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Interacting with socio-emotional agents

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Abstract

In this paper I present our current work toward endowing virtual agents with socio-emotional capabilities. Through its behaviors, the agent can sustain a conversation, display emotional states as well as show various attitudes and levels of engagement. I will describe methods, based on corpus analysis, crowd-sourcing or motion capture, we are using to enrich its repertoire of multimodal behaviors. These behaviors can be displayed with different qualities and intensities to simulate various communicative intentions and emotional states. We have been developing a platform of humanoid agent able to interact with humans. I will describe an interactive system of socio-emotional agent dialoging with human users.

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1. Introduction

Within the past years we have developed a platform of Embodied Conversational Agent, Greta (Niewiadomski et al., 09). This platform meets the requirements of the standardized architecture SAIBA (Kopp et.al, 06). Saiba is composed of three main modules. The module *Intention Planner* automatically generates communicative intentions of the agent. We use the representation language Function Markup Language-Affective Presentation Markup Language FML-APML (Mancini & Pelachaud, 08) based on the theory of communicative functions proposed by Isabella Poggi (2007). FML-APML describes the communicative functions that the agent wishes to convey by its behavior. The module *Behavior Planner* receives as input the communicative intentions of the agent, which can be speaker or listener, written in FML-APML. The module generates a list of multimodal behaviors with time-stamps to organize them across each other and to the spoken text to be said aloud. The behaviors are described by the representation language Behavior Markup Language, BML (Kopp.et.al., 06). BML describes behaviors symbolically, while being independent of the technology of animation and geometry selected for the agent. The output of this last module is sent to a player that can be set on different devices (PC, mobile, web, robot, etc.).

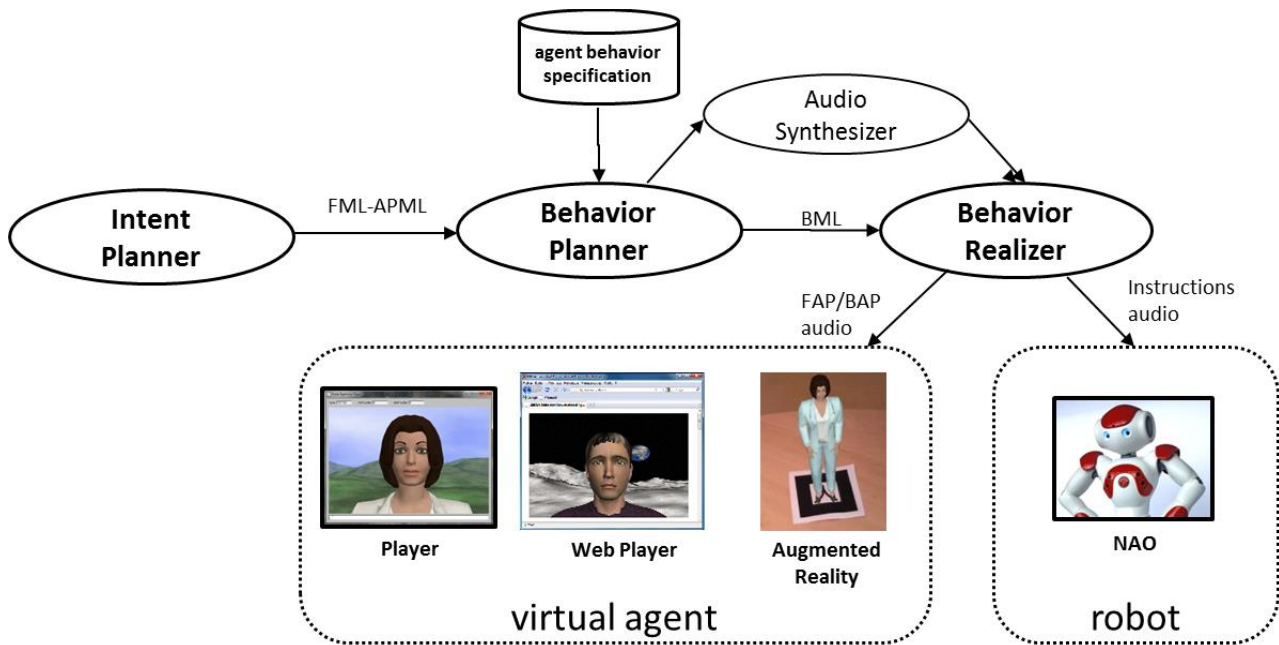


Fig. 1. The overall architecture of the Greta platform

2. Modeling social signals

When interacting with humans, agents should be capable of starting an interaction and of maintaining it (Sidner et al, 04). By displaying multimodal signals, referred as feedbacks, they indicate they pay attention to their interlocutor but also they agree or disagree, etc (Bevacqua et al, 2011). However when fully engaged in an interaction, conversational partners may align their behaviors with those of their partners, to imitate, and to synchronize with them. Alignment may involve a large range of phenomena such as lexical alignment, postural one, expression of emotions. During an interaction, participants can get synchronized by imitating the behavior of their partners, such as nodding or smiling. They can also bring their social attitudes (eg showing a polite smile when the other participant does so).

At first we have focused on a particular signal, namely smile, and lately on laughter. We present our work in this research direction in the next subsections.

2.1. Social functions of smile

We have developed a computational model that allows virtual agents to line up with their counterparts in synchronizing their behavior and adapting their social positions (Ochs & Pelachaud, 2013a). To overcome the difficulty of analyzing the multimodal behavior of humans in real-time with high accuracy, we first study the interactions in agent-agent interaction. We chose to study a particular signal: smile. A smile improves the overall perception of a person and even of a virtual character (Krumhuber et al, 08). In addition, a smiling virtual agent improves human-machine interaction; eg the user is more motivated and more enthusiastic in his task. Smile can have several communicative functions; for each of them the morphology of smiles varies. To capture this variability into a virtual agent, we selected a set of morphological features involved in smiles description.

First, we designed an interface that allows users to create smiles for different communicative functions (fun smile, politeness, embarrassment) on a virtual agent (Ochs & Pelachaud, 2013a). Users can create a smile by selecting values for any parameters involved in the characterization of a smile: labial parameters, lip tension, crow feet, etc. Using statistical technique, the morphological characteristics of smiles were determined for each communicative function. We found that smiles associated with a particular social attitude shared morphological characteristics. The next step was to evaluate if those smiles were perceived by human participants. A computational model based on a probabilistic model of the perception of smiles of the virtual character was developed. This model allows evaluating how user perceives potentially the social attitude of the virtual character during the interaction (Ochs & Pelachaud, 2013b).

When our interlocutor smiled back at our own smile, you tend to keep smiling; that is we modulate our behavior to the behavior of our partners; our behaviors align to each other. We call this effect the ‘snowball effect’ (Prepin and Pelachaud, 11). This coupling acts as a mutual reinforcement. In our work, we model this snowball effect by allowing a virtual agent to change their behavior on the fly. This change is made in the calculation of the character’s animation. The agent is aware of its own behavior and is able to perceive the behavior of others. When a virtual agent smiles at its interlocutor, and sees the other smiles back, it continues to smile (Prepin et al, 2013).

2.2. Other social sign, laughter

We study another important social signal: laughter. As for smile, laughter has several communicative functions. It can result from a joke but it can also be a sign of social cohesion, embarrassment, irony ... In the ILHAIRE project[†] we focus on two specific functions: laughter and hilarious social laughter. Through perceptual studies we measure the impact of certain signals in the perception of the agent. For example, we conducted an experimental study for understanding the link between the perception of the intensity of laughter and of facial expressions (type and intensity of muscular contractions). We have developed learning models based on HMM from motion capture data (Ding et al, 14). Our model can render rhythmic body movement involved in laughter as well as shaking movement of shoulder, head movement, lip shapes... (see Figure 2).

We have conducted an experiment where participants were asked to tell a riddle to an agent or to listen to the agent telling a riddle. Two conditions were considered: the agent would either smile or laugh at the end of the riddle told by the participant. The social attitude perceived by the participant of the smiling agent was perceived significantly different than the one of the laughing agent. The smiling agent was perceived stiffer, colder and more boring. Moreover the participant found his own riddle less funny when the agent just smiled at it. The choice of the social signal of the agent, here a smile or a laugh, affects not only how the agent is perceived, which social attitude it expresses, but it also acts on the perception participant have of their own behaviors. That is, participants integrate agent’s reaction when evaluating what they are saying (here a riddle).

[†] <http://ilhaires.eu/>



Fig. 2. Example of a laughing agent

3. References

1. Bevacqua E., de Sevin E., Hyniewska S., Pelachaud C., A listener model: Introducing personality traits, *Journal on Multimodal User Interfaces*, special issue Interacting ECAs, Elisabeth André, Marc Cavazza and Catherine Pelachaud (Guest Editors), July 2012, 6(1-2), pp 27-38.
2. Ding Y., Prepin K., Huang J., Pelachaud C., Artières T., Laughter animation synthesis, 13th International Conference on Autonomous Agents and Multiagent Systems AAMAS'14, Paris, pp 773-780, May, 2014
3. Kopp, S. Krenn, B. Marsella, S. Marshall, A. N. Pelachaud, C. Pirker, H. Thorisson, K.R. and Vilhjálmsson. H. Towards a common framework for multimodal generation: The behavior markup language, In IVA Conference, 2006, 21–23.
4. Krumhuber, E., Manstead, A., Cosker, D., Marshall, D., Rosin, P.: Effects of dynamic attributes of smiles in human and synthetic faces: A simulated job interview setting. *Journal of Nonverbal Behavior* 33 (2008) 1–15
5. Mancini M., Pelachaud, C. The FML - APML language, The First FML workshop, AAMAS'08, Estoril, Portugal, May 2008
6. Niewiadomski, R., Bevacqua, E., Mancini, M., Pelachaud, C. Greta: an interactive expressive ECA system. Demo session at AAMAS'09, Budapest, May 2009, pp. 1399-1400.
7. Magalie Ochs, Catherine Pelachaud, Socially Aware Virtual Characters: The Social Signal of Smiles. *IEEE Signal Processing Magazine* 30(2): 128-132 (2013)
8. Ochs, M. Prépin, P. and Pelachaud, C. From emotions to interpersonal stances: Multi-levels analysis of smiling virtual characters, in Proc. of ACII, 2013
9. Poggi I., Mind, Hands, Face and Body. A Goal and Belief View of Multimodal Communication, Weidler Verlag, Körper, Zeichen, Kultur, 2007.
10. Prepin, K. Ochs, M. and Pelachaud, C. Beyond backchannels: co-construction of dyadic stance by reciprocal reinforcement of smiles between virtual agents, *International Conference CogSci*. 2013.
11. Sidner C. L., Kidd C. D., Lee C., and Lesh N., Where to look: A study of human-robot interaction. In *Intelligent User Interfaces Conference*, pages 78–84. ACM Press, 2004.