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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 valued 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 (Dunbar, 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 Svennevig's 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 represents 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]. It is identified as like-mindedness [1] where interactants have the same behaviors and share for example the same preferences.

## 2.2 Dialogue utterances

The utterances are the intentions to update the tuser /agent belief during the interaction. To define the utterances semantic, we will use the language definition defined in [?]. **BEL** is short for belief, **INT** for intention and **MB** for mutual belief. We define a preference as tuple  $\{P = (O, v) / O \in \text{Ontology}, v \in \{+, -, ?\}\}$ , where O is the object preferred. For example, if the agent like Japanese restaurant then  $P_{\text{agent}} = (\text{Japanese}, +)$ . Dominance  $\in \{-, =, +\}$ , where dominance = +, means that the agent dominates the user. The knowledge base of the agent represent its beliefs (self representation, user representation) and intentions. Thus we note:

- belief  $B_{\text{agent}} \Pi$ .
- belief  $I_{\text{agent}} \Pi$ .

We note  $\text{Pref}_i(p)$ , where p is a preference and  $i \in \{\text{agent}, \text{user}\}$

- 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. The 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.

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|--|---|
| 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).         |

## References

1. Timothy W Bickmore and Rosalind W Picard. Establishing and maintaining long-term human-computer relationships. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 12(2):293–327, 2005.
2. Carolyn Y Nicholson, Larry D Compeau, and Rajesh Sethi. The role of interpersonal liking in building trust in long-term channel relationships. *Journal of the Academy of Marketing Science*, 29(1):3–15, 2001.
3. Harry T Reis, W Andrew Collins, and Ellen Berscheid. The relationship context of human behavior and development. *Psychological bulletin*, 126(6):844, 2000.
4. Jan Svennevig. *Getting acquainted in conversation: a study of initial interactions*, volume 64. John Benjamins Publishing, 2000.