Characterizing Head Movement in First-Person Games

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1 Introduction

First-person computer games are designed to make the player feel he/she is directly interacting with the game. However, camera movement seldom mimics real head walking movement. Lécuyer *et al.* [2006] has previously evaluated the quality of translational head movements. Our system allows the careful control of head movements in game-like environments. This poster compares various types of head movement and extends Lécuyer's results.

2 System

The C4 engine (www.terathon.com) was used to build the virtual environment (VE), a corridor with a line of lamp posts. Objects are placed along the way to provide additional visual-flow cues. Our interface for controlling head movement enables setting up head rotation and translation values in any of the three spatial axes. It allows subjectively fine-tuning of the camera movements. The system can also apply pseudo-realistic head movement behavior based on the work of Boulic *et al.* [1990] and Mulavara *et al.* [2002]. Speed control is also provided.

The virtual user consisted of three interconnected nodes: one at the bottom of its neck, one in the center of its head, and another between its eyes. Translations were applied to the first node, rotations to the second node and the virtual camera was attached to the third node. The virtual user walks over a predefined spline.

3 User Study

The study aimed at evaluating different camera walking movements for first-person games. Five types of camera movement were presented to subjects, as illustrated in Table 1. T_i and R_i indicate translation and rotation on the i axis respectively. P indicates periodic movement. The x, y and z axes point right, forward and upward, respectively, in relation to the camera. Our initial hypothesis was that M would be preferred, followed by R, U and I. Vertical movement (V) would be the least preferred.

Type of movement	P	T_X	T_Y	T_Z	R_X	R_Y	R_Z
Vertical (V)	✓			✓			
U-like (U)	✓	✓		✓			
Infinity-like (I)	✓	✓		✓			
Pseudo-random (R)		✓		✓	✓	✓	✓
Pseudo-realistic (M)	✓	✓	✓	✓	✓	✓	✓

Table 1: Types of walking head movement.

Each movement was represented by a ten-second 1152x720 video. Subjects had to watch pairs of videos and pick the one that he/she found the most realistic out of each pair. Ten pairs were formed by pair-wise combination. But pairs could be viewed in two orders for a total of 20 pairs. Furthermore, each pair was presented thrice, resulting in 60 trials per subject. Subjects could take a break every 20 trials. Before the experiment, instructions were presented on paper. After it, subjects were asked about the number of movement types, their descriptions, and which one was the best, as well as for comments about the experiment. 8 women and 26 men participated in the experiment. The normal distribution model for their ages was N (22.7, 6.44), skewed right with median 20. In addition, 20.6% claimed to play first-person games daily, 26.5% weekly, 44.1% seldom and 8.8% never play.

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4 Results

Preliminary results show that subjects chose movements V (19.41%), U (23.48%), I (25.34%), R (19.9%), and M (11.86%), indicating a preference for movements U and I. Additionally, when calculating the difference between the number of choices of a movie y in the pairs (x, y) and (y, x), it was noticed that this difference would not follow a normal distribution centered in 0. This result indicates a possible effect of the order in which videos are presented on subject's decision.

5 Conclusions

This research has measured how subjects perceive and prefer different realistic camera movements. M was not the preferred movement. There are two plausible explanations for this result. Either M was not well calibrated or subjects needed more time to get used to rotations in walking movement in games. R, with smaller rotations than M, was not subjects' first choice either, indicating choice of periodicity over movement variety.

The authors believe that in a long term study, a better calibrated realistic movement camera should be the first choice for most subjects as initially hypothesized. As future work, we will attempt to validate this claim. Other research extensions would be testing the effect of camera movements on avatar control and relating walking configurations to game character types, sizes, and moods.

References

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