Small group discussion simulation for middle Level of Detail Crowds

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1 Introduction

In the Mission Rehearsal Exercise at University of Southern California, (Swartout et al., 2001), a leader is trained with a story-based immersive simulation including many characters, both teammates and others. While a number of these characters (especially the ones in the front and center) play lead roles in the story and interact heavily with the trainee (Rickel et al., 2002), there are also a number of "supporting" characters who play fairly minor roles, but are still important to the setting of the story. The original versions of these characters had all their motions painstakingly hand animated, and were set in loops when the interaction lasted longer than the amount of scripting. Such scripting has three problems: first it is labor intensive, second, it is not reactive to local circumstances, and third, the repetition can detract from the realism, even if well animated for short segments.

A solution to these problems is to use some automatic simulation rather than hand-scripting. As (O'Sullivan et al., 2002) point out, crowd and group simulations are becoming increasingly important for a number of applications, including movies, as well as games and simulations. Random or scripted behaviors are satisfactory for low levels of details (e.g., very distant crowds), and full animated conversational agents are adequate for the main characters, but these are overkill for middle-level group members who are seen at some distance and not directly interacted with. What we need for our middle-level characters is something good enough to look like characters involved in conversation without the overhead of fully intelligent agents. A very good starting point is provided by (Padilha and Carletta, 2002), who synthesize some of the best research on group dialogue behavior into a parameterizable, probabilistic algorithm for individual behavior as part of a group. We have re-implemented this simulation, with some enhancements, and used the results to animate the Bosnian crowd members in the Mission Rehearsal Exercise.

2 Crowd Simulation for Animation

While (Padilha and Carletta, 2002) have a simulation algorithm with results specifying outputs such as talking, gestures of a few sorts, and gaze, they did not actually link up the simulation to an animation system. Doing such, in this case to BDI's Peopleshop^{TM} characters, necessitated making individual choices of types of gestures to indicate speaking and other motions. Figure 1 shows a snapshot of the characters involved in conversation.

We have also made several extensions to the simulation of (Padilha and Carletta, 2002) to account for the use of this simulation as embedded in the virtual world. First some extensions to the gaze model, to account for change of addressee and audience gaze at multiple speakers. More importantly, though, we also allow attention to pass away from the group discussion to focus on external events such as the main conversation between the human trainee and main character virtual humans and other occurrences, such as explosions and people and vehicle movements.

Figure 1: Bosnian Group in conversation

The simulation runs by cyclically testing a set of parameter values against random numbers, with the results leading to decisions of whether to speak or listen or attend elsewhere and which gestures to make.

These parameters were defined in (Padilha and Carletta, 2002):

talkativeness: likelihood of wanting to talk.

transparency: likelihood of producing explicit positive and negative feedback, and turn-claiming signals.

confidence: likelihood of interrupting and continuing to speak during simultaneous talk.

interactivity: the mean length of turn segments between TRPs.

verbosity: likelihood of continuing the turn after a TRP at which no one is self-selected.

In addition, we added the following parameters:

responsiveness: likelihood of a participant reacting to interruptions from outside the group.

continuity: likelihood of selecting an addressee (for example, by asking a question to him/her specifically) at the end of the speaker's turn.

A loop (a modification of the algorithm in (Padilha and Carletta, 2002)) is executed every cycle (approximately 500 ms long) by each character. The main modifications involve allowing agent responsiveness to events and speech outside the group and the linking of abstract behaviors to specific animation calls for the characters.

3 Evaluation

Padilha and Carletta's evaluation plan involved comparing their simulation to transcripts of group conversation data, showing a better fit than simpler models. While this kind of evaluation would certainly be interesting, we propose a different kind of evaluation - whether the simulation "looks like a conversation" to a viewer. Two baselines for performance are whether the simulation looks more natural than random motion and whether the simulation looks more natural than the looping, hand-crafted animation.

We also want to evaluate the effects of the individual parameters. We have constructed experiments in which different characters are given different values for parameters (such as talkativeness and confidence), and then showed viewers recordings of different simulation runs with these parameters to judge features like apparent talkativeness of individual characters.

References

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