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Sleight of Mind: Choice Blindness at a Simple Feature Level*

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Choice blindness, the failure to notice mismatches between an intended choice and presented outcome, has mostly been documented in decision-making tasks focusing on preferences, opinions, and facial recognition. To expand upon the existing choice blindness literature, we investigated whether the effect occurs in a non-ambiguous decision-making situation. To test this, we examined if conspicuous mismatches were detected when a simple single feature was manipulated using unidimensional stimuli. In Experiment 1, participants were presented with two bars of differing length and were told to choose the longer bar. Afterwards, their selection was presented on screen and participants had to enter how much longer their selection was than the other. In a few trials, however, the relationship between choice and outcome was manipulated and participants received the bar they did not choose. Consistent with previous experiments, only 20% of the manipulations were detected. To make sure participants actually interacted with the stimuli, in Experiment 2, participants had to adjust the length of the chosen bar themselves. While detection rates rose, choice blindness was still existent. Experiment 3 investigated the effect of task-relevancy on choice blindness. Participants were more susceptible to choice blindness when a task-irrelevant feature was swapped rather than a task-relevant feature. The principal finding was that, though all accurately remembered the difference, most were unaware of the mismatch even when the sole feature was manipulated. Also, both task-relevancy and stimulus similarity moderated the effect, hinting that both top-down and bottom-up attention plays a role.

Keywords: choice blindness, working memory, selective attention, decision making, conscious awareness

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Decades of research have demonstrated the importance of conscious deliberation when making decisions (Bettman, Luce, & Payne, 1998; Kahneman, 2003), strongly suggesting that inconsistencies between one's choices and results will be easily noticed. However, this popular belief was challenged by a group of researchers that provided evidence that discrepancies between one's decision and outcome may go unnoticed. Johansson, Hall, Sikström, and Olsson (2005) presented participants with two pictures of female faces and asked them to choose the more attractive face from each pair. Afterwards, participants were presented with their selection and asked to explain their decision. On 3 out of 15 trials, however, covertly using a magic trick, the experimenters switched one picture for the other after a choice had been made (i.e., in these manipulated trials, participants received the picture they had rejected). Surprisingly, only 26% of the manipulations were noticed and this failure to detect

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mismatches has been since called choice blindness.

Though replications in multiple domains suggest that choice blindness is a robust effect (Hall, Johansson, Tarning, Sikstrom, & Deutgen, 2010; Sauerland, Sagana, & Otgaar, 2012), the underlying mechanism is still unknown. While theories of change blindness offer an explanation, decision-making theories make it difficult to converge on a single reason (Hall & Johansson, 2008). For instance, change blindness occurs when initial representations are forgotten or overwritten by feedback (Beck & Levin, 2003) or when one fails to compare information before/after change (Hollingworth, 2003). However, based on decision-making theories, immediately forgetting something that was deliberated and decided is highly unlikely, because intentions guide actions (Sirigu et al., 2004). Also, while changes are more easily and frequently detected if they are at the center of attention (Rensink, 2002), choice blindness is observed even when the changes are of central interest (Johansson et al., 2005).

While the precise mechanism is unknown, studies have suggested that factors such as similarity and memory failure moderate choice blindness (Hall et al., 2010; Sauerland et al., 2012; Sauerland et al., 2013b). Recently, ambiguity has been suggested as an important moderator of choice blindness (Merckelbach, Jelicic, & Pieters, 2011). Considering that ambiguity refers to situations that allow multiple interpretations, it can be argued that decisions based on personal preference and subjective experience are innately unclear (Sagana, Sauerland, & Merckelback, 2013). Furthermore, studies have shown that decisions can alter (Ariely & Norton, 2008; Festinger, 1957; Egan, Bloom, & Santos, 2010) and shape one's preference (Sharot, Velasquez, & Dolan, 2010; Johansson, Hall, Tärning, Sikström, & Chater, 2013), suggesting that decisions do not merely reveal preexisting preferences, but can even create new ones. Combined with the intrinsic ambiguity of evaluative judgments, the high malleability of preference may have facilitated choice blindness and made it difficult for participants to detect manipulations in their decisions.

A possible explanation behind choice blindness is that participants may have attended to the difference between the two options. For instance, a subsequent memory test after a choice blindness experiment revealed that while participants remembered their original choice in 92% of the non-manipulated trials, only 33% of their decisions in manipulated trials were remembered (Johansson, Hall, & Sikstrom, 2008). Thus, most of the decisions in the manipulated trials were not maintained in memory. If a decision was properly maintained in memory, one would be aware of an inconsistency between the selection and outcome. However, in the manipulated trials, all participants were able to provide a reason behind their decision and some even described traits from their original choice (Johansson, Hall, & Sikstrom, 2008). Thus, it is possible that after a decision, only the difference information between the two options is maintained in memory, rather than that of the original decision.

In this study, we investigate whether 1) choice blindness occurs in a decision task that focuses on one element and 2) whether the difference information between two options is maintained. Since most existing choice blindness experiments examined decisions based on personal preference and utilized real stimuli (e.g. pictures of people, jam, tea), quantifying the difference information between the options was difficult to measure. Additionally, the use of real stimuli also made it challenging to control exactly what features of the stimulus changed and what did not. Across a set of 3 experiments, the physical features of a stimulus were manipulated with the goal of testing whether choice blindness is present in a simple decision making task. We hypothesized that choice blindness occurs because participants selectively attend to only the difference between two options and maintain it in their working memory rather than the representations of the individual choices. To test this, college students completed a simple dimension judgment task: choosing the longer/thicker between two bars of differing length/width.

Experiment 1

Experiment 1, investigated whether choice blindness occurs in a single feature judgment task. Participants were presented with two rectangular stimuli that differed in one dimension (length) and were told to select the longer stimuli. After a decision was made, the chosen stimulus was displayed on screen, and participants were instructed to answer how much longer it was than the other. In a few trials, however, the manipulated the length in a few trials amongst a majority of non-manipulated trials. Manipulating a sole feature allowed us to experimentally control the manipulations and allow a more accurate observation of choice blindness.

Method

Participants and design

Nineteen undergraduate students participated in Experiment 1.The number of participants recruited was based on previous choice blindness studies (Johansson et al., 2005; Hall et al., 2010). The study was disguised as a length judgment experiment and all participants were compensated with research credits or a gift certificate.

Materials

The experiment was executed on an IBM computer with a 23 inch 1920-by-1080-pixel LED monitor using the psychophysics toolbox on MATLAB (Brainard, 1997; The MathWorks, Natick, MA) with a viewing distance of 57 cm. Pairs of black rectangular bars with a width of 1 cm and varying length were used. The length of each bar was one of five possible lengths (3cm, 4 cm, 5 cm, 6 cm, 7 cm; visual angles 2.96˚, 3.94˚, 4.93˚, 5.91˚, 6.90˚ respectively) and was paired with a bar that was 20, 30, or 40% longer, resulting in a total of 15 possible pairs.

Procedure

Each trial began with two rectangular bars of differing length appearing in the middle of the screen for 3 seconds (Figure 1). Participants were informed to attend to both stimuli and remember which stimulus was physically longer. Afterwards, the two bars were replaced

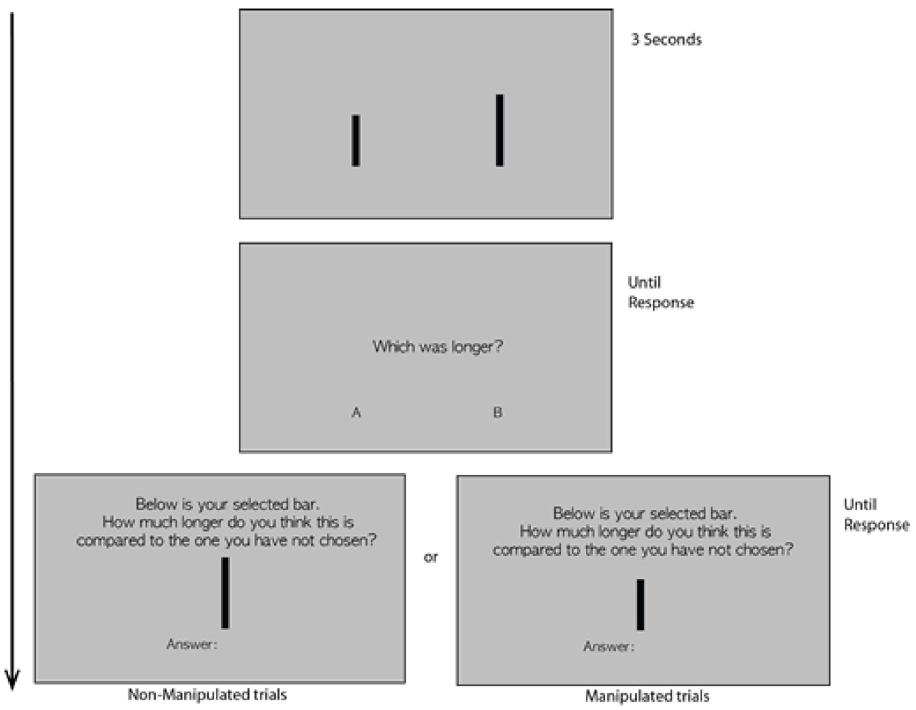

Figure 1. Example trial sequence from Experiment 1. The task was to select the longer bar and determine how much longer it was than the other. In non-manipulated trials (left), participants received their chosen bar as the reference bar. In manipulated trials (right) participants received the unchosen shorter bar as the reference bar. They then entered the difference between bars in mm before moving on to the next trial.

with the question, “which was longer?” along with the letters “A” and “B” under where each respective rectangle was positioned. Participants made a decision by clicking the respective letter with a mouse click. In the non-manipulated trials, the selected stimulus (reference bar) appeared in the middle of the screen and participants were tasked to enter how many millimeters longer their selection was compared to the unchosen stimulus (perceived difference) by using the number pad on the keyboard. In the manipulated trials, however, the displayed reference bar was not the correct longer rectangle, but the incorrect shorter rectangle.

The experiment consisted of 15 trials with 3 manipulated trials (trials 7, 10, and 14) - one trial each for the three percentage differences (20%, 30%, 40%) - administered consistently throughout participants (Johansson et al., 2005). The order of the manipulations was counterbalanced among participants. After all 15 trials, participants were presented with a survey that consisted of the questions: “What did you think of the experiment?” (1-5, from interesting to not at all interesting), “Was anything weird or intrusive with the experiment?” (Y/N), “If so, why?” (free answer), “If you were to participate in a future experiment where you are not presented with your initial choice, would you notice this trick?” (Y/N), “There were a few trials in the experiment where we manipulated your choices, did you notice? (Y/N), “How many times?/When did you notice?” (free answer) (Johansson, Hall, Gulz, Haake & Watanabe, 2007). Upon completion, participants were fully debriefed.

Results and Discussion

Manipulation Detection

Based on the data collected from the post-experiment survey, a manipulated trial was categorized as detected if participants either correctly described the manipulation or claimed to have noticed something weird about the experiment. Among a total of 57 manipulations, 11 (19.30%) were detected, a detection rate similar to the original choice blindness experiment (Johansson et al., 2005). Of the 19 participants, one detected all three manipulations, four detected two, and the remaining 14 were unable to detect any. Thus, choice blindness was observed using a task where the stimuli differed in one simple dimension.

Perceived difference

To investigate whether participants who observed choice

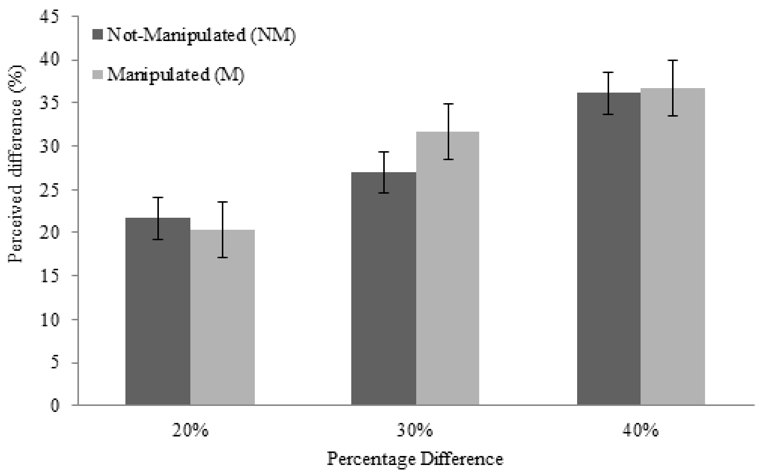

Figure 2. Results from Experiment 1: participants' mean perceived difference in length between bars as a function of manipulation and the percentage difference between bars. All differences between percentage differences was significant, $p < .05$. Five participants who had detected at least one manipulation were removed from the analysis because once a detection has been made, they become more aware of potential changes and allocate more resources accordingly than focusing on the task in hand (Johansson et al., 2005). There was no significant interaction between manipulation and percentage difference, nor was there a significant main effect in manipulation, $ps > .05$. Error bars represent ±1 SE

blindness properly maintained the difference between the two rectangular bars in memory, a 2 x 3 mixed Analysis of Variance (ANOVA) with manipulation (manipulated, non-manipulated) as a within-subjects variable and percentage difference (20%, 30%, 40%) as a between-subjects variable was conducted. Only data from 14 participants were used in this analysis (5 participants who detected at least 1 manipulation were removed). There was a significant main effect of percentage difference, $F(2, 52) = 51.94$, $p < .001$, $\eta_p^2 = .67$. Post hoc tests revealed that there was a significant difference among all three conditions (ps 〈 .001, Bonferroni corrected values) (see Fig. 2). No other main effect or interaction reached significance ($ps > .18$, $Fs < 1.8$).

This result demonstrates all participants who were not aware of the decision-result discrepancy, accurately determined the difference in length between bars. By reducing the choice blindness paradigm to its bare minimum, we were able to observe a robust choice blindness effect despite the simple nature of the task. Participants were unable to notice that they were not given their selected bar, but rather the significantly shorter one while accurately remembering the difference between the two options.

Experiment 2

The results of Experiment 1 demonstrate that choice blindness does indeed occur in a simple decision making task and that participants who showed choice blindness accurately remember the difference between the two options. However, some responses from the post-experimental survey suggested that there was no need to focus on the selected bar to complete the task. Most participants responded that they never looked at the screen when answering what the perceived difference between the stimuli were. This made it difficult to claim that participants did not notice manipulations; if they had not looked in the first place, any manipulation would have been irrelevant. To minimize this issue, a new experimental design was utilized in Experiment 2. Participants had to actively interact with their selection when responding to what the difference between the two stimuli was. This forced participants to allocate their attention to the screen, ensuring that participants are interacting with their selection (or the switched stimulus in the manipulated trials). Considering that changes are more frequently noticed if at the center of attention (Rensink, 2002), we predicted that this change would increase the number of detected manipulations. Also, to test if stimulus similarity influenced choice blindness, percentage difference between bars was manipulated between participants rather than within participants.

Method

Experiment 2 was identical to Experiment 1 except as follows. Thirty new participants were recruited. More participants were recruited in Experiment 2 to ensure that a similar number of participants experienced choice blindness as in Experiment 1. The length of each bar was one of four possible lengths (4cm, 5 cm, 6 cm, 7 cm) and paired with another 20% or 40% longer bar. Where the participants typed in the difference between the pair of bars in Experiment 1, two reference bars were displayed in the center of the screen with a 1cm gap in between the two reference bars. In the majority of the trials (i.e., non-manipulated trials), two identical correctly selected longer rectangle appeared while in the few manipulated trials, two identical incorrect shorter rectangle appeared as reference bars. By moving the mouse up and down, participants adjusted the length of the reference bar on the right until it matched that of the unchosen bar and clicked save their response and advance to the next trial. The features of the reference bar on the left did not change throughout this task. This new design made sure that participants attended to the screen when performing the task. Participants were randomly assigned to either the 20% or 40% percentage difference condition.

Results and Discussion

Manipulation Detection

In total, 41 out of 90 manipulations (45.55%) were detected. Out of the 30 participants, 10 detected all three manipulations, four detected two, three detected one, and the remaining 13 were unable to detect any. Subjects in the 40% group detected more manipulations than those in the 20% difference group (64.44% vs. 26.67%, $t(28) = 2.50$, $p < .05$, $d = 0.94$). This indicates that choice blindness is more likely to occur when the difference between the two stimuli are greater, similar to results from previous findings using real-world stimuli (Hall et al., 2010). Overall, the detection rate for Experiment 2 (54.44%) was greater than that of Experiment 1 (19.30%), suggesting that participants who interacted with their selection were more likely to detect a manipulation, $\chi(1) = 10.53$, $p = .001$. However, although participants had to interact with the reference bar, it is important to note that 45% of the manipulated trials still went unnoticed, even in such circumstances.

Perceived difference

A 2 x 2 ANOVA with manipulation (manipulated vs. non-manipulated) as a within-subjects variable and percentage (20% vs. 40%) as a between-subjects variable was conducted to examine whether participants properly maintained the difference between the two rectangular bars in memory. This analysis was only conducted on the 13 participants who observed choice blindness. Again, there was only a significant main effect of percentage, $F(1, 12) = 15.71$, $p < .01$, $\eta_p^2 = .57$, indicating that participants accurately perceived the difference between bars in the 40% condition to be larger than that of the 20% condition (35.54% vs. 24.00%) (Figure 3). Overall, the results of Experiment 2 replicate that of Experiment 1; even when participants actively attend and interact with their selection (or the switched stimulus) they accurately maintain the difference information while being unaware of whether the presented bar is actually their selection.

Experiment 3

Experiment 2 demonstrated that choice blindness occurs even when participants interacted with the reference bar after their decision. Additionally, the significant difference in manipulation detection between the 20% and 40% conditions showed that stimulus similarity facilitates the effect; the greater the discrepancy between the two stimuli, the more likely one is to be aware of a manipulation. To further understand what would modulate choice blindness, we manipulated the task-relevancy of the manipulated feature in Experiment 3. If the task-relevant feature is being manipulated, we hypothesized that participants would be less prone to exhibit choice blindness whereas participants would be more prone to experience choice blindness when a task-irrelevant feature was being manipulated. To test this, both the length and width of the rectangular stimuli

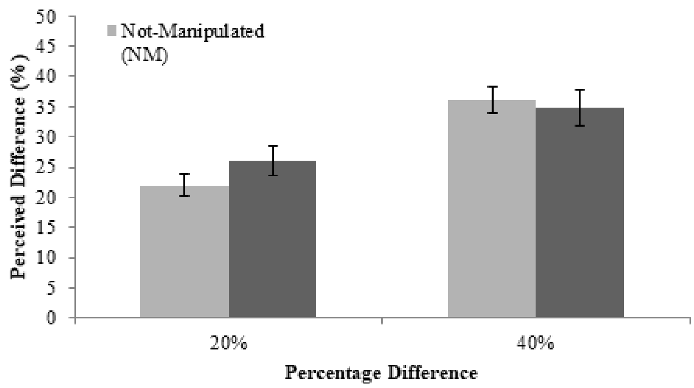

Figure 3. Results from Experiment 2: participants' mean perceived difference (in length) between bars as a function of manipulation and the percentage difference between bars. Sixteen participants who detected at least one manipulation were removed from the analysis. Error bars represent ±1 SE.

were altered.

Method

Participants and design

A 2 (task-relevancy: relevant, irrelevant) x 2 (percentage difference: 20%, 40%) factorial design was utilized. A total of 104 participants were randomly assigned to the four groups. Because the experiment was a between-subject design, more participants were recruited to ensure each condition was properly powered. We estimated that at least 80 participants would be needed based on a medium effect size based on an a-priori power analysis. For half of the participants, the relevant feature was the length of the rectangle stimuli and the for the other half, the relevant feature was the width.

Materials

Each bar was one of four possible lengths (4cm, 5cm, 6cm, 7cm) and was paired with another bar that was 20% or 40% longer. The width of each bar was one of four possible widths (7mm, 8mm, 9mm, 10mm) and was paired with another bar that was 20% or 40% thicker. The length and width of a bar was randomly paired for each trial.

Procedure

Experiment 3 was identical to Experiment 2 except the following. The actual test consisted of 20 trials with 4 manipulated trials administered consistently on trials 4, 7, 10, and 14. Participants were told to choose the appropriate bar based on their group (length group: longer, width group: thicker). On manipulated trials, participants in the relevant group received a reference bar in which the task-relevant dimension was manipulated while the task-irrelevant dimension was identical to their original choice; those in the irrelevant condition received a reference bar in which the task-irrelevant dimension was manipulated while the task-relevant dimension was kept constant. (e.g., participants in the length judgment task and designated to the relevant group received a bar that was shorter while the width was the same as that of the originally chosen bar).

Results and Discussion

Manipulation Detection

Across all groups, 114 out of 416 manipulated trials (27.47%) were detected. Out of all participants, 14 detected all four, nine detected three, 10 detected two, 11 detected one, and the remaining 60 were unable to detect any manipulations. Manipulation detections were analyzed in a 2 x 2 x 2 ANOVA with relevancy (task-relevant vs. task-irrelevant), percentage difference (20% vs. 40%), and dimension (length vs width) as between-subjects variables. There was a significant main effect of task relevancy on the manipulation detection rate, $F(1, 96) = 8.91$, $p < .05$, Detection rate was higher when a task-relevant feature was manipulated than when a task-irrelevant feature was (37.98% vs. 16.83%). The main effect of percentage

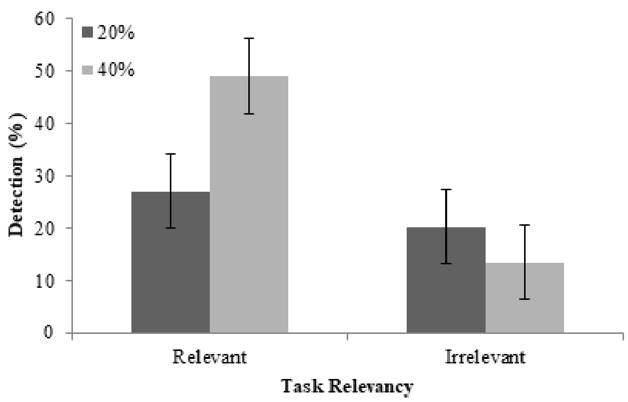

Figure 4. Results from Experiment 3: detection rate of manipulations as a function of the task-relevancy of the manipulations and percentage difference between stimuli. Error bars represent ±1 SE.

difference was not statistically significant. There was a significant 2 x 2 interaction between relevancy and percentage, $F(1, 96) = 4.14$, $p < .05$, $\eta_p^2 = .04$ (Figure 4). Further analyses revealed that when a task-relevant feature was manipulated, detection was significantly higher when the difference between the bars was 40% than 20% (49.04% vs. 26.92%), $t(96) = 2.26$, $p < .05$, $d = .46$. There was no difference between percentages when a task-irrelevant feature was being manipulated, $t < 2$, $p > .05$. Any other main effects and interactions did not reach significance, $Fs < 2$, $ps > .05$.

Perceived difference

The perceived differences (%) were analyzed in a 2 x 2 x 2 mixed ANOVA with manipulation (manipulated vs. non-manipulated) as a within-subjects variable and percentage (20% vs. 40%) and dimension (length vs. width) as between-subjects variables. Participants who had detected at least one manipulation (n = 44) and those who provided means that exceeded 3 standard deviations (n = 6) were removed from the analysis. There was a significant main effect for percentage, $F(1, 50) = 83.35$, $p < .05$, = .63., and dimension, $F(1,50) = 10.68$, $p < .05$, $\eta_p^2 = .18$. Participants perceived the difference between the bars in the 40% condition (M = 36.36%) to be larger than the difference in the 20% (M = 19.17%) and the difference between bars when determining length (M = 30.84%) to be larger than the difference when determining width (M = 24.69%). Any other main effects or interactions did not reach significance $Fs < 2$, $ps > .05$.

General Discussion

Across three experiments, we investigated whether 1) choice blindness occurs in a decision task focusing on one feature of a stimulus and 2) the difference between the two stimuli are properly maintained in memory. Experiments 1 and 2 manipulated the length of rectangular stimuli and demonstrated that participants experienced choice blindness even when a single, simple feature was manipulated. These findings suggest while ambiguity from real-world stimuli may induce choice blindness (Sagana, Sauerland, & Merkelbach, 2013), discrepancies between decisions and results may still go unnoticed during a decision making task that minimizes ambiguity by using simple stimuli. Experiment 3 examined whether the task-relevancy of the manipulated feature modulates choice blindness. The results demonstrated that participants were more likely to be prone to choice blindness when a task-irrelevant feature was being manipulated than when a task-relevant feature was manipulated. This was also modulated by the size of difference between the stimuli; participants were more likely to exhibit choice blindness when the difference between the task-relevant feature between the two stimuli was greater. These results suggest that both bottom-up and top-down factors of attention influence choice blindness.

Whether stimulus similarity moderates choice blindness has been divided with some studies finding supporting evidence (Hall et al., 2010; Sauerland, Sagana, & Otgaar, 2012), while others have not (Johansson et al., 2005). Our results add support to the former; participants were more likely to notice a change when the difference between options were 40% rather than 20%. Using bars of differing length and width allowed us to meticulously manipulate stimulus similarity and find evidence that choice blindness is modulated by exogenous, bottom-up attention. The noticeable finding of our study, however, is that task-relevancy also acts as a moderator. By reducing the choice blindness paradigm to its bare minimum, we were able to control what features were manipulated and what were not. Participants were significantly more likely to detect a change in their selection when a task-relevant feature was manipulated than when a task-irrelevant feature was, indicating that endogenous, top-down attention also has an effect.

Our results suggest that change blindness theories might not offer a full explanation for choice blindness. Levin and Simons (1997) suggested that failure to intentionally encode features may be a reason to blindness. Also, in order to successfully detect a change, we must consciously perceive the properties that are related to the task in hand (Triesch, Ballard, Mayhoe, & Sullivan, 2003). Similarly, Hollingworth (2003) argues that change blindness roots from the failure to compare information from the initial scene with that from the changed scene; for successful detection, visual information must be retained in memory. Failure to encode, retain, or compare visual information could lead to blindness in change. However, in the current set of experiments, participants only had to attend to, encode, and perceive one feature to make a decision. Since participants properly responded to the dimension judgment task, it is hard to believe that participants failed to do any of the above.

Importantly, across all three experiments, participants who were subject to choice blindness accurately remembered the difference between the two options. This suggests that a potential explanation behind the mechanism of choice blindness may be because participants attend and maintain only the information about the difference between the two options in memory. Our findings suggest that the chosen stimulus could have been immediately forgotten. Since the task was to answer how much longer (or thicker) the bar was right after a decision, it is possible that participants only maintained the difference information in their working memory and forgot the information about the options, exhibiting a form of amnesia. While participants attended to both options when making a decision, the representations of the individual choices were not sustained because it was no longer task-relevant. Another possibility is that there was no need to maintain the information of the two options to begin with. Participants may have just encoded and maintained the difference information. As a result, participants who were completely oblivious to manipulations did not vary in their answers for the difference judgment between manipulated and non-manipulated trials.

Considering that decisions are made continuously, it seems to be detrimental to forget them immediately. We would no doubt realize if the shampoo we picked was different than that on our shopping list. Nevertheless, it would be inefficient to constantly dwell on information that was needed prior to a decision in everyday situations. Because our visual system assumes that the world is not sporadically changing but rather consistent (Simons & Levin, 1998), we do not expect one object to change into another instantaneously. Hence, we do not keep a constant effort to notice every change that happens in our environment and decisions. If so, it would prevent us from utilizing our resources to future tasks. While our data offer a possible explanation to choice blindness, further experiments are required to fully support this claim, In tandem with the fact that memory failure acts as a moderator for choice blindness (Sauerland et al., 2013b), our findings suggest that a lapse of memory does seem to play a role in choice blindness.

A possible limitation concerns the reluctance to report changes in decisions by participants. However, the detailed questionnaire participants took immediately after the experiment encouraged to report anything weird or was of concern during the experiment. It would be illogical for one to refrain from answering what he or she truly thought or experienced during the experiment. Future experiments should try to incorporate experimenter-participant interaction to see if there is a difference in concurrent and retrospective detection. Also, future studies should focus on manipulating features that are mutually exclusive (i.e. color and length) to generalize the effect

In conclusion, through three experiments, our findings show that choice blindness still occurs when ambiguity is minimized. Choice blindness is also moderated by stimulus similarity and task-relevancy suggesting that both top-down and bottom-up elements of attention are involved in the phenomena. Our results extend that of previous choice blindness experiments and establishes the effect where preferences do not exist by using simple stimuli. While the results seem to suggest that choice blindness occurs because we maintain the difference information in our working memory and not the information of the given options, further research is necessary to ascertain the mechanism behind choice blindness. Taken together, our results demonstrate that choice blindness is still a strong effect when one must choose between two non-ambiguous stimuli.

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마음 속임: 세부 특징 수준에서 나타나는 선택맹*

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자신이 선택한 것과 실제로 얻은 결과가 서로 다를 때, 이를 눈치채지 못하는 현상을 선택맹이라고 한다. 선택맹의 보다 근본적인 인지적 메커니즘을 알아보기 위하여, 본 연구에서는 세 가지의 실험을 수행하였다. 실험1에서는, 객관적인 답이 있는 경우에서도 선택맹 현상이 나타나는지 알아보았다. 참가자들은 길이가 서로 다른 두 막대를 제시받고, 둘 중 더 긴 막대를 선택하였다. 선택 후, 참가자들은 자신이 선택한 막대를 제시받고 선택하지 않은 막대에 비하여 얼마나 더 길었는지 답하였다. 그 중 몇 개의 조작된 시행에서는 자신이 선택했던 긴 막대 대신 선택하지 않았던 짧은 막대를 제시받고, 여타의 시행과 같이 자신이 선택했던 막대가 선택하지 않았던 막대에 비하여 얼마나 더 길었는지 답하였다. 기존의 선택맹 연구 결과와 유사하게, 약 20%의 조작된 시행에서 참가자들은 선택과 결과간의 불일치를 발견하였다. 실험 2에서는, 참가자들이 제시된 막대에 실제로 주의를 두었는지 알아보기 위하여 참가자들이 선택한 막대의 길이를 스스로 조작할 수 있게끔 하였다. 그 결과, 선택과 결과 간의 불일치 발견율이 실험 1에 비해 증가하였지만 선택맹은 여전히 현저하게 나타났다. 실험1과 실험2의 결과를 통하여, 한 가지의 세부특징만 조작이 되어도 선택맹 현상이 나타난다는 것을 확인하였다. 실험 3에서는, 조작되는 세부특징의 과제관련성이 선택맹에 어떠한 영향을 미치는지 알아보았다. 그 결과, 과제와 관련있는 세부특징이 조작된 경우에 비하여 과제와 관련없는 세부특징이 조작된 경우에 선택맹 현상이 보다 현저하게 나타남을 알 수 있었다. 본 연구의 결과를 통하여 선택맹에 영향 끼치는 요인에는 하향식과 상향식 주의 메커니즘 모두 관련이 있다고 추론해 볼 수 있다.

주제어: 선택맹, 작업기억, 선택적 주의, 의사결정, 의식적 자각