Chapter 7
Design and Implementation
Issues for Convincing Conversational Agents

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ABSTRACT
This chapter describes a selection of experiences from designing and implementing virtual conversational characters for multimodal dialogue systems. It uses examples from the large interactive narrative VirtualHuman and some related systems of the task-oriented variety. The idea is not to give a comprehensive overview of any one system, but rather to identify and describe some issues that might also be relevant for the designer of a new system, to show how they can be addressed, and what problems still remain unresolved for future work. Besides giving an overview of how characters for interactive narrative systems can be built in the implementation level, the focus is on what should be in the knowledge base for virtual characters, and how it should be organized to be able to provide a convincing interaction with one or multiple characters.

1. INTRODUCTION
The design and implementation of a non-trivial system where the user can interact with virtual characters via natural language or other modalities is still a creative challenge besides being an engineering task. This chapter aims to explain some issues that were encountered when designing and implementing dialogue systems for narrative purposes, especially the VirtualHuman system.

VirtualHuman as a whole is quite large, as dialogue research projects go: about 25 people worked on it for its duration of four years. Not surprisingly, the number of issues and lessons learned is big and cannot be covered entirely. Therefore, we decided to limit the scope, and to talk about only a selected subset of issues that could – in our opinion – provide relevant and helpful cues for the reader who wants to work on the creation of future systems in that area. Also, during the course of discussion, some of the still numerous shortfalls will be described that still need to be addressed.
After a general overview of related work in the area, the basic setup of VirtualHuman will be explained. The main matter of the chapter describes several important issues regarding the representation of the knowledge base for character design and control, and how they are addressed in the system to create an immersive and convincing interaction. The ideas and techniques presented here are not in any way meant to constitute definite or complete solutions. They should instead be taken as examples of how the issues they relate to can be approached and as food for thought to nudge towards further improvements.

2. BACKGROUND AND RELATED WORK

Most implementations in dialogue research are task-oriented systems intended to solve a clearly-defined problem, or to examine a given research topic. However, the less straightforward genre of virtual narratives is gaining importance and attention in the scientific community, and improved storytelling is also increasingly used in commercial software. Some design principles, including the basic modular approach for the VirtualHuman system, are derived from a line of task-oriented research systems, most prominently the Verbmobil and SmartKom systems.

One reason for the dominance of task-oriented systems, in addition to their applicability in many practical areas, might be that such interactions tend to be reasonably focused and predictable practical dialogues that are less complex than general dialogue (Jönsson, 1993). The domain – the task – can also usually be defined by formal means such as task completion criteria and limited sets of actions with pre-conditions and post-conditions that can achieve the goals of the interaction.

Task-oriented frameworks require rational agents that ideally help the user to get to the goal quickly and/or effectively. On the other hand, interactive narratives are more complicated and multifaceted. Good narratives will certainly require more elaborate language than purely task-focused prose. Also, a character acting in a narrative setting does not have to be rational; in a story, the main goal is to entertain users, and this above all requires that the interaction is interesting and the actors are believable. A character in a play can very well act in a decidedly irrational manner, as long as the audience can understand its motivations.

Following the increased interest, there is currently substantial research in the area of interactive narrative systems. Notable research systems include the Mission Rehearsal Exercise, a military emergency simulator (Swartout et al., 2006); the FearNot system, intended to train children to cope with bullying situations (Hall et al, 2006); and Façade, an enacting of a couple’s breakup (Mateas & Stern, 2003). Commercial applications mainly fall into two categories, edutainment/instructional software and, of course, games.

A well-known example is the series The Sims that models the motivations of its simulated characters very similarly to the BDI (belief-desire-intention) paradigm originating from academic research (Rao & Georgeff, 1991). For current games, there is also a growing trend towards more serious and mature stories like the 2010 title Heavy Rain, which is a rather gloomy experience that emphasizes narrative depth and moral choices rather than striving for player satisfaction. However, commercial producers are not inclined to publish details about the inner workings of their software.

The perspective of the designer of the dialogue and the application content is often neglected in dialogue systems research. There are not many frameworks available that are ready to use for authors who are not specialists in the fields of linguistics or computer science. This has much to do with the fact that in research, system and content design is frequently done by members of the same team or even by the same person, usually being computer scientists or linguists rather than...
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