Research on Motion Picture Perception and Change Blindness

My second primary research interest is in understanding motion picture editing from a cognitive standpoint. I have long been interested in both the art and science of motion pictures, not only from the standpoint of observer-in-wonder and psychologist, but also as a film maker myself. This interest therefore runs in two directions. First, the evolution of the film-editing craft has been based on a series of heuristic guesses about the human cognitive and perceptual apparatus. Understanding the rules film editors use to combine different views into a coherent whole can provide a great deal of basic information about the cognitive processes involved in perceiving natural scenes and events. Second, a cognitive/perceptual analysis of the formal structure of motion pictures is long overdue, and can contribute substantially to the advancement in the fields of film studies and communications.

I have been engaged in two projects based on this interest. First, I have been collaborating with Daniel Simons on a series of studies that assess the degree to which viewers notice large changes that occur between different views both in motion pictures and the real world. Our basic finding is that individuals often fail to notice between-view changes, even in objects they are directly attending. For example, in one set of experiments we created two- or three-shot films in which the sole actor in the scene spontaneously changes from one individual into another across an edit. Despite the fact that the actors were wearing different clothing, two thirds of participants failed to notice the switch (see Levin and Simons, 1997). This research suggests that the representations we use to bind different views of a scene are very abstract and lack object properties that have not been explicitly encoded. We have also done this kind of switch during real-world interactions. In these experiments, one experimenter approaches an unsuspecting pedestrian and asks for directions. While they are talking, two other people carrying a door rudely walk right between them. While the pedestrian's view is briefly blocked, the first experimenter grabs the door and one of the experimenters carrying the door is left behind. Thus, the pedestrian begins a conversation with one person, is interrupted, and then continues the conversation with a completely new person! Despite the rather blatant nature of this change, we find that approximately 50% of subjects fail to detect it (Simons and Levin, 1998). In addition, we have been testing people's beliefs about their change-detection ability. This stems from the simple observation that the majority of subjects believe they would detect unexpected changes that actually go undetected (see Levin, Momen, Drivdahl, and Simons, in press).

In a second project, I am interested in gaining a more detailed understanding of how a limited set of perceptual cues operate to fix the location of actors and important objects in the action-space where scenes occur. This project involves creating short edited motion pictures to test the effects of violating spatial and narrative expectations based on these cues. The most important of these are based on gaze direction which specifies the relative locations of intentional agents in a scene. Much of my understanding of the psychology of motion pictures has come from developmental and neural work that assesses core perceptual and conceptual constraints in the perception of intentional social agents and mechanical causality.

Relevant Papers and Talks:

Levin, D.T. (1996, July). Implicit and explicit perceptual theory in the development of motion pictures. Invited talk at the Scene Perception Workshop: Max Planck Institute, Tubingen, Germany.

> Although psychologists have only recently begun to explore the process of binding different views of a scene, film makers have been using a variety of implicit theories about scene perception for at least 80 years. A key task for early film makers was to create visual narratives that were correctly apprehended by anyone with a nickel and a spare hour. Their audience often had minimal experience viewing motion pictures, and spanned most of the world's cultures. Early film makers were, therefore, required to create motion pictures that accurately tapped the core of human perception. I discuss the work of these artists and relate it to current work on scene perception using a variety of demonstrations. Dan Simons and I have also completed a number of experiments that verify and extend these artistic intuitions. In concordance with film makers' intuitions, we find that it is possible to make fairly dramatic changes across different views of a scene which participants fail to notice. These changes can extend to changing the actor present in a scene.

Levin, D.T., & Simons, D.J. (1997). Failure to detect changes to attended objects in motion pictures, Psychonomic Bulletin and Review, 4, 501-506.

> Our intuition that we richly represent the visual details of our environment is illusory. When viewing a scene, we seem to use detailed representations of object properties and inter-object relations to achieve a sense of continuity across views. Yet, several recent studies show that human observers fail to detect changes to objects and object properties when localized retinal information signaling a change is masked or eliminated (e.g., by eye movements; Blackmore, Brelstaff, Nelson, & Troscianko, 1995; Grimes, 1996; McConkie & Currie, 1996; O'Regan, Rensink, & Clark, 1996; Pashler, 1988; Rensink, O'Regan, & Clark, 1996; Simons, 1996). However, these studies changed arbitrarily chosen objects which may have been outside the focus of attention. We draw on research showing the importance of spatio-temporal information for tracking objects (Spelke, Kestenbaum, Simons, & Wein, 1995; Xu & Carey, 1996) by creating short motion pictures in which objects in both arbitrary locations and the very center of attention were changed. Adult observers fail to notice changes in both cases, even when the sole actor in a scene transforms into another person across an instantaneous change in camera angle (or "cut").

Simons, D.J., & Levin, D.T. (1998). Failure to detect changes to people during a real-world interaction. Psychonomic Bulletin and Review, 5, 644-649.

> Recent research on change detection has documented surprising failures to detect visual changes occurring between views of a scene, suggesting the possibility that visual representations contain few details. Although these studies convincingly demonstrate change blindness in still images and motion pictures, they may not adequately assess the capacity to represent objects in the real world. Here we examine and reject the possibility that change blindness in previous studies resulted from passive viewing of two-dimensional displays. In one experiment, an expertmenter intitated a

conversation with a pedestrian and during the interaction, he was surreptitiously replaced by a different experimenter. Only half of the pedestrians detected the change. Furthermore, successful detection of the change depended on social group membership; pedestrians from the same social group as the experimenters detected the change, but those from a different social group did not. A second experiment further examined the importance of this effect of social group. Provided that the meaning of the scene is unchanged, changes to attended objects can escape detection even when they occur during a natural real-world interaction. The discussion provides a set of guidelines and suggestions for future research on change blindness.

Levin, D.T., Momen, N., Drivdahl, S.B., & Simons, D.J. (in press) Change blindness blindness: The metacognitive error of overestimating change-detection ability. Visual Cognition

Recent research has demonstrated that subjects fail to detect large between-view changes to natural and artificial scenes Yet, most people (including psychologists) believe that they would detect the changes. We report two experiments documenting this metacognitive error. In Experiment 1, students in a large General Psychology class were asked if they thought they would notice the change in four different situations previously tested by Levin & Simons (1997) and Simons & Levin (1998). Most claimed that they would have noticed even relatively small changes that real observers rarely detected. In Experiment 2, subjects were tested individually and half were asked to predict whether someone else would detect the changes. Subjects again overestimated the degree to which changes would be detected, both by themselves and by others. We discuss possible reasons for these metacognitive errors including distorted beliefs about visual experience, change, and stability.

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