A Dynamic System for Controlling the Head Movement and Gaze of Virtual Characters

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Figure 1. *Images of the avatar looking directly at the user, looking at another object of interest while facing the user and facing away to look at another object of interest.*

1. Introduction

Creating virtual characters with natural movements is a challenging problem. Users are very aware of how people in general m**o**ve when interacting based on a lifetime of experience. Unintentionally unnatural movements can adversely affect the experience of the participant. Computationally intensive techniques for calculating dynamic movements can cause the system to run slowly, reducing the frame rate or the performance of the avatar within the simulation. Our system provides a simple implementation that enables precise individual control of multiple avatars.

Studies have shown that contextually accurate gaze results in better communication with participants than random gaze (Garau, Slater, Bee, Sasse 2001). Different types of eye contact can also have an effect on the conversation. Along with eye contact, appropriate head orientation can better engage a person in a virtual conversation, much more so than with random or no head movements (Garau, et al 2001; Bailenson, Beall, Blascovich 2002). With proper context appropriate "look at's," one can create a conversation environment that is both engaging and realistic.

2. Approach

To simplify the problem we first separated the movement of the head and eyes and allowed them to combine dynamically. Head movement is slower and directed more by the object of primary attention. Eye movements are quicker and allowed to move with higher variability to more objects. In our implementation, objects of interest are defined for each avatar. These are other avatars, objects in the environment, and other points in the scene that would naturally draw interest. Head movement parameters consist of the set of objects in the environment, each of which has a time to be looked (with a random variance) at and a weight to determine how often it is looked at. When the time is up, a decision is made about what to look at next based off the weights of the objects in the list. This list is changed during different points in the scene. By adjusting the weights dynamically the avatar is directed to look at a specific other avatar or other object. The model is based on the assumption that the avatar will look at the person who is talking as the primary interest holder. Past research has established that gaze is higher when one is listening than speaking (Guerrero et al., 1999). Thus, when the user is talking, their weight is increased, making the avatar look at the user. This provides a natural behavior of the avatar looking at the user and other objects in a motivated way.

The avatar's eyes shift between looking along the direction that the head is facing and looking at one of the look away points. When the avatar looks away, the time to look away, position to look at, and traversal speed are all calculated. The eyes then traverse to look at the point chosen. After the calculated time has passed, the time to look ahead and traversal time are chosen and the eyes return to look towards the user. The cycle then repeats.

A recent psychology experiment conducted by our group provided a test of the role of eye gaze in determining reactions to an avatar. The study involved a brief conversation between an avatar and a participant. Eye contact was manipulated with either high gaze or low gaze (15% above or below established norms of gaze during speaking and during listening). Results showed that participants in the high gaze condition felt more connected to the avatar than in the low gaze conditions.

We have created a simple system for creating dynamic head and eye movements for virtual characters. This system allows the programmer to change the objects of interest and the likelihood that the avatar will look at the objects throughout the scene. This system is easy to use and computationally light.

References

BAILENSON, J. N., BEALL, A. C. AND BLASCOVICH, J. 2002. Gaze and task performance in shared virtual environments. *The Journal of Visualization and Computer Animation*, *13,* 313–320.

GUERRERO, L. K., DEVITO, J.A., & HECHT, M.L. 1999. *The nonverbal communication reader: Classic and contemporary readings.* Prospect Hills, Il: Waveland Press.

M. GARAU, M. SLATER, S. BEE, AND M. A. SASSE. 2001. The impact of eye gaze on communication using humanoid avatars. *In Proceedings SIGCHI Conference on Human Factors in Computing Systems (CHI-01)*, 309–316.

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