Eurographics Workshop on Intelligent Cinematography and Editing (2015)
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The Influence of a Moving Camera on the Perception of Distances between Moving Objects

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Abstract

Movies and especially animations, where cameras can move nearly without any restriction, often use moving cameras, thereby intensifying continuity [Bor02] and influencing the impression of cinematic space [Jon07]. Further studies effectively use moving cameras to explore perception and processing of real world action [HUGG14]. But what is the influence of simultaneous multiple movements of actors and camera on basic perception and understanding of film sequences? It seems reasonable to expect that understanding of object movement is easiest from a static viewpoint, but that nevertheless moving viewpoints can be partialed out during perception.

1. Introduction

Film literature discusses how a moving camera intensifies the gist of a chasing scene [Ken12]. But what are the basic cognitive processes leading to this effect? Several studies in psychology examine perceptual processes if viewers move in an otherwise static environment or the perception of moving objects. Only rarely, both kinds of movements are combined. For example, some studies presented photographs of objects in varying distances, thereby implying forward movement of the observer, and found that effects on perception like boundary extension and representational momentum are unrelated [MOC05]. In other studies, a moving object is surrounded by other moving objects, and results suggest that the perceptual forward displacement of the central object is greater if the surrounding objects move in the same direction [WC02]. But there are very few studies examining the perception of varying distances between multiple moving objects in combination with a moving viewpoint – and this is exactly what happens if the camera is moving during a chasing sequence.

In a first study we used stationary and moving cameras and examined if viewers are able to partial out different speeds of camera movement during the perception of a chasing sequence. Participants watched several animated clips presenting two actors moving in a virtual environment. The chased person always moved with constant speed, but the speed of the chaser varied between clips, thus leading to trials where the chaser was catching up and trials where he fell back. Participants decided after each clip if the chaser was catching up or falling back. Camera viewpoint was from behind and either static or following the actors with different speeds. For every camera condition the speed of the chaser was varied until a participant merely guessed, i.e. we used an adaptive staircase and determined the point of subjective equality (PSE) of speeds of the actors. An analysis of variance showed a significant linear effect of camera movement on PSE: Contrary to our prediction, moving rather than stationary cameras led to the most accurate estimates. Furthermore, PSEs were higher the faster the camera moved. This means that the chaser´s perceived speed is relative to the camera speed. Faster camera movement requires faster chaser speed in order for the chaser´s speed to be perceived the same as a slower moving camera. It seems that viewers are not able to partial out different speeds of camera movement with similar accuracy. Taken together the study is a first step to examine the influence of a moving camera on the impression of film sequences on the basis of underlying perceptual processes.

2. References

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DOI: 10.2312/wiced.20151078