Chapter 94
On Vision-Based Human-Centric Virtual Character Design:
A Closer Look at the Real World From a Virtual One

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ABSTRACT

Enabling cognition in a Virtual Character (VC) may be an exciting endeavor for its designer and for the character. A typical VC interacts primarily with its virtual world, but given some sensory capabilities (vision or hearing), it would be expected to explore some of the real world and interact with the intelligent beings there. Thus a virtual character should be equipped with some algorithms to localize and track humans (e.g. via 2D or 3D models), recognize them (e.g. by their faces) and communicate with them. Such perceptual capabilities prompt a sophisticated Cognitive Architecture (CA) to be integrated into the design of a virtual character, which should enable a VC to learn from intelligent beings and reason like one. To seem natural, this CA needs to be fairly seamless, reliable and adaptive. Hence a vision-based human-centric approach to the VC design is explored here.

He's as blind as he can be
Just sees what he wants to see
Nowhere Man, can you see me at all?
-John Lennon

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INTRODUCTION

A pure virtual character (VC) is typically limited to interactions with and reasoning about its virtual world. However, given certain abilities to perceive and explore some of the real world and interact with the intelligent beings there, can a VC evolve into an intelligent virtual being? Let us equip a VC with visual sensors, include some algorithms for object recognition and tracking, and provide some ability to learn and reason. Then such a virtual character, much like Alice stepping through the looking-glass (as in Figure 1) and becoming aware of the other world, should have a chance to eventually discover some intelligent characters there, observe their traits, and by virtue of interacting with them, learn and reason about that world and its beings. Such perceptual capabilities evidently prompt a sophisticated cognitive architecture (CA) to be integrated into the design of a virtual character, and to seem natural, this CA needs to be fairly seamless, reliable and adaptive at both sides of the virtual looking glass. Thus, enabling cognition in a virtual character may truly be an exciting endeavor for the VC designers and hopefully for the VCs themselves.

In general, there is a difference between cognitive architecture approaches and Artificial Intelligence (AI) approaches to intelligent agents design. The latter usually are optimized for the maximum task performance, while the former are optimized for a human-like performance. This chapter focuses on the human-centric CA that enable a perception-capable VC to learn and imitate the traits of the intelligent agents it observes and interacts with ultimately striving towards a human-like performance, but also allowing for developing and optimizing certain abilities that may eventually surpass those of the humans, e.g. very fast and accurate content based image retrieval.

Virtual character's perceptual abilities would naturally rely on the given sensory capabilities, e.g. video cameras for its eyes or microphones for its ears. Clearly those sensory streams should be synchronized and carry enough of the signal resolution to distinguish the important features of the objects and beings a VC would need to interact with. Those features would be extracted by various signal and image processing algorithms accompanying the given sensors, and hence be known and referred to as the

Figure 1. Alice Through the Looking Glass sculpture by Jeanne Argent at Guildford Castle, Surrey, UK