

An Ontology for 3D Environment Modeling with Smart Objects for Autonomous Digital Actors

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***Abstract.** This work is part of a project that aims at developing an Autonomous Digital Actor. Regarding this, one important problem is the interaction between autonomous digital actors and objects in a virtual environment. This research aims at studying how to design an ontology for smart objects to be used as the settings for the actors. Preliminary results are an early version of an ontology.*

1. Introduction

Animation studios have teams to script, draw, animate and voice characters. Together, they are able to create animation films that take a lot of effort and time, because every single part of the movie has to be done manually: facial expressions, gestures, lip syncing, walking and many other features.

A new way to create computer animations have been discussed and it involves the development of autonomous digital actors (ADA) [Perlin and Seidman 2008]. An ADA is an analogy to a real actor, which autonomously, and by its independent interpretation of the situation, can perform its role according to a given script, as part of a story [Iurgel and Marcos 2007].

There are many challenges regarding the implementation of a virtual actor that is able to interact autonomously. They have to perceive the surrounding environment, learn from it and take actions. This is a rather difficult task to be accomplished and in order for it to look real, it is necessary that these characters can interact with other virtual actors, recognize and produce speech, gesticulate, manipulate objects and many other tasks that are complicated to synchronize. And since this work focuses on the interaction of ADAs and the objects of the environment, the contribution of this research will be an ontology that will describe semantic and physical characteristics of smart objects in a 3D animation set.

2. Developing an Ontology

An ontology is a series of knowledge representations structured based on its meaning, similarities, hierarchies, properties, relation, etc. The main use of ontologies is to represent in form of symbols, such as letters, colors, graphs, what is known from a certain domain and with such representation, it is possible to share, reuse, make hypothesis and analyze it [Semprebom et al. 2007].

Smart objects are virtual objects in a 3D environment that carry information about themselves [Tirrell 2012]. This information can be physical (color, size, position) and

semantic (function, interaction animation with actor). Therefore, the actor would not need to know how to interact with all the objects of the movie set. The objects themselves can share this information with the characters. This approach (using smart objects) was chosen because it significantly reduces the complexity of the implementation of autonomous actors. This decentralized knowledge spread throughout smart objects can be successfully seen on the game *The Sims*TM.

So far, it has been studied several concepts necessary to describe smart objects such as, knowledge representation, ontology, smart objects themselves and character animation techniques. A movie can be composed of three components: set, cast and script, but since the focus of the research is on objects, this ontology will not be expanded further than the set. An early version of an ontology, developed from scratch using XML and RDF languages, has been produced and many other components were found to be part of the set and the objects themselves. An object in movies set could be in the interior or exterior, in a house or an apartment building and inside a room like a bedroom or kitchen. The objects could be physical structures like a wall or the floor and they could be furniture, animated or inanimated. Animated objects would have a set o movements like the opening of a door and inanimated objects would be static like a picture frame. Physical characteristics are: height, width, depth, color, texture, the area an object occupies, etc. And beyond physical, all objects have behavioral characteristics: how things work.

3. Conclusion

This work is part of a project that aims at developing an Autonomous Digital Actor. One important problem to be solved is the interaction between ADAs and the environment. Smart Objects are a way to represent knowledge regarding the surrounding objects in the environment. This distributable knowledge could help ADAs to reason about how to act coherently. This research aims at studying how to design an ontology for smart objects for further implementation of interactive movie sets for ADAs. An extensive literature review has been conducted and produced an early version of the ontology. Next steps involve detailing this ontology to the point that it would be possible to apply it to describe the set of an animation film.

Reference

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