in obs(a)$, and $Y \subseteq \mathcal{P}$.*

Clearly, all closed contexts are also closed under claim. Given an open context $X = \langle \alpha, C \rangle$, Algorithm 1 will create a social context that is an extension of it, and that is closed under claim. Notice that when commitments involve some event that cannot be observed by any of the principals, the context should be extended by including further principals who can observe the events at issue.

Algorithm 1 Closure under Claim of an Open Context

Require: $X = \langle \alpha, C \rangle$ is a social context
Require: A' is the set of events that do not arise in X, and each of which is relevant to some practical commitment $c \in C$
Require: for any $a' \in A'$, there is at least one $p \in \mathcal{P}$ such that $p \in obs(a')$

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1: function CLOSURE(X = ⟨α, C⟩, A')
2:     α' ← α; C' ← C
3:     for all a' ∈ A' do
4:         x ← one of p ∈ P, such that p ∈ obs(a')
5:         Y ← P − obs(a')
6:         α'(p) ← α'(p) ∪ {create(C^d(x, Y, a'))}
7:         C' ← C' ∪ {C^d(x, Y, a')}
8:     end for
9:     X' ← ⟨α', C'⟩
10:    return X'
11: end function
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Pragmatic rules are patterns of pragmatic reasoning that a *social context* may or may not adopt. We define a pragmatic rule (*Social Recognition* of a claim) to enable to consider dialectical commitments to events as sufficient claims that can be used to progress commitments:

$$\frac{C^d(w, z, t)}{C^p(x, y, r, q) \longrightarrow C^p(x, y, r/t, q/t)}\ SR$$

The intent is detaching or discharging practical commitments based upon the creation of appropriate dialectical commitments; raising the violation or expiration of practical commitments in presence of appropriate dialectical commitments. The dialectical commitment bridges between two contexts: the one in which the event occurred and the one in which it is socially relevant but where it does not arise.

In order to exploit the pragmatic rule SR, we require that:

$$\tau \models_i C^d(w, z, t) \wedge \tau \models_i C^p(x, y, r, u) \Rightarrow \tau \models_{i+1} C^p(x, y, r/t, u/t) \quad (1)$$

Proposition 2 (Alignment under Claim). *Given an open social context $X = \langle \alpha, C \rangle$, such that for any relevant event that does not arise in X, at least one of the principals in X observes it: (1) Let $X' = \langle \alpha', C' \rangle$ be the context closed under claim, that is produced by applying Algorithm 1 to X; (2) Let τ be a run where each event a_k either arises in X or there is a commitment $c \in C$ such that a_k is relevant to c; (3) Let τ' be the run, that is obtained by substituting to each a_k in τ, that is relevant to a commitment but that does not arise in X, the creation of the corresponding dialectical commitment, taken from X'. For any pair of principals $p', p'' \in P'$, and for each index i, we have that $\pi(\tau', p', i) \equiv \pi(\tau', p'', i)$.*

Theorem 1 shows that practical commitments still progress when adopting SR and considering dialectical commitments as evidence. The proof is simple by construction.

Theorem 1. *Given a social context $X = \langle \alpha, C \rangle$ that is closed under claim, and assuming requirement (1), if $\tau \models_i C(x, y, r, u)$ and $\tau_i = e$, then*

$$\tau \models_{i+1} \begin{cases} Expire(C(x, y, r/e, u/e)) & \text{if } r/e \doteq 0 \\ Violate(C(x, y, r/e, u/e)) & \text{if } r/e \doteq \top,\ u/e \doteq 0 \\ Discharge(C(x, y, r/e, u/e)) & \text{if } u/e \doteq \top \\ C(x, y, r/e, u/e) & \text{otherwise} \end{cases}$$

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