Goal Directed Animation using English Motion Commands

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ABSTRACT

This paper describes a prototype 3D animation system which can execute limited types of english motion commands by solving simple goals and directions.

This system has a frame-based knowledge base (KB) to describe objects and another to describe motions. A hierarchical planning system uses the motion descriptions as forward production rules to form a plan for a goal task. Directional commands relative to the object or a reference object can also be processed by refering to the directional description in the motion KB and the object's reference frame.

The underlying objective is to develop a method to incorporate goals into a graphical animation system so that it will be a *task level* system [Zelt85], where a behaviour is described in terms of events and relationships and frees the user from specifying all details of a motion.

Keywords : KB graphics, animation, motion description, goals.

1. Background

Developing animation systems which are task level systems is a relatively new research area in computer graphics and a complete one does not yet exist. Currently some *animator* level systems [Zelt85] in which the behaviours of the objects are described algorithmically in a programming language, exhibit properties that would be useful to a task level system.

In Reynold's actor-based [Reyn78] and Murtagh's object-based [Murt85] systems, objects can pass messages which allows adaptive motion. Adaptive motion occurs when the control processor uses information about the objects and their environment to control the objects' movements [Zelt85]. In MIRA [Thal83, Magn84, Magn85] attributes of the objects can be updated and examined also allowing adaptive motion.

Badler [Badl80, Badl81, Badl82] has been involved in representing human motion and developed Tempus. This system contains resolved motion algorithms for limb positioning and approaches task level animation. Zeltzer [Zelt82, Zelt83] developed SAS which uses local motor primitives (LMP's) to execute movement functions which have preconditions and has described ideas for a KB system which would be a task level animation system.

In the meantime work in Artificial Intelligence concerning motion descriptions was being done. Using Miller's [Mill72] classification of motion verbs, Badler [Badl75] and Tsotsos [Tsot80] added their own modifications to create motion description and analysis systems. The KB for our system GEMS was derived from a modification of the frame based system proposed by Tsotsos.

A frame [Mins75, Gold79] is a representational structure which consists of slots which can decribe parts of the item being represented and can contain information describing the relations between the slots. The slots form a PART-OF hierarchy. The frames form an IS-A hierarchy defining general to specific information (see example 1).

A frame based system was proposed because it can express hierarchical descriptions, allows general to specific levels of detail and conveys inheritance of properties. A frame which is below another frame in the IS-A hierarchy inherits the properties of the one(s) above it.

GEMS arose by incorporating a motion processing queue scheme similar to Zeltzer's [Zelt82] to process the information in the frames of the KB.

2. Overview

The user must first define a KB for 3D hierarchical objects and a KB for their motion descriptions. To begin an animation the user must *instantiate* objects from the frames defined in the object KB.