

Analyzing Gaze Synchrony in Cinema: A Pilot Study

Katherine Breeden*
Stanford University

Pat Hanrahan
Stanford University

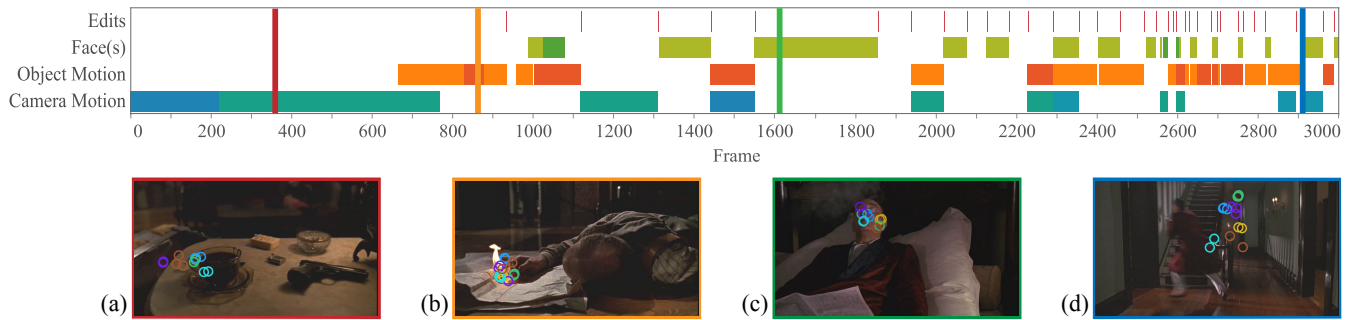


Figure 1: Hand-coded aspects of the moving image can be associated with observed gaze behavior. Above: Colored bars span the frames in which the corresponding feature is present. Below: Example frames demonstrating common gaze behaviors.

Keywords: Eye-tracking, attentional synchrony

Concepts: •Applied computing → Fine arts;

1 Introduction

Recent advances in personalized displays now allow for the delivery of high-fidelity content only to the most sensitive regions of the visual field, a process referred to as *foveation* [Guenther et al. 2012]. Because foveated systems require accurate knowledge of gaze location, *attentional synchrony* is particularly relevant: this is observed when multiple viewers attend to the same image region concurrently.

Previous work has investigated attentional synchrony in moving images as a result of low-level features, such as edges and flicker [Mital et al. 2011]. Gaze response to higher level characteristics is less well understood. However, nearly a hundred years of filmmaking has led to the establishment of many common practices thought to affect gaze location, including certain types of editing, image composition, and camera motion. We aim to explore the effectiveness of these techniques and to provide a quantitative analysis of the attentional synchrony achieved in modern cinema. This poster contains preliminary observations.

2 Pilot Study

To explore the degree of gaze clustering present in typical films, a pilot study was conducted. Six participants were shown 5 short movie clips, each 1-3 minutes in duration, and eye movements were recorded using a Tobii EyeX¹ desktop eye tracker. Film clips were hand coded for the following features: (1) edits; (2) the presence of

human faces; (3) motion of one or more objects; and (4) camera motion, including panning and tilting, zooming, and so forth. Figure 1 contains an example hand coding for the film *Miller's Crossing*².

3 Preliminary Results

Faces: There is high correlation between gaze synchrony and the presence of faces, e.g., Figure 1(c). This reflects a familiar aspect of human eye motion, namely, the high degree of attention paid to human faces [Judd et al. 2009].

Camera motion: At some times, camera motion is associated with increased attentional synchrony. At others, camera motion appears to have the opposite effect. Figure 1(a) illustrates the former case, as a right-to-left dolly leads to anticipatory clustering in the left region of the screen. Subsequent placement of salient features into this region suggests that filmmakers may be using camera motion as a subtle cue to guide attention. For instance, following the above dolly shot participants are able to simultaneously observe a cigarette igniting a newspaper in Figure 1(b).

Gaze is persistent: Once cultivated, an attentive gaze can be quite tenacious. When actively fixated on an image feature, participants readily ignore large-scale motion and occlusions. Figure 1(d) shows a case in which viewers maintain attention on a background feature, even as a foreground character moves quickly across the frame.

Ongoing work seeks to expand the data collected and provide meaningful quantitative analysis of these measurements.

References

- GUENTHER, B., FINCH, M., DRUCKER, S., TAN, D., AND SNYDER, J. 2012. Foveated 3d graphics. *ACM Trans. Graph.* 31, 6 (Nov.), 164:1–164:10.
- JUDD, T., EHINGER, K., DURAND, F., AND TORRALBA, A. 2009. Learning to predict where humans look. In *IEEE International Conference on Computer Vision (ICCV)*.
- MITAL, P. K., SMITH, T. J., HILL, R. L., AND HENDERSON, J. M. 2011. Clustering of gaze during dynamic scene viewing is predicted by motion. *Cognitive Computation* 3, 1, 5–24.

*e-mail: kbreeden@cs.stanford.edu

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s). © 2016 Copyright held by the owner/author(s).

SAP '16, July 22–23, 2016, Anaheim, CA, USA

ISBN: 978-1-4503-4383-1/16/07

DOI: <http://dx.doi.org/10.1145/2931002.2947704>

¹ <http://www.tobii.com/xperience/>

² Directed by Joel & Ethan Coen, copyright 20th Century Fox, 1990.