Interpersonal Attitude of a Speaking Agent in Simulated Group Conversations

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Abstract. Embodied Conversational Agents have been widely used to simulate dyadic interactions with users. We want to explore the context of expression of interpersonal attitudes in simulated group conversations. We are presenting a model that allows agents to exhibit a variety of non-verbal behaviors (e.g gestures, facial expressions, proxemics) depending on the interpersonal attitudes that they want to express within a group while talking. The model combines corpus-based and theoretical-based approaches and we present a preliminary implementation of this model.

1 Introduction

There is a growing interest for Embodied Conversational Agents (ECAs) that interact in small group situations that implies generally three to twenty interactants [1]. We propose an agent's model that allows them to adapt and exhibit different nonverbal behaviors when talking, depending on the interpersonal attitudes that they want to express. Interpersonal attitude is an "affective style that can be naturally or strategically employed in an interaction with a person or a group of persons"[2]. We are using the representation from Argyle to manipulate agent's interpersonal attitudes [3]. Our approach is based on a combination of behavior models coupling a data-based model of conversational gestures and a rule-based model of group formation that simultaneously influence the ECAs' nonverbal behavior from the literature of Human and Social Sciences. Previous works were either missing the influence of interpersonal attitudes on agent's exhibited behavior [4–6] or was not considering group formation behavior (i.e. simulated group conversation) [7, 8].

2 Our Augmented *Behavior Planner*

Our model works as a *Behavior Planner* that takes into account the interpersonal attitudes the agent wants to express to select the appropriate nonverbal behaviors. Interpersonal attitudes can be expressed with nonverbal behavior in both dyadic [9, 10] and small group interactions [11]. A more dominant person tends

to do more gestures [9] and mutual gaze is a sign of dominance or friendliness [10]. In [11], Mehrabian describes eye gaze, posture and distance as important behaviors that impact the evaluation of attitude in small group interactions.

2.1 Two-stage influence

On one hand we are influencing the nonverbal behavior related to conversational and performative intents (e.g. facial expression, gestures, head orientation). On the other hand, we are influencing the behavior related to group formations and cohesion (e.g. gaze behavior, interpersonal distance and body orientation). We limited the generated conversational nonverbal behavior only for the ECA that is speaking but we plan to consider other conversation roles in the future. As we are integrating two models that both influence the nonverbal behavior of an agent, we define the following mechanism to combine them: on each modality, the two stages are given a weight (which sum equals to 1) to indicate the degree of influence each model has on the modality. We are now presenting the first stage. The nonverbal conversational behavior that we are considering in our model is the following: presence of gestures and head movements, type of facial expressions, head orientation, presence of gaze avoidance, spatial extent and power of the gestures. Depending on the speech act and the desired expressed attitude, the generated nonverbal behavior should vary. In order to do this we integrated the model developed in [12] with the current model. We are manipulating the probabilities to select particular values for our parameters following this network. A possible outcome for a dominant attitude would be for instance wide and powerful gestures and an upward head, no gaze avoidance and a neutral facial expression. For a friendly attitude, the agent might perform the speech act using a smiling face, tilting his head on the side with wide and smooth gestures. The second stage of our Behavior Planner is the influence of the attitude on the ECA behavior that manages the group formation and cohesion, in particular the interpersonal distance, the gaze behavior and the body orientation. Based on Hall's proxemics [13] and Kendon F-Formation [14] theories, our model adds on top of these a set of rules to configure this spatial organization depending on the social attitude. When performing a speech act, the model chooses for the speaking agent which other member (human or agent) is its preferred target for a glance, the importance of maintaining an body orientation related to the group or to the adressee and how close it wants to stand to each other member within its social space. For instance, the agent should have a higher probability to glance at the group member towards which it expresses submissiveness or friendliness, stand closer with group members towards which it expresses friendliness or a neutral status level and it should orient its body more directly towards group members with which it expresses submissiveness [11].

2.2 Combining the models

This Behavior Planner takes as input the interpersonal attitudes of the agent towards all the other agents. The first stage instantiates this speech act into

upper body nonverbal behavior (facial expression, presence of gestures and head movement, head orientation, spatial extent and power of gestures) considering the interpersonal attitude towards the adressee. The other stage, computes the body orientation, the interpersonal distance and the group member which is looked at within an F-Formation. On top of this, the combined model computes the preferred target, the weights for the body orientation modality (more weight from the group formation model resulting in an orientation more consistent with the group and less towards the adressee) and the desired interpersonal distances between all characters in their social spaces.

3 Implementation

The preliminary implementation of our model relies on two separate technologies, the VIB platform [15] and the Impulsion[3] AI engine. VIB is a SAIBA compliant platform for the generation and realization of multimodal behavior for ECAs. In [12], we extended the *Behavior Planner* of this platform with a bayesian network to generate the agents' nonverbal behavior to express different social attitudes in dyadic interactions. The Impulsion AI engine is a software platform developed to improve ECAs nonverbal behavior in social simulations with particular emphasis on F-formation systems and gatherings. The engine is grounded on Scheflen's human territories and Kendon's F-Formation [14] theories and it provides ECAs with autonomous generation and realization of gaze, proxemics and body orientation behavior supporting a simulated group conversation. VIB and Impulsion have been deployed within the Unity3D[4] game engine. In this implementation, we geared up a set of ECAs with an integrated version of VIB and Impulsion. We have coordinated this integration by allowing VIB to control the upper body part (gestures and facial expressions, the head orientation is not handled by VIB in this implementation), while Impulsion is controlling the interpersonal distances, body orientation and gaze behavior. This integration is still work in progress and presents two challenging issues that we need to address: the whole orchestration of nonverbal behavior needs to be consistent with the intended social attitudes that we aim to express and, at a lower level, we are working on blending the resulting animations corresponding to the behaviors exhibited.

4 Conclusion

In this paper, we have presented a model for generating the nonverbal behavior of an agent displaying different attitudes within a group and a preliminary implementation. This novel approach introduces some challenging issues that we need to address: on a theoretical level, we need to assess if two separate models of social behavior are compatible when combined together to generate believable and consistent behavior. We are aware that the model for attitudes in dyadic interactions cannot simply be migrated to small group interactions.

[3] http://impulsionproject.net
[4] http://www.unity3D.com

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References

1. Beebe, S.A., Masterson, J.T.: Communication in small groups: principles and practices. Boston: Pearson Education, Inc (2009)
2. Scherer, K.: What are emotions? and how can they be measured? Social Science Information (2005)
3. Argyle, M.: Bodily Communication. University paperbacks. Methuen (1988)
4. Prada, R., Paiva, A.: Believable groups of synthetic characters. In: Proceedings of the fourth international joint conference on Autonomous agents and multiagent systems, ACM (2005) 37–43
5. Traum, D., Rickel, J.: Embodied agents for multi-party dialogue in immersive virtual worlds. In: Proceedings of the first international joint conference on Autonomous agents and multiagent systems: part 2, ACM (2002) 766–773
6. Pedica, C., Högni Vilhjálmsson, H.: Spontaneous avatar behavior for human territoriality. Applied Artificial Intelligence **24**(6) (2010) 575–593
7. Lee, J., Marsella, S.: Modeling side participants and bystanders: The importance of being a laugh track. In Vilhjlmsson, H., Kopp, S., Marsella, S., Thrisson, K., eds.: Intelligent Virtual Agents. Volume 6895 of Lecture Notes in Computer Science. Springer Berlin Heidelberg (2011) 240–247
8. Damian, I., Endrass, B., Huber, P., Bee, N., André, E.: Individualized agent interactions. In: Motion in Games. Springer (2011) 15–26
9. Carney, D.R., Hall, J.A., LeBeau, L.: Beliefs about the nonverbal expression of social power. Journal of Nonverbal Behavior **29** (2005) 105–123
10. Burgoon, J.K., Buller, D.B., Hale, J.L., de Turck, M.A.: Relational Messages Associated with Nonverbal Behaviors. Human Communication Research **10**(3) (1984) 351–378
11. Mehrabian, A.: Significance of posture and position in the communication of attitude and status relationships. Psychological Bulletin **71**(5) (1969) 359
12. Ravenet, B., Ochs, M., Pelachaud, C.: From a user-created corpus of virtual agent's non-verbal behaviour to a computational model of interpersonal attitudes. In: Proceedings of Intelligent Virtual Agent (IVA) 2013. (2013)
13. Hall, E.T., Hall, E.T.: The hidden dimension. Volume 1990. Anchor Books New York (1969)
14. Kendon, A.: Conducting interaction: Patterns of behavior in focused encounters. Volume 7. CUP Archive (1990)
15. Niewiadomski, R., Bevacqua, E., Mancini, M., Pelachaud, C.: Greta: an interactive expressive eca system. In: Proceedings of The 8th International Conference on Autonomous Agents and Multiagent Systems - Volume 2. AAMAS '09, Richland, SC, International Foundation for Autonomous Agents and Multiagent Systems (2009) 1399–1400