Chapter 5

Personality-Based Cognitive Design of Characters in Virtual Environments

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ABSTRACT

Personality-based cognitive architectures should yield consistent patterns of behaviour through personality traits that have a modulatory influence at different levels: These factors affect, on the one hand, high-level components such as ‘emotional reactions’ and ‘coping behaviour’, and on the other hand, low-level parameters such as the ‘speed of movements and repetition of gestures. In our hybrid cognitive architecture, a deliberative reasoning about the world (e.g. strategies and goals of the 3D character) is combined with dynamic real-time response to the environment’s changes and sensors’ input (e.g. emotional changes). Hybrid system copes dynamically with changes in the environment, and is complicated enough to have reasoning abilities. Designing a cognitive architecture that gives the impression of personality to 3D agents can be a tremendous help making 3D characters more engaging and successful in interactions with humans.

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1 INTRODUCTION

During daily human to human interactions, people evaluate the personality of others, to predict their behavior, to understand them, to help or to motivate them (Campbell & Rushton, 1978; Funder & Sneed, 1993). One of the important sources people refer to when attributing personality to others is nonverbal behavior such as gestures, body stance, facial expressions and gaze behavior. Psychological data show a correlation between the perceived personality and nonverbal behaviour. For instance, the speed at which someone moves their hands or the direction of their gaze reveals information about their personality (Campbell & Rushton, 1978; Funder & Sneed, 1993; Borkenau & Liebler, 1992). Likewise, people tend to assess the personality of 3D virtual agents (McRorie et al., 2012; Carney, Colvin & Hall, 2007). Our goal is to design and develop a cognitive architecture for generating nonverbal behaviour to express personality for 3D virtual agents. We are focusing on the nonverbal behaviour of the agent and there is no speech involved.

The hybrid computational architecture which models the agent’s personality, consists of two components: an ‘Event-based’ component and an ‘Emotionally-Continuous’ component (Saberi, Bernardet & DiPaola, 2014). The Event-based component will generate the agent’s communicative gestures based on different states of the interaction and the user’s behaviour. The behavioural scope is limited to strategic turn-taking interaction between the agent and the user. The agent’s facial expressions will be controlled by the Emotionally-Continuous component. Opposite to communicative gestures, which are triggered when an environmental event is triggered, emotions are continuously updated based on internal and external status. The emotional weights of the gestures are also specified by the Emotionally-Continuous component. Using MATLAB/Simulink and Stateflow structure, we simulate the real-time continuous behavior in addition to event-based behavior which is responsive to changes of states of the interaction. MATLAB’s Model-Based Design, facilitates model level access to components of the system which makes it very easy for future researchers to tune parameters of the system and see how that affects the results of the simulation. Matlab/ Stateflow’s graphical charts are developed as modular and encapsulated libraries that can be reused across multiple charts and models.

The intended contribution of this architecture is to preserve the believability of the 3D agent over time by generating consistent behaviour while being responsive to the user. Believability is defined as providing the illusion of life and provokes the audience’s suspension of disbelief (Mateas, 1999). Our proposed architecture aims at maintaining the consistency in behaviour, emotions and thoughts of the 3D virtual agents while interacting with humans. Hierarchical structuring of our proposed architecture will address behaviour, emotions and thoughts of the 3D
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