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1 Interpersonal relationship

Social relationship and its effects on behavior lies at the heart of social science. It was proved that understanding interpersonal relationship is crucial for social cognition [3]. Most of the literature that get interested in the conceptual analysis of interpersonal relationship have agreed that the essence of relationship appears in the nature of interaction that occurs between relationship partners. Moreover, social relationship is a dynamic system that may develop and change continuously over interactions [3, 4]. Communication between relationship partner will grow in stages from the initial interaction where partners share superficial information to a more deeper relationship where partners can share more personal information. Therefore, the social relationship of partners affects their behavior and their strategy of dialogue.

2 Representation of interpersonal relationship

The aim of this section is to relate the work of N.HASLAM who get interested on the mental representation of social relationship. In summary, there are three different representation in the literature.

The first is the dimensional representation. It is the most common representation that consists on represent relationships in a dimensional circle (c.f wiggins model). Therefore, any relationship can be situated and valuated in this *continuous* dimensional space.

The second representation is the lawful representation. Laws are defined in the same circle's dimension of affiliation and control. The main difference with the dimensional representation is that laws try to make discrete prediction about the other behavior. For each behavior, complementarity and symmetry make discontinuous prediction about the the other interact behavior.

Finally, categorical representation make a discrete prediction on which kind of social relationship are well performed. In addition the categorical representation focus only on local prediction (prediction in a small region within a dimensional scheme).

Dimensions	Laws	Categories
Continuous	discontinuous	discontinuous
Local	Global	Local

2.1 Dimensions of interpersonal relationship

The definition of dimensions was widely studied under different labels. However, we distinguish four dimensions that are always used for the representation of interpersonal relationship.

Dominance and power Scholars from different fields converge to define power as the ability to influence the other behavior [4]. Power may be latent (Komter, 1989), which is in contrast with the definition of dominance which is inevitably manifest (Dunber, 2004). It is an asymmetric variable in which one interactant's assertion of control is met by acquiescence from another (Rogers-Millar & Millar, 1979).

Familiarity In Svennevigs relational model [4], the definition of familiarity is based on social penetration theory (Berscheid and Reis, 1998) which describe the grades of relationship evolution through mutual exchange of information both in depth (superficial information to personal and intimate information) and breadth(from narrow to a broad range of personal topic).

Affect This dimension represent the degree of liking that have one interact for the other. This dimension allows interactants to create personal attachment and improve the relationship of interactants [2]

Solidarity The solidarity dimension is in the opposite of power dimension. It is a symmetrical dimension where two individuals share equal obligations and rights [4]. Is is identified as like-mindedness [1] where interactants have the same behaviors and share for example the same preferences.

2.2 Dialogue utterances

In this paper we are interested by modeling a collaborative negotiation of preference in the context od social dialogue. The negotiation takes its values during the dialogue, when messages are exchanged between interlocutors. A message $M = <i \rightarrow j, s(cont), F>$ is defined as triple where $i,\ j \in$ {agent, user} are the agents participating in the dialogue,$s \in \wp\ s$ is the utterance used to express a the message. $\wp = \{Ask, Propose, Reject, Accept, State\}$ represent the set of utterances that agents can express to exchange messages. $F \in \Im$ where $\Im = \{Strongly, weakly, yelling, withhesititation...\}$ is a set of multimodal features that are applied to the utterance to express a personal linguistic style or social move.

   The social relationship evolves during the interaction and influence this later. We focus on the relation of dominance in this paper. $Dom = \{+, -, =\}$. For example, when $Dom = +$ represents the fact that the agent is dominant and the user is submissive. We assume a social relationship: $2^{\wp}\ x\ context \rightarrow Dom$ that tells which feature says in term of social move. The context represent all the previous knowledge of the speaker.

Preferences Now, that the model of communication is defined, we introduce the notion of negotiation on preferences. First, lets define the domain of preference. We assume that the agent express its preference on a defined object based on one or multiple criteria.

- Criteria C: a set of preferred objects. For example, we assume that we can choose a restaurant based on one or several of the following criteria $= \{$cuisine, ambiance, quality of food, price, location$\}$. $\forall c \in C$, D_c is its domain. For example $\mathsf{cuisine} = \{\mathsf{chineese}, \mathsf{italian}\}$.
- Objects O : Set of all possible objects of negotiation. For example, negotiate to find the object restaurant.
- $\forall o \in O, \forall c \in C$, we define $v(c, o) \in D_c$ as the objective value of preference attributed for the object o in the context of the criteria c. For example, Ginza is an expensive Japanese restaurant. Thus $v(\mathsf{prix}, \mathsf{Ginza}) = \mathsf{exprensive}$ and $(\mathsf{cuisine}, \mathsf{Ginza}) = \mathsf{japanese}$.
- Lets now define interlocutor's preferences. $\forall \mathsf{agent_i}$.Imagine hat the agent has to choose a restaurant, depending on the criteria that matters for him first and depending on those criteria, the agent will choose a restaurant. First, the agent has to know his preferences on criteria represented as follows: Pref_i^C is a total ordered set of criteria. $\mathsf{cuisine} >_c \mathsf{price}$ means that the criteria of cuisine is more important than the price. Second, when the criteria is defined, the agent i defines his preferences on the domain of this criteria. Thus, $\forall c$ pre-odrerd in $D_c : \mathsf{pref_i(c)}$. For example, the agent prefers the cuisine criteria, and for the cuisine the agent i: Japanese $>_{\mathsf{cuisine}} \mathsf{chinois}$, which means that the agent prefers the Japanese cuisine than the Chinese.

- State.Preference(*Pref*) : I like *Pref*
  Agent express *Pref* to user. After communicating the message, the mental state of the agent will be updated as the following:
  (Bel Agent *Pref*)
  (Bel Agent (communicated Agent *Pref* User)).
- Ask.Preference(*Pref*) : Do you like *Pref* ?
  Here the intention of the agent is to identify if the user believes *pref*.
  (INT Agent (Identify user *Pref*))
- Propose.Preference(*Pref*): I think that *Pref* would be great.
  (Bel Agent *Pref*)
  (INT Agent (Achieve Agent(Bel User *Pref*)))
  (Bel Agent (communicated Agent *Pref* User)).
- Accept.Preference(*Pref*): Okay, let's choose *Pref*. After receiving a propose utterance from the user, the agent might accept the proposal. The mental state of the agent is:
  (MB Agent User *Pref*))
- reject.Preference(*Pref*): Sorry, I would choice something else.
  (Not (Bel Agent *Pref*))
  (Bel Agent (communicated Agent (Not (Bel *Pref*)) User)).
  In the experiment and in the modeling of the first dialogue, the dominant was able to insist and propose several times the same proposition. I'm not sure

if a special utterance will be needed or we can simply use the utterance *ProposeStrongly*. Dans la dfinition dans ces utterances. est que l'agent exprime dans ce cas sa dominance. et si c'est le cas, l'expression de sa dominance est implicite.

– StateStrongly.Preference(*Pref*): I really like *Pref*.
– ProposeStrongly.Preference(*Pref*): *Pref* is the best choice for you.
– AcceptStrongly.Preference(*Pref*): Yes of course. *Pref* is a great choice.
– RejectStrongly.Preference(*Pref*): I really don't like *Pref*. I'd rather prefer something else.

2.3 Find utterances in dialogues

In the following I represented the utterances in the hand made dialogues. When analyzing the recorded dialogues, the utterances appears in a more implicit manner. For example, when Lauriane says: " Sinon j'aime bien japonais". here its a State.preference(Lauriane, leonor,japonais).Loenor perceives it as a propose and make a reject by saying : "Je n'aime pas du tout le japonais." Dialogue Utterance

2.4 Synthetic dialogue with utterances

In this section, I present a synthetic dialogue to illustrate the language definition.Yhe goal of the agent is to invite the user to a restaurant. The Agent has a predefined list of preferences of types of food (AgentPreferences = { +Indian, +Italian, -Japanese}) and the agent has no information on user preferences (UserPreferences = {}). In this example the Agent is peer with the user.

1. A: Would like to have dinner with me ? 1. Propose.Preference(A,U,dinner).
2. U: Yes, that would be great. 2. Accept.Preference(U,A,dinner).
3. A: What kind of food do you prefer ? 3. Ask.Preferences(A,U,UserPreferences)
4. U: I like Japanese food 4. State.Preference(U,Japanese)
5. A: Oh, I really don't like japanese food. 5. RejectStrongly.Preference(A,U,Japaneese)
6. U: Ok. What do you prefer ? 6. Ask.Preferences(U,A,AgentPreferences)
7. A: I like italian food 7. State.Preference(A,italian).
8. U: Yeah, I like italian food too. 8. State.Preference(U,italian).
9. A: So let's have dinner at an italian restaurant. 9. Propose.Preference(A,U,Italian).
10. U: perfect for me! 10. Accept.Preference(U,A,Italian).

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