Expressive Gesture Model for Storytelling Humanoid Agent

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Abstract : We aim at developing an expressive gesture model for the humanoid robot Nao and the virtual agent Greta during a storytelling application.
Keywords: Humanoid robot, expressive gesture, Nao, Greta, ECA, BML, FML, SAIBA.

1 Introduction

The work is a part of the GVLEX project whose objective is to equip agents with the capacity of reading story agreeably through expressive verbal and non-verbal behaviors. While other partners of the project deal with expressive voice and linguistic aspects, our task focus on expressive behaviors, especially on expressive gesture, that will be displayed by the humanoid robot Nao developed by Aldebaran [6] and by the virtual agent Greta [5].

2 System Overview

The system takes as input a text (i.e. a story) to be said by the agent. The text has been enriched with information on the manner the text ought to be said (i.e. with which communicative acts it should be said). The behavioural engine bases on information extracted from the enriched text, such as the structure, the various semantic and pragmatic elements as well as the emotion content of the story to select the multimodal behaviors to display and to synchronize the verbal and nonverbal behaviors of the agents.

The first attempt is to develop our existing agent system, Greta - a general purpose ECA (Embodied Conversational Agent) using and modular architecture which follows SAIBA framework [3], to control multimodal signals (i.e. expressive gestures, speech, etc) in a precise context: telling a story expressively for children. In this architecture, the agents are driven by two representation languages, one at the intention level FML (Function Markup Language) [2] and one at the behavior level BML (Behavior Markup Language) [3,4].

Both FML and BML are XML languages and they do not refer to any particular parameters of an agent. We also use BML to describe repertoire of behaviors, called lexicon. The robot and the agent do not have the same behavior capacities (e.g. the robot can move its legs and torso but does not have facial expression and very limited hand movements). That is why a proper lexicon should be elaborated for each agent based on the storytelling video corpus [7] in order to fit the storytelling application. Moreover, the respective elements in both lexicons should have the same meaning. To ensure that, behavior invariant should be elaborated. By Calbris's taxonomy, description dimensions of a gesture might be divided into two parts: invariant and variant, in which the invariant dimensions should be consistent meanwhile the variant dimensions can be adjusted without changing the meaning of the gesture [1]. For instance, in the "refuse" gesture, orientation of the palm towards ahead is one invariant dimension while the distance between the hand and the body is one variant dimension. BML will be extended to include information related to behavior invariant. An overview of the system is illustrated in Figure 1.

3 Behavior Engine

The Greta platform, which is used to control behaviors of the Nao robot and the virtual agent, bases on the interfaces of the multimodal generation SAIBA framework (Situation, Agent, Intention, Behavior, Animation). Its structure consists of three separated modules[3]:

Intent Planning: Planning a communicative intent that agent will convey.

Behavior Planning: Planning multimodal behaviors that agent will realize.

Behavior Realization: Realize the planned behaviors.

Two processing stages, Intent Planning and the Behavior Planning, are interconnected by an interface described in FML, a representation language encodes the communicative and expressive intent that the agent aims at transmitting. That may be emotional states, beliefs or goals, etc. [2].

Meanwhile, two processing stages, Behavior Planning and Behavior Realization, are linked by another interface described in BML, another representation language specifies multimodal behaviors with constraints to be realized by agent. The description of BML may be occurrence of behaviors, relative timings of behaviors, form of behavior or reference to extented animation scripts, conditions, events, feedbacks, etc [3.4].

Last, the behavior is keyframed. Each keyframe is described by the value of all the articulators of the robot (the virtual agent correspondingly).

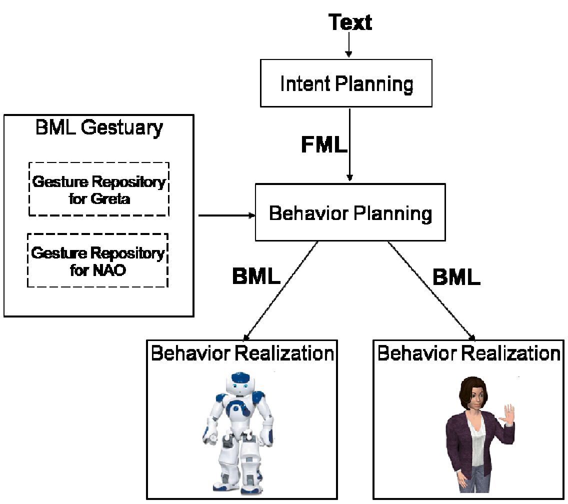

Fig. 1: The Greta platform controlling the behaviors of the Nao robot (left) and virtual agent (right).

4 Conclusion

In this article, we present an overview of a common system that controls expressive gesture for the humanoid robot Nao and the virtual agent Greta. In order to solve different behavior capacities of the agents, we use two lexicons, one for the robot and one for the virtual agent where their respective entries convey the similar meaning.

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References

[1] Calbris, G. 1983. *Contribution à une analyse sémiologique de la mimique faciale et gestuelle française dans ses rapports avec la communication verbale*. PhD Thesis, Volume II.

[2] Heylen, D., Kopp, S., Marsella, S., Pelachaud, C., Vilhjalmsson, H., 2008. *The Next Step Towards a Functional Markup Language*, Intelligent Virtual Agents, IVA'08, Tokyo.

[3] Kopp, S., Krenn, B., Marsella, S., Marshall, A., Pelachaud, C., Pirker, H., Thorisson, K, Vilhjalmsson, H., 2006. *Towards a Common Framework for Multimodal Generation in ECAs: The Behavior Markup Language*. 6th Int. Conf. on Intelligent Virtual Agents.

[4] Vilhjalmsson, H., Cantelmo, N., Cassell, J., Chafai, N.E., Kipp, M., Kopp, S., Mancini, M., Marsella, S., Marshall, A.N., Pelachaud, C., Ruttkay, Z., Thorisson, H. van Welbergen, R. van der Werf, 2007. *The Behavior Markup Language: Recent Developments and Challenges*, Intelligent Virtual Agents, IVA'07, Paris.

[5] Niewiadomski, R., Bevacqua, E. Mancini, M., Pelachaud, C. 2009, *Greta: A Interactive Expressive ECA System*. The 8th Int. Conf. on Autonomous Agents and Multiagent Systems.

[6] Gouaillier, D., Hugel, V. et al, 2009. *Mechatronic design of NAO humanoid*. IEEE Int. Conf. on Robotics and Automation, Kobe, Japan.

[7] J.-C. Martin. *The contact video corpus*, 2009.