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The Role of Gender on the Accuracy of Change Detection

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Does gender play a role in the accuracy of change blindness when observers are presented with a Rensink, O'Regan, and Clark (1997) flicker paradigm? I presented male and female subjects with two sets of A and B photographs that depicted a model in a natural setting with some sort of obvious change occurring between scenes A and B. Participants were asked to record any noted changes. I hypothesized that females would be more successful in accurately identifying the changes between scenes A and B than males. Results of the study reveal that there is no statistically significant effect of gender on a participant's accuracy in change detection.

Recently a number of studies have shown that under certain circumstances, very large changes can be made in a picture without observers noticing them. The word that is used to describe these phenomena is change blindness. Change blindness occurs most often when a large retinal disturbance takes place. The most common of these retinal disturbances are events such as the blinking of an eye, a brief flicker of lights, or even a film cut in a motion picture sequence.

The majority of the studies done on the phenomena of change blindness have predominantly focused on the three different aspects of spatial attention: the locus of attention (where in the visual field is the center of attention?), the extent or distribution of attention (how widely is attention spread over space?), and detail level (is the attention set for the 'forest' or the 'trees'?)(Scholl & Simons, 2001). However, none of these experiments have examined the role of gender on the occurrence of change blindness. Before describing such a study, I will briefly summarize some of the most extensive past research on change blindness.

In the first experiments that triggered an interest in change blindness observers were told to indicate when a previously memorized letter showed up in a random string of letters. The screen would quickly flash a new string of letters periodically and the observers would indicate when they saw their assigned memorized letter among them. Response time was recorded for the detection of a specified target letter. The main findings were that the more changes made to the string of letters during each switch the less likely the observers were to notice the target letter among the random string of letters (Hauber, 1983).

In the more recent experiments involving change blindness, participants were presented with high resolution, full color everyday visual scenes presented on a computer monitor. While their eye movements were being measured, the computer would make changes in the scene as a function of where the observer looked. When the participant's eyes moved from one spot on the photograph and focused on another, an element of the photograph would change in some way: a car parked outside a house would change color, change position and so on (McConkie & Currie, 1996).

The results of this experiment showed that when the participant's eyes shifted or blinked and the change in the photograph occurred during this time, surprisingly large changes could be made without the participants noticing them. In an attempt to explain these phenomena, McConkie and Currie (1996) assumed that change blindness had something to do with mechanisms the brain uses to process the combination of information that eye fixations form in succession. For example, every time the eye moves, the retinal image shifts, so in order for the brain to create a stable image that can be processed and decoded, the brain leaves out even the most obvious of changes in scenery.

This was the most popular explanation for change blindness until a subsequent set of experiments showed that in fact, the change blindness phenomena was not specifically related to eye movements. Rensink, O'Reagan, and Clark (1997) used a paradigm that became known as the "flicker" technique. Instead of making changes in a photograph each time the eye moved, a brief flicker was introduced between successive images. A scene was shown to participants for approximately 250ms followed by a brief blank screen for 80ms and then for 250ms a slightly modified version of the first scene was shown again. This brief blank scene introduced between the two photographs was similar to an eye movement. The participants were told that between scenes A and B a change was occurring. They were asked to search for this change.

It was found that when the participants viewed the changes without the blank screen inserted between photographs A and B, they were able to detect the changes immediately. However, with the addition of the flicker, it was often extremely difficult to locate the change. Once these changes were pointed out to the participants, they became perfectly visible (Rensink, O'Reagan & Clark, 1997).

What was so profound about the flicker technique is that it showed that change blindness could occur without the change being synchronized with eye movements. The experiment by Rensink, O'Reagan and Clark (1997) showed that change blindness was not specifically related to eye movements and the brain's attempt to stabilize the image for interpretation (change blindness) occurred because of the brief disruption that is inserted between two versions of one scene.

In the experiment that follows, I report a study that examines the role of gender in successful change detection. An equal number of male and female participants were shown two sets of photographs consisting of two scenes. A similar design to the Rensink, O’Regan, and Clark (1997) flicker paradigm was used to present the photographs. Photograph A was shown for 250ms followed by photograph B for 250ms with the presentation of a blank screen between A and B for 80ms. Participants were informed that some element of the scene was changing between photograph A and B and that every time the flicker occurred, they were to identify it on the provided questionnaire. I hypothesized that females would be more successful in accurately identifying the changes between scenes A and B than males based on the theory that women pay more attention to detail than men.

Method

Participants

Participants were fifteen male and fifteen female undergraduate students ages 18 and older. The participants were recruited through the Lindenwood University Human Subject Pool as well as from a Sensation and Perception class at Lindenwood University. The participants recruited through the Human Subject Pool received extra credit points for their participation in the study.

Materials

A manual 35mm Pentax camera, and Kodak 400 speed color film was used to take four photographs of a female model in two different natural settings. In the first set of pictures the model wore her shoulder length hair in a ponytail and was seated at a computer that had words visibly present on the whole screen with a red cup on the desk on her right side. In the second picture, the model wore her hair down, the computer screen was only half filled with words, and the cup on the desk to her right was changed to blue. In the second set of photographs the same female model stood holding onto a red vacuum cleaner wearing a blue shirt. In the second photograph the model stood holding the red vacuum wearing a red shirt. The photographs were developed and scanned onto a computer so the images could be placed onto a 3.5 floppy disk.

The research took place at Lindenwood University in a large classroom with enough desks to seat over 20 participants. The room was equipped with a computer that was able to project images onto a large screen.

Two consent forms were provided to the participants. One consent form was for the participant to keep, and the second was handed into the researcher. 30 surveys were handed out to the participants. There was a place to mark their gender (male or female), as well as their age at the top of the survey. There were two questions, one on the front side of the page, and the second on the opposite side. Both questions will ask the participants to list any changes he/she has detected from one set of photographs to the other.

Procedure

As the participants enter the classroom they received two consent forms (one for them to keep and one for the researcher to keep on file). They were asked to seat themselves every other seat leaving distance between themselves and other participants. Once the consent forms were completed the experimenter collected one copy of the consent form from each participant and placed them in a manila envelope than then sealed the envelope so the participants privacy and identity were kept anonymous. The experimenter then explained to the participants that they were about to view four photographs and will have to detect and record changes between the two sets of photographs. The participants were given the chance to ask any questions regarding the study and the experimenter answered these questions thoroughly being careful not to give away the content of the photographs.

A one-page survey was then handed out to the participants and they were asked to fill out the top portion of the survey that requests the participant to circle their gender and approximate age (Appendix A).

The experimenter will then begin showing the first set of two photographs. The participants will be presented with a high-resolution scene of a female model seated at a computer desk, her hair was in a pony tail, the computer screen was filled only half way with typed letters, and a blue plastic cup was resting on the desk to her right. This scene will be shown for approximately 250ms followed by the presentation of a gray screen for 80ms followed by the presentation of the high-resolution scene again for 250ms. The second presentation of the scene included the following changes: the model's hair was down instead of tied up in a ponytail, the computer screen will display a full page of letters rather than a half, and the cup on the desk to the model's right was changed from blue to red. The participants were then asked to record any changes that they noticed between the first scene and the second scene in the provided space on the survey.

Due to the fact that this experiment is a within-subjects design, the experimenter was concerned with the disadvantages of this particular design and was careful to avoid problems such as carryover effects. To avoid this problem the photographs always featured the same model, but the sets of photographs featured this model in two very different settings. The experimenter also counterbalanced the photographs by showing them in a different order. Sometimes the Photos A and B were shown first, and sometimes they were shown second behind photos C and D.

The participants were then asked to view another set of two photographs. The first high-resolution scene involved a female model wearing a blue shirt, a necklace and standing upright and holding a red vacuum cleaner. This scene was shown for 250ms followed by a grays screen for 80ms, followed by the second scene in which the following changes occurred: the female model was wearing a red shirt rather than a blue shirt, and she was no longer wearing a necklace in photograph two. The participants were asked to record any changes they detected between the two scenes in the space provided on the survey.

Following the completing of the surveys, the experimenter collected all of the surveys and placed them into a manila envelope separate from the envelope containing the consent forms. The experimenter then allowed the participants to ask any questions or voice any concerns regarding the experiment. The participants were also given the chance to view the photographs a second time and had the experimenter point out the changes to them.

Results

In order to test the hypothesis that women, rather than men, would be more accurate in detecting changes in a natural setting a t-test was conducted with the independent variable being the gender (male or female) of the participants, and the dependent variable being the responses to the change detection questions in the questionnaire (Appendix A). To analyze the collected data from the questionnaire a *t*-test was conducted to test differences between the two means. The results revealed a statistically non-significant effect of gender on a participants accuracy in change detection, $t\ (29)=2.47, p>0.5$. According to the results male participants were not any more accurate ($M=1.60$) than the female participants ($M=2.40$) when detecting changes made between the sets of photographs (see table two and three).

Discussion

While the findings of this study were found to be not statistically significant, it still demonstrated an important point. While this study did not find gender to have an effect on the accuracy of change detection, it was very clear that change blindness was very present in each group of participants studied. In the first set of photographs there were three possible changes that could have been detected by participants. The mean score for all participants (male and female) in the first set of photographs was 1.23. This is still very low considering all participants could easily detect the changes between the photographs after the 80ms gray screen was removed or the change was pointed out to them. A second observation made during the study was the fact that many of the participants noticed *something* changed but did not know exactly *what* had changed. For example in the first set of photographs, when the model goes from having her hair up in a pony tail to having her hair down, several participants recorded that the model was a different girl, or she was no longer smiling, however they did not attribute the difference to a change in her hairstyle. As noted in the study done by Rensink, O'Regan, & Clark (1997) when the change occurs, it produces a visual transient, which attracts attention to the change location. The transient then provides information that change *has* occurred, and it *where* it occurred, but it does not provide information about *what* the change was (Rensink, O'Reagan, & Clark 1997). The change will only be immediately noticed if an observer happens to have been paying attention to the changing element at the exact moment that it changes. If the observer is not paying attention to the changing element at the exact moment it changes the chances of successfully detecting change is very limited.

If I were to do the study over I would make a few changes that would help eliminate confounding variables and possibly change the results of the study. One of these changes would be the addition of more participants. I do not believe that I had an accurate representation of both the male and female gender. I would also use a different method when taking the initial photographs to be used in the experiment. Due to small imperfections in the positioning of the camera there were a few camera angles and zoom distances that differed from picture to picture. This could have easily caused a confounding variable, which in turn affected the results of the study.

Finally, the interest in change blindness in psychology has led to many studies in how and why change blindness occurs. Studies such as the flicker paradigm study done by Rensink, O'Reagan, and Clark (1997), have provided important findings as to the causes of change blindness. These experiments are what initially interested me in the phenomena of change blindness. Even though the presented study of the effects of gender on change detection concluded that the results were not statistically significant, it was still an interesting and rewarding study.

Will scientists and psychologists ever fully understand the phenomena of change blindness? Past studies show that we have the impression of seeing everything in perfect detail because our brains lead us to believe that we have access to every detail in our environments, when in fact, we do not. This explains the apparent paradox between the illusion our brain presents to us making us believe we are aware of every detail in our visual environments, and our consistent inability, in change blindness experiments, of knowing what has changed.

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Appendix A

Visual Memory
Questionnaire

Please circle the answer that best describes you.

Gender: M F

Age: 0-17 18-24 24-35 36-50 50 or older

Photographs #1 and #2

After viewing the two photographs in the sequence, please record any changes that occurred from photograph #1 to photograph #2 in the space provided below.

Visual Memory Questionnaire page 2

Photographs #3 and #4

After viewing the two photographs in the sequence, please record any changes that occurred from photograph #3 to photograph #4 in the space provided below.

Table 2

Participant #	M or F	Group 1	Group 2
101	F	1	1
102	F	0	1
103	F	2	1
104	F	2	1
105	F	1	1
106	F	0	1
107	F	2	1
108	F	3	1
109	F	2	1
110	F	1	1
111	F	2	2
112	F	2	1
113	F	0	1
114	F	0	1
115	F	2	1
116	M	0	1
117	M	2	1
118	M	0	1
119	M	2	1
120	M	1	1
121	M	1	0
122	M	2	1
123	M	0	1
124	M	2	1
125	M	0	1
126	M	2	1
127	M	2	2
128	M	1	1
129	M	1	1
130	M	1	1
TOTALS		**37**	**31**

Table 3

Part. #	**F/M**	**SCREEN**	**CUP**	**HAIR**	**SHIRT**	**NECKLACE**	**TOTALS**
101	F	1	0	0	1	0	**2**
102	F	0	0	0	1	0	**1**
103	F	1	0	1	1	0	**3**
104	F	1	1	0	1	0	**3**
105	F	0	1	0	1	0	**2**
106	F	0	0	0	1	0	**1**
107	F	1	1	0	1	0	**3**
108	F	1	1	1	1	0	**4**
109	F	1	1	0	1	0	**3**
110	F	1	0	0	1	0	**2**
111	F	1	1	0	1	1	**4**
112	F	1	1	0	1	0	**3**
113	F	0	0	0	1	0	**1**
114	F	0	0	0	1	0	**1**
115	F	1	1	0	1	0	**3**
Totals		**10**	**8**	**2**	**15**	**1**	**36**
116	M	0	0	0	1	0	**1**
117	M	1	1	0	1	0	**2**
118	M	0	0	0	1	0	**1**
119	M	0	1	1	1	0	**3**
120	M	1	0	0	1	0	**1**
121	M	0	0	1	0	0	**1**
122	M	1	0	1	1	0	**2**
123	M	0	0	0	1	0	**1**
124	M	1	1	0	1	0	**2**
125	M	0	0	0	1	0	**1**
126	M	1	1	0	1	0	**2**
127	M	1	0	0	1	1	**3**
128	M	1	0	1	1	0	**1**
129	M	1	0	0	1	0	**1**
130	M	0	1	0	1	0	**2**
Totals		**8**	**5**	**4**	**14**	**1**	**24**