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Highly correlated stimuli do not necessarily facilitate the measurement of unconscious perception: Exclusion failure is hard to find in forced-choice tasks

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ABSTRACT

Persaud and McLeod (2008) report that unconscious perception is easier to measure with forced-choice exclusion tasks when the stimuli are highly similar, such as choosing between the letters 'h' and 'b'. The high degree of stimulus similarity may decrease conscious awareness of the target stimuli while leaving unconscious cognition intact. The present experiments used forced-choice exclusion tasks (i.e., choosing the opposite of a masked target stimulus) with the aim of replicating these findings. No evidence of relevant perception – either conscious or unconscious – was obtained with short duration targets. The forced-choice exclusion task was correctly performed at longer target durations (25 ms and higher), which suggests conscious perception of the target stimuli. We conclude that increasing stimulus similarity does not reliably produce exclusion failure effects and does not appear to facilitate the measurement of unconscious cognition.

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1. Introduction

An important part of the Process-Dissociation Procedure is to assess the unconscious components of cognitive processes by using an innovative task called exclusion (for a review, see Yonelinas & Jacoby, 2012). The key feature of the exclusion task is that participants must make responses that presumably require an intentional, deliberate action that overrides their natural, automatic behaviors. In unconscious perception studies, the standard exclusion paradigm begins by showing observers masked target words (e.g., “STAGE”) for short durations (e.g., 50 ms). Following the presentation, the observer is given the stem of the masked prime (e.g., “STA__”) with the instructions to create a word from the stem that does not match the masked prime word. Proper performance of the exclusion task requires that the participants must make a new word from the stem. For example, a correct exclusion response for the target “STAGE” would be completing “STA__” with the letters “MP” to make “STAMP”. When matches between target and response occur, despite instructions to the contrary, the interpretation is that the exclusion response could not be properly performed because the perceptual information was unavailable to consciousness. However, unconscious perception of the target stimulus still influenced the response on the exclusion task, thereby resulting in a target – response match. The finding of significant elevations in matching mistakes suggesting unconscious perception has been replicated by a number of laboratories (Debner & Jacoby, 1994; Fisk & Haase, 2007; Merikle, Joordens, & Stolz, 1995; Smith & Bulman-Fleming, 2004).

Several studies have called the unconscious status of exclusion failure results into question. Exclusion failure might only occur at relatively long target durations (Fisk & Haase, 2007; Experiments 2 and 3) and the effects may depend upon

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participant motivation (Bengson & Hutchison, 2007; Snodgrass, 2002; Visser & Merikle, 1999). One of our approaches to testing the validity of exclusion methods was to examine the role of the stem-completion task, which is the standard task used in exclusion-based studies (e.g., Merikle et al., 1995). In several experiments we have replaced the standard stem-completion task with a forced choice exclusion task. For example, the masked target word “STAGE” would be followed with a choice between two dissimilar words, such as “STAGE” and “HOUSE”. Forced-choice exclusion would be choosing the opposite of the target word, which would be “HOUSE” in this example. Our results in these studies demonstrate exclusion success – choosing the opposite of the target word – at longer target durations. At shorter target durations the responding is equal to random performance. Exclusion failure effects supporting unconscious perception are not obtained, even though the stimulus parameters are the same as studies based on stem-completion tasks (Fisk & Haase, 2006; Haase & Fisk, 2001). Exclusion failure does not occur in the two-alternative forced-choice (2AFC) exclusion task possibly because participants may use information from their incomplete, degraded percept to simply choose the stimulus that is most dissimilar to the percept (Irvine, 2009). Another possibility is that an optimal exclusion decision is easier to pursue in forced-choice tasks compared to stem-completion tasks, thereby leading to improved performance and a lack of exclusion failure (Snodgrass, Kalaida, & Winer, 2009).

In contrast to our work, Persaud and McLeod (2008) report exclusion failure effects in a 2AFC exclusion task. The participants in their study were shown the masked letters ‘b’ or ‘h’ for “short” (5 or 10 ms) and “long” (15 ms) durations (Persaud & McLeod, 2008). The forced-choice exclusion task was to choose the opposite of the presented stimulus, such as being presented with a ‘b’ target stimulus, then choosing the ‘h’ response when given a choice between ‘b’ and ‘h’. Their results showed significant exclusion failure for the short duration stimuli, as indicated by matching the response and target contrary to the exclusion instructions (Experiment 1). This finding suggests that exclusion tasks might require highly similar stimuli, like the letters ‘h’ vs. ‘b’, in order to produce exclusion failure effects (Persaud & McLeod, 2008). This stands in contrast to previous studies with 2AFC exclusion tasks, which did not find exclusion failure when using dissimilar stimuli for the exclusion choice (example: an exclusion choice between “STAGE” and “HOUSE”; Fisk & Haase, 2006). In support of this possibility, Persaud and McLeod also report that their unpublished experiments with dissimilar stimuli (entire words or line drawings) did not produce exclusion failure (p. 571). Persaud and McLeod conclude that using highly similar responses elevates the exclusion task difficulty, and this increased difficulty is required for producing exclusion failure effects “if subconscious processing is to be observed” (p. 571). From a Signal Detection Theory (SDT) perspective, the use of highly similar stimuli, such as “h” and “b”, should produce distributions that are highly overlapping in decision space (i.e., low sensitivity expressed as d'). This overlap in decision space could mean that the participants are less aware of the target stimulus, which, according to Persaud and McLeod, would make the presence of unconscious perceptual influences easier to measure.

The possibility that highly correlated stimuli might decrease the conscious experience of a degraded target stimulus without affecting unconscious processing would be a potentially useful methodological finding for the study of unconscious perception. This idea is consistent with the possibility that conscious and unconscious processes are independent of each other, which is a central assumption of the Process-Dissociation Procedure (for a review, see Yonelinas & Jacoby, 2012). For unconscious perception, the presence of independent processes should enable the reduction of consciousness without affecting unconscious perception. The use of highly correlated stimuli also raises the practical possibility that investigators might be able to make the meaning of a target stimulus unavailable to consciousness by simply using stimuli that are highly similar or confusable in some way. (Note: Some investigators call masked stimuli “invisible”, but this description is inaccurate because most participants in unconscious perception experiments can detect the presence or absence of the target, even if they are unsure of the target’s meaning.) This approach could help reveal or isolate the role of unconscious perception, which is presumably more sensitive and robust than the consciously experienced percepts. This would be an important methodological step forward for unconscious perception research, which has a long history of controversial findings with ambiguous interpretations (Eriksen, 1960; Holender, 1986).

The present study was conducted to investigate the role of stimulus similarity in producing exclusion failure effects. We attempted to replicate the exclusion failure findings of Persaud and McLeod’s Experiment 1 by using briefly presented (8 or 17 ms), masked ‘b’ or ‘h’ letter stimuli as targets. Experiment 2 was similar, except that more extensive training was used along with a wider range of target durations (100–0 ms). A successful replication of Persaud and McLeod’s work would support the hypothesis that similar stimuli are essential for producing exclusion failure effects that suggest unconscious perception. A successful replication would also support the possibility that investigators can selectively decrease conscious awareness of the target stimuli without affecting unconscious processes by utilizing stimuli that are highly similar and thereby achieve the goal of isolating unconscious cognition. Conversely, an inability to replicate Persaud and McLeod’s results would be consistent with our previous studies of forced-choice exclusion that did not produce evidence of exclusion failure (Fisk & Haase, 2006; Haase & Fisk, 2001) and raise questions about the possibility that highly correlated stimuli facilitate the measurement of unconscious processes.

2. Experiment 1

2.1. Methods

2.1.1. Participants

The 22 participants were recruited from Introductory Psychology or Human Growth and Development classes at Georgia Southwestern State University. These participants were recruited from a subject pool that was mostly female (79.1%) and

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