The Interactive Specification of Human Animation

G. Ridsdale, S. Hewitt and T. W. Calvert
Laboratory for Computer and Communications Research
Simon Fraser University, Burnaby, B.C. V5A 1S6

Abstract

This paper describes the Figure Animation Project in progress at Simon Fraser University. The project has two goals for the specification of figure animation: the first is to implement an interactive Figure Animation Test Bed for specifying movement at the *detail* level and the second is to develop a mechanism for describing figure animation at the *scene* level. These goals — and approaches to solving them— are discussed. In particular, the application of knowledge-based inference to the problem of scene description is examined.

Introduction

The long-term goal of this project is to develop scene-level motion descriptions for articulated, humanoid figures. In general, three-dimensional animation of the human body — or of any other vertebrate — is based on an underlying framework of articulated elements. For instance, a reasonable approximation of the human skeleton can be achieved with about 24 segments if the fingers and toes are ignored. Most of our efforts over the past few years have been directed towards developing interactive techniques for specifying detailed figure movements, since a system embodying such techniques is a necessary component for developing and testing scene descriptions. Such an interactive test bed must be capable of displaying the full range of interesting scene actions; this range includes both the actions of individual joints, and the movements of the body as a whole.

Above the detail level are the motivations of the characters and their interactions with the environment. This is animation at the *scene* level. After about ten years of continuous research in this area we are still not sure whether truly convincing animation of the full range of human movement is feasible, but there is no question that progress has been made in certain specialized areas of figure animation. What is needed now is the guidance of an intelligent supervisor to tie together these many pieces of the animation problem.

To coordinate the activities of a human animation system we require a supervisory program that has knowledge of the overall goals of the characters in the scene. In particular, such a program needs to deal with the issues of path planning and with the physical constraints on jointed figures. Ideally, it should only be necessary to specify the character's motivation in the scene and its initial position. The figure would then progress automatically and *characteristically* to its most likely destination from that starting point. In reality, the problem of determining an appropriate path from knowledge of the character's intentions is difficult, as is the problem of having the character navigate around both the fixed objects and the other characters in the scene. This latter problem has occupied robotics researchers for many years. The problem of sophisticated route planning is particularly difficult when the characters are jointed walking figures. Not only does the figure have to move about unencumbered, but the feet must also pick their way around and over any objects that may be found on the floor. While performing this, the figure must maintain its balance and a reasonable posture. This is a particular problem when shifting weight smoothly from one limb to another.

There are many physical constraints on what a character can and cannot do in a scene. For instance, a real figure's anatomy and physiology impose limitations on how it can move and interact. An intelligent supervisory program for human figure animation must understand these limitations; in this way, only physically realizable scenes will result.

Who Uses the System

The Figure Animation Test Bed is used mostly by choreographers who work in the disciplines of skating and dance. This test bed system has been designed to evaluate the various interactive techniques — buttons, menus, pick-and-drag, rendering speed traded off against image quality — that can be applied in a figure animation system. Since the people best qualified to judge the effectiveness of a system's user interface are themselves the future users, we select the techniques with which these choreographers feel most comfortable.