Dwelltime - Individual's Attentional Patterns Through the Change Blindness Phenomenon

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Introduction

People witnessing identical streams of information can experience that information very differently. This incongruence of experience was famously observed in the following psychological experiment: one group of research participants watching a video of a crowded area failed to notice a man in a gorilla suit meander across the room, although another group described the man in the gorilla suit as the most salient aspect of the video.

How do we account for such diversity in experience? My research investigates this general question via a new technique: the dwell-time paradigm, in which viewers advance at their own pace through slideshows depicting dynamic events while the time they spend looking (dwelling) at each image is measured.

Images depict recordings from the experiment mentioned above.

Research Question

We hypothesize that patterns of dwelling across time will clarify which aspects of events viewers are prioritizing in their processing, and thus we will be able to predict – well in advance -- who will subsequently report salient features of interest (such as a man in a gorilla suit).This study also attempts to replicate previous dwell time findings in an online format. This include various patterns seen in dwell time research like the boundary advantage effect (dwelling longer on new information in the video).

Research Questions -
To what degree will patterns of dwelling across time clarify which aspects of events viewers are prioritizing in their processing?
To what degree will dwell time be able to predict – well in advance -- who will subsequently report salient features of interest?
To what degree will previous patterns seen within dwell time research replicate?

Methods

My research simultaneously deploys two methodological techniques: the "inattentional blindness paradigm" (IBP), which has an extended history in cognitive psychology, and the recently innovated "dwell-time paradigm" (DTP). My aim is to utilize these two methods in tandem to investigate how attentional patterns, as assessed by the DTP, correspond with, and even predict, inattentional blindness, as measured by the IBP. In a validation study that is underway, I hope to replicate existing inattentional blindness findings utilizing new event sequences that are displayed in a slideshow format (rather than in video format, as is typical in this literature).

My preliminary findings indicate clear replication of the inattentional blindness phenomenon. The next step in the research is to mount a new study that involves recording viewers' looking times ("dwell times") as they advance at their own pace through the inattentional-blindness-inducing slideshows. These data will be collected via an on-line DTP program that I have developed in collaboration with my advisor and two student colleagues. The proposed study will simultaneously a) validate the on-line DTP code (via replication with slideshows previously utilized in in-lab DTP studies), and b) provide altogether new data regarding attentional (i.e., dwell-time) patterns predictive of inattentional blindness.

Two Part Research Method -

Part one - A replication and verification study which will validate change blindness in selected videos.
Part two - New research which will look at attentional patterns in change blindness.

Study One

Study one tested three selected videos for the change blindness effect. Following previous research in the field, change blindness was tested through various groups of participants given different instructions. Participants were divided into easy medium and hard conditions each tasked with following different phenomena in the video. Accuracy in tracking and identification of the change blindness phenomena was collected and analyzed. (Below are images from the different videos used in this study.)

Findings -
1. Statistically significant findings which indicate that the easy (just watch) condition produces more accuracy in change blindness occurrences than the hard (track two events) condition (shown in figure 3).
2. Two slideshows have clear change blindness effects occurring (shown in figure 1, 2, and 3).
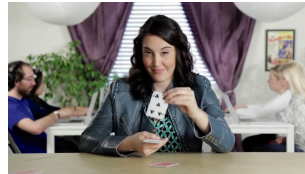3. Change blindness does occur in a slideshow format (shown in figure 1).
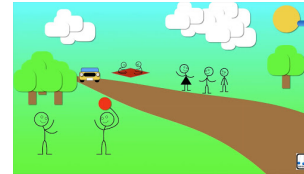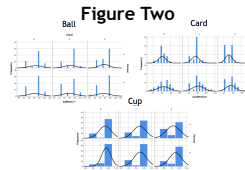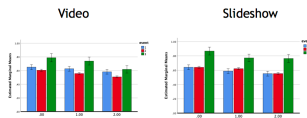

Figure One

Figure Two

Figure Three

Study Two

Challenges - The pandemic has proven to be a significant challenge for data collection, but many roadblocks have been cleared. Incorporation of dwell time tracking into an online survey has recently been made possible in preparation for this study. Code has been developed by Nicco Garofalo (with contributions from Scott Wallner, Yasu Tanaka). This tracking technology will become an open source research technique.

Study Two Method - The goal of this study is to evaluate the change blindness effect (validated in slideshow format in part one) through dwell time tracking technology. A minimum of 100 participants will participate per condition for data collection Evaluate dwell time using the easy, medium, and hard condition (between subjects). Participants will view same two slideshows validated in the first study (within subjects). Participants' accuracy and dwell time patterns will be measured.

Anticipated Results - Anticipated results are based off predictions from our hypothesis and previous patterns seen in dwell time research.
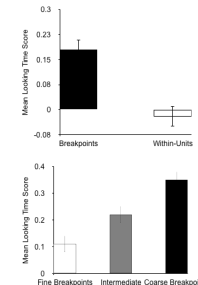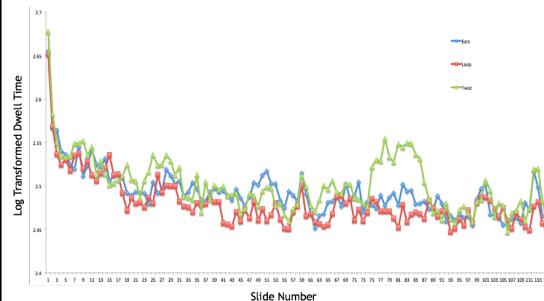
Conclusions

Conclusions surrounding the findings of this study cannot be made as the study has not been completed in its entirety. Speculative findings assuming that our hypothesis is correct can be identified. If the hypothesis is confirmed as a correct conclusion, these findings will hold considerable real-world significance. Specifically, it will be possible to utilize dwell-time patterns across a range of situations where monitoring the focus and adequacy of people's attention is crucial. For example, applications could include a) refinements to diagnosis in those with attentional impairments, such as attention-deficit hyperactivity disorder, dementia, and severe brain injury, and b) the creation of systems that alert people when their attentional patterns have become suboptimal for an essential task, such as drivers, train operators, pilots, and air traffic controllers.

Clearly much more work is needed to be done in order to complete this study, but results look promising thus far. Upon completion of this project, We will be submitting the results of this research for publication through academic journals such as Cognition, Memory and Cognition, and Frontiers in Psychology. In addition, we plan to present the research at various professional meetings such as the Cognitive Science Society and Psychonomics.

References

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Acknowledgments