**Own-Gender Bias in Change Detection for Gender-Specific Images**

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**ABSTRACT.** Change blindness is a phenomenon that occurs when individuals fail to notice changes that take place in the visual world. Although individual differences in change blindness have been relatively well-studied, no one has examined differences in detection for gender-relevant images. In the present study, men and women (N=53) determined whether subtle changes were present in three types of images: male-oriented, female-oriented, and gender-neutral. Images were presented using a modified flicker paradigm. As expected, there were no overall differences in change detection across biological sex or image type. However, men and women more accurately detected changes for images that pertained to their gender, F(1, 51) = 4.78, p = 0.03, \( \eta^2 = .09 \). Men detected more changes in male-oriented images (M = 3.30, SD = 0.86) than female-oriented images (M = 3.10, SD = 0.86). Conversely, women detected more changes in female-oriented (M = 3.50, SD = 0.69) images than male-oriented images (M = 3.20, SD = 0.69). All remaining interactions were not significant, all F's < 2.24, and all p's > .14. These findings are consistent with research positing an own-gender bias and extend previous research indicating that top-down processes can partially explain change blindness.

How can individuals miss such glaring changes in their environment? The fact that changes this extreme can be missed demonstrates the limitations of our attentional system, which has important implications for tasks that require sustained attentional focus, such as driving. It further suggests that foundational tenets on which society functions, such as the belief in the accuracy of eyewitness accounts of events, are potentially problematic themselves. When individuals encounter a visual scene, their evaluation depends, in part, upon environmental sensory information, or bottom-up processing (Gerrig & Zimbardo, 2002). By contrast, top-down processes are personal experiences, expectations, and expectations of others. How do these factors influence our perception of the world?

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1Throughout the manuscript, we used the word gender as opposed to the word sex. We recognize that this was not consistent with other Psi Chi Journal articles. However, this was done to provide readers with consistency of language because of the prevalent usage of the term, own-gender bias, which was already well-established and could not be changed.
knowledge, background, and motivations that affect one’s evaluation of a visual scene (Gerrig & Zimbardo, 2002). Recent research has aimed at understanding how these two processes explain change blindness.

Changes to certain physical features of the visual scene, or bottom-up processes, are more easily detected than others. For example, Cole et al. (2004) found that the changes made to the color of objects, as well as the addition of new objects were easily detected. By contrast, changes made to the luminance of an object were not as easily detected.

Top-down processes can also affect change detection. Participants’ personal beliefs, expectations, and knowledge could direct attention to specific features of stimuli, making changes easier to detect (Rensink et al., 1997). Such influences may lead individuals to focus on parts of visual stimuli that are not altered, which could impair change detection (Caird, Edwards, Creaser, & Horrey, 2005; Hollingworth, 2003). Indeed, changes to central interest areas (i.e., parts of images that are relevant for understanding the gist of the scene), are more detectable than changes made to marginal, or less significant, areas (Rensink et al., 1997).

Experience with domain-specific imagery is another top-down factor that affects change detection. Werner and Thies (2000) tested individuals who were considered experts in a domain (American football) and compared them to individuals who were considered novices. Participants were asked to detect changes in images that depicted football and traffic scenes. Football experts detected more changes in football images than did novices. By contrast, both groups detected changes in traffic scenes comparably.

If expertise in a specific domain enhances change detection for images within that domain, we may observe a similar effect for images that are relevant to the social groups to which individuals believe they belong. Social psychologists have found that individuals tend to be biased towards others based on appearances, preferences, and similarities, even when assigned to artificial social groups that do not represent actual differences between groups (Powlishta, 1995). Powlishta (1995) demonstrated that even children display own-group biases.

Own-gender biases have been documented in facial recognition as well (Rehnman, 2007; Wright & Sladden, 2003). Wright and Sladden (2003) reported that men exhibited a recognition advantage for male faces, whereas women demonstrated superior recognition for female faces. However, Rehnman (2007) found the own-gender effect only in women. The own-bias effect has been found not only for gender, but for age, physical appearance, and race as well (Loven, Rehnman, Wiens, Lindholm, Peira, & Herlitz, 2012; Rehnman, 2007; Wright & Sladden, 2003). Loven et al. (2012) argued that superior recognition for own-race faces occurs because participants spend more time viewing own-race faces than other-race faces. Consequently, there may be an attentional bias toward images that broadly represent a social category with which an individual identifies. Such bias may impact accuracy for detecting changes in images that are relevant to particular social categories, such as gender.

Thus, in the present study we examined whether participants would exhibit an own-gender bias in change detection. To this end, men and women attempted to detect changes in both gender-specific and gender-neutral images. To disrupt bottom-up processing, a flicker paradigm was used, in which an external image intermittently masked a visual scene (Rensink et al., 1997). We predicted that men and women would not significantly differ in their overall ability to detect changes. Consistent with research on processing gender-relevant information, we predicted that there would be a significant interaction between gender and imagery, such that women, and perhaps men, would detect changes more accurately for images relevant to their gender compared to images irrelevant to their gender (Werner & Thies, 2000; Wright & Sladden, 2003).

Method

Participants
A total of 53 undergraduates (31 women, 23 men) from a comprehensive state university in the Northeast volunteered to participate in the study. Approximately half of the participants \( n = 26 \) were recruited from an introductory psychology course. The remaining participants were recruited through a psychology research participant pool that consisted of students in mostly lower-division psychology courses. Forty-two participants identified as White, seven identified as Black, and four identified as Hispanic. Their ages ranged from 18 to 26 and the mean age was 20 for both men \( (SD = 2.27) \) and women \( (SD = 2.59) \). Participants were required to have perfect or corrected vision to participate. Out of the 53 participants, 25...
reported that they wore glasses or contacts, and 21 reported that they were wearing their lenses during the time of testing. All participants provided informed consent and received course credit for their participation.

**Materials**

Following Werner and Thies (2000), we selected 30 images from the Internet depicting male-oriented (e.g., sports scenes, images of cars, and motorcycles), female-oriented (e.g., make-up advertisements and fashion), and gender-neutral content. Some of the male and female-oriented images included opposite-sex models. Most gender-neutral images (e.g., landscapes and traffic intersections) did not include any human figures.

We pretested the stimuli to ensure that the images were perceived as female-oriented, male-oriented, or neutral. Students in a Research Methods class viewed all 30 images projected on a large screen at the front of the classroom and determined whether an image was male-oriented, female-oriented, or neutral. Following the pretest, five images were replaced because the majority of the participants believed that the images corresponded to a different gender than the one intended.

Using Microsoft Paint® and Microsoft Word® (Version 14.0, 2010), equal numbers of male-oriented \((n = 5)\), female-oriented \((n = 5)\), and gender-neutral \((n = 5)\) images were altered to reflect a single change. Alterations included color changes, the addition or removal of objects, and changes in the placement or rotation of objects. Further, alterations were made to parts of the images that were in the foreground, rather than the background. See Figure 1 for an example of an altered image.

Microsoft PowerPoint® (Version 14.0, 2010) was used to sequence the 30 images. For each trial, participants viewed an image for 5 s, a blank slide for 3 s (i.e., a flicker), and then an altered or identical image for 5 s. Half of the trials contained a change, whereas the other half did not. Two random orders of trials were generated. In Slideshow A the original version of altered images occurred first on change trials. In Slideshow B the altered image occurred first on change trials. No more than four trials of the same type (male-, female-, or neutral-oriented) occurred consecutively.

**Procedure**

After seeking and obtaining approval from the Institutional Review Board, testing occurred in quiet classrooms and in a small computer lab. All testing was completed by the first author. Participants were run in groups ranging in size from 2 to 15. In the classrooms, the images were presented at the front of the room on a large projection screen. Participants in the computer lab viewed the images on computer monitors. The participants were informed that they would view a series of images that may or may not contain changes. Participants then read and signed the consent form.

Before beginning the experiment, the participants completed a practice trial in which a stop sign that read “Changes Ahead” changed color from yellow to purple. Participants then decided whether a change occurred. Participants were reassured that detecting these changes can be difficult and that they should try their best.

Once the demonstration was finished, participants began the experiment. Participants were randomly assigned to one of the two slideshows. Thirty-three participants (13 men and 20 women) experienced Slideshow A. Twenty participants (9 men and 11 women) experienced Slideshow B. The number of participants varied across orders because of sampling constraints. After each trial, a screen stating “Record Your Answers” appeared for 15 s, during which participants indicated whether a change occurred on a printed response sheet. After 15 s elapsed, the next trial began.

After completing the change blindness task, written debriefing forms were distributed to participants. The participants were then informed that the purpose of this study was to examine whether men and women more accurately detected changes in images that were specific to their gender. The study took approximately 20 min to complete.

![FIGURE 1](image-url)
Results

A 2 x 2 x 2 mixed model analysis of variance was conducted with change condition (changed, unchanged images) and image type (male-oriented, female-oriented) as within-participant factors and participant biological sex as the between-participant factor. The dependent variable was the total number of correct responses. The maximum number of items correct for any within-participant condition was 5. Gender-neutral images were not included in the analysis because they were used solely as filler trials. Their function was to prevent participants from predicting the purpose of the study.

The main effects of gender and image type were not significant, both $F$’s < 0.70, all $p$’s < .40. The mean number of correctly identified changes was 2.50 ($SD = 1.45$) for men and 2.60 ($SD = 1.22$) for women. The mean number of correctly identified changes in male-oriented images was 3.20 ($SD = 0.86$) and 3.30 ($SD = 0.69$) in female-oriented images. However, the main effect of change was significant, $F(1, 51) = 77.10, p < .001, \eta^2 = .60$, such that participants were more accurate on no-change trials than on change trials. The mean number of correct responses was 4.00 ($SD = 0.81$) for no-change trials and 2.50 ($SD = 0.95$) for change trials, which is not different from chance levels of responding.

As illustrated in Figure 2, the image type x gender interaction was significant, $F(1, 51) = 4.78, p = .03, \eta^2 = .09$. Greenhouse-Geisser corrected values were used to account for a violation in homogeneity of variance. Men detected more changes in male-oriented images ($M = 3.30, SD = 0.86$) than female-oriented images ($M = 3.10, SD = 0.86$). Conversely, women detected more changes in female-oriented images ($M = 3.50, SD = 0.69$) than male-oriented images ($M = 3.20, SD = 0.69$). The statistical power for this analysis was .57. All remaining interactions, including the three-way, were not significant, all $F$’s < 2.24, and all $p$’s > .05.

Discussion

The goal of the present study was to examine an own-gender bias in regards to change detection for gender-specific imagery. As predicted, we observed an own-gender bias such that change detection was more accurate for images relevant to their own gender. As Wright and Sladden (2003) suggested, things relevant to one’s gender command attention simply because they are more interesting or meaningful. Our results are also consistent with Werner and Thies (2000), who found that individuals are more likely to detect changes in images with content pertaining to them. The findings of this study demonstrate how gender schemas and our personal biases can affect our perception and attention to objects in our environment. Further, top-down processes appear to be stronger determinants of attention than bottom-up processes.

Although we found evidence of an own-gender bias in change detection, the effect size was relatively small and our statistical power was low. Future research should attempt to replicate this finding with a larger sample size and stronger experimental control. Fully automating the procedure, including the responses, would not only better control the experimental setting, but also allow for the collection of reaction time data. In addition, making the task more difficult by using flickers of white noise (Rensink et al., 1997) rather than blank images and increasing the speed of presentation could increase differences between gender-relevant and gender-irrelevant images.

Of note, we did not expressly examine the degree to which participants identified with their gender. Rather, we grouped participants by their biological sex, which does not guarantee strong identification with a particular gender. Nevertheless, we did find evidence of an own-gender bias, which was slightly stronger for women than for
men; such that our results showed that men and women more accurately detected changes in images that pertained to their biological sex. Due to a combination of biological and social factors, women may tend to be more interested in other individuals and pay more attention to other women than to men (Rehnman, 2007).

Another limitation of this study is that the types of changes that occurred across all trial types were not perfectly counterbalanced. Upon visual inspection of the data, it appeared that changes in the rotation or spatial location of objects were easiest to detect, followed by color changes. The addition and removal of objects appeared to be the most difficult. The results from Cole et al.’s (2004) study are somewhat consistent with these findings. They found that changes in color were among the easiest to detect. However, the addition of objects was also one of the easier changes to detect, which is contrary to our observations.

Despite these limitations, the current study makes a significant contribution to our understanding of change blindness. The findings suggest preliminary support for an own-gender bias in change detection and extend previous research indicating that top-down processes can partially explain change blindness. For example, Hourihan and colleagues (Hourihan, Benjamin & Liu, 2012) found that participants were not only better at remembering own-race faces as opposed to other-race faces; they also found that participants were better at predicting their ability to recognize own-race faces as well.

Hence, identification with a particular social group, including one based on race or ethnicity, may affect our susceptibility to change blindness. Such findings have direct real-world implications related to assessing the accuracy of witness memory in legal proceedings or the accuracy of memories potentially influenced by other top-down processes. Whereas seminal research regarding change blindness involved incidental learning (e.g., Simons & Levin, 1998), the current study adds to the evidence demonstrating change blindness in intentional laboratory tasks (e.g., Werner & Thies, 2000). Unlike domain-specific expertise where knowledge and experience must be explicitly sought and developed over time (Werner & Thies, 2000), learning about one’s gender seems to occur as a normal part of everyday life from a young age (Powlishta, 1995) and may influence our ability to recall details and detect change. Thus, the findings of this present study suggest that the own-gender bias not only affects an individual’s ability to recognize others, and our overall preferences towards other individuals, but it can also affect our ability to detect changes in our environment.

References


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