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Variability in response criteria affects estimates of conscious identification and unconscious semantic priming ☆

Jesse J. Bengson, Keith A. Hutchison *

Department of Psychology, 304 Traphagen Hall, Montana State University, Bozeman, MT 59717-3440, USA

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Abstract

Three experiments examined the role of response criteria in a masked semantic priming paradigm using an exclusion task. Experiment 1 used on-line prime-report ("report the prime if you saw it") and exclusion instructions in which participants were told to avoid completing a word stem (e.g. *mo*—) with a word related to a prime (e.g. *cash*) flashed for 0, 38 or 212 ms. Semantic priming (i.e. exclusion failure) was significant in the items analysis, but was moderated by peoples' ability to report the prime in the participant analysis. Prime-report thresholds in Experiment 2 were made more liberal by instructing participants to guess on every trial. Prime-report increased from Experiment 1 as exclusion failures were eliminated. Experiment 3 clarified the relationship between awareness and prime identification using an on-line measure of confidence and different liberal prime report instructions. The current findings suggest that the ability to act upon (via exclusion performance) and report information in a masked prime is determined by a variable response criterion, which can be manipulated as an independent variable.

Keywords: Unconscious perception; Subliminal semantic priming; Response criteria; Masked priming; Exclusion task; Conscious awareness

1. Variability in response criteria affects estimates of conscious identification and unconscious semantic priming

In his *Monadology* (1698/1999), Gottfried Leibniz proposed a theory of perception suggesting that behavior can be influenced by causes unknown to the actor. Empirical research eventually followed demonstrating that individuals may be influenced to act while unaware of the stimulus information that

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* Corresponding author. Fax: +1 406 994 3804.
E-mail address: khutch@montana.edu (K.A. Hutchison).

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compelled a particular behavior, even though this information was consciously perceived (Bargh, 1996; Wilson & Nisbett, 1978). Other research, within the field of cognitive psychology, explored the influence of an unconsciously presented masked prime on subsequent responses (see Erdelyi, 2004; Kihlstrom, Barnhardt, & Tataryn, 1992; Merikle & Daneman, 1998; Reingold & Merikle, 1993; for summaries). This line of research has explored unconscious perceptual priming (Abrams & Greenwald, 2000; Hutchison, Neely, Neill, & Walker, 2004), in which sub-word perceptual characteristics of a stimulus produce a facilitated response; and unconscious semantic priming, in which the semantic relationship between a prime and target can facilitate a behavioral response (Draine & Greenwald, 1998; Marcel, 1983; Naccache, 2001). Although there seems to be converging lines of evidence for the existence of unconscious perceptual priming (Deeprose & Andrade, 2006), the scientific community continues to debate the reliability of unconscious semantic priming (Van Opstal, Reynvoet, & Verguts, 2005), and the methods by which it is measured (Merikle & Joordens, 1997).

By its very definition, any claimed unconscious effect, semantic or not, is inextricably linked with the experiential aspect of consciousness. In order to successfully demonstrate an unconscious effect, researchers must provide sufficient evidence that rules out conscious access to a given stimulus set. Because the definition and measure of this conscious experience must be drawn from a method of inference, controversies abound. For example, the literature contains variable definitions of what it means for a stimulus to be unconscious. According to the logic of dissociation, a stimulus must be completely unavailable to conscious awareness for unconscious perception to occur (Merikle & Joordens, 1997). In understanding the difficulty of designating an awareness threshold, Greenwald (1992) defined unconscious semantic activation as "indirect evidence for analysis of semantic content of target word stimuli under conditions that limit or prevent awareness of the presence of these words" (p. 768). Assuming that perception and activation are interchangeable terms, the critical distinction is that one definition characterizes unconscious activation under conditions that may *limit* awareness, while the other defines unconscious perception as occurring *without* awareness. Although subtle, the difference is important because researchers have perennially questioned the adequate measure of awareness, suggesting that presumed unconscious effects may actually be driven by conscious access (Holender, 1986; Holender & Duscherer, 2004; James, 1890/1983; Merikle, 1982).

Cheesman and Merikle (1984) presented a description of the two methods by which conscious awareness can be measured and termed them the subjective and objective thresholds. A subjective threshold is characterized by relying on a participant's report of his or her experiential awareness, whereas an objective threshold is determined by chance performance on a series of discriminative responses. A summary of each approach reveals that the subjective threshold is prone to participants' response variability (Macmillan, 1986) whereas the objective threshold is problematic because it may eliminate all forms of perception (Cheesman & Merikle, 1984) and does not take into account phenomenological awareness of participants (Baars, 2003; Bisiach, 1986).

Researchers who question the use of a subjective threshold appropriately note that its shortcomings rest in the fact that reports of conscious awareness function on a continuum driven by differing confidence levels required for prime-report (Kunimoto, Miller, & Pashler, 2001). This issue is central to the use of the subjective threshold because participants' tendency to report a prime has been demonstrably variable across trials and between subjects (Bengson, 2005) and priming has been found to be positively correlated with prime identification (Dark & Benson, 1991). Therefore, an overall effect interpreted as unconscious may be driven by conscious access to the prime on some of the trials or by a subset of the participants. Despite these difficulties, the subjective threshold is the preferable measure because it captures the essential phenomenological distinction between conscious and unconscious processes.

As a way to circumvent the problems inherent in subjective threshold paradigms, researchers (Debner & Jacoby, 1994; Merikle, Joordens, & Stoltz, 1995) implemented the Process Dissociation Procedure. The Process Dissociation Procedure uses inclusion and exclusion instructions to separate the influences of unconscious and conscious processes. Under exclusion instructions, the focus of the present work, participants are instructed to complete a task without using the information presented in the prime. The exclusion condition is meant to provide a conservative estimate of unconscious priming by placing conscious contributions to a response in opposition to unconscious effects. Thus, according to Jacoby (1991), the increase in responses that use previously presented information under exclusion instructions reflects an unconscious effect, since conscious access will produce the opposite response.

According to Merikle and Joordens (1997) the interpretation of exclusion failure as evidence of unconscious processing relies on the critical assumption that conscious access to the prime leads the participant to act upon and exclude that information when performing an indirect task. However, it may be possible that participants have conscious access to a briefly presented prime, but choose not to exclude it. As researchers have noted (Erdelyi, 2004; Holender & Duscherer, 2004; Lupker, 1986), there exists a continuum of increasing information between an objective and subjective threshold. Kunimoto et al. (2001) also demonstrated that the measure of conscious access at the subjective threshold may be prone to response bias and other researchers have demonstrated increased exclusion performance under highly motivated conditions (Visser & Merikle, 1999). Thus, as noted by Snodgrass (2002), exclusion failure may reflect the grey area between conscious access and the subjective criterion at which participants decide to exclude uncertain information. Exclusion failure in this case would be produced as a result of uncertain rather than completely unconscious information. If strict response criteria are the driving force underlying masked semantic priming in an exclusion paradigm, then we would expect an inverse relationship between semantic priming and prime report: when participants are caused to report information under uncertain conditions, they will be less likely to demonstrate masked semantic priming in an exclusion paradigm. The present research explores this possibility in a masked semantic priming paradigm by observing prime-report thresholds (Experiment 1), and manipulating them as an independent variable (Experiments 2 and 3).

The present work employs a version of Baars (2003) method of contrastive analysis which defines the treatment of consciousness as a variable. Within this perspective, Baars proposes that the most feasible operational definition of conscious access is characterized by the ability to act upon and report information. Under this definition, the present work explores the effect of participants' decisional criteria on prime-report and exclusion performance as an individual difference (Experiment 1) and as an independent variable (Experiment 2) between participants. With this definition, we propose that (a) prime-report performance is variable between participants, (b) variability in prime-report is a result of a response criterion that can be manipulated as an independent variable, and (c) variability in response criterion predicts exclusion performance upon prime-report failure.

The fundamental assumption concerning the exclusion task is that inability to exclude information presented in a briefly flashed prime reflects a process that is driven by purely unconscious information. Given the variability in prime-report between subjects and over time, and that subjective reports in a masked priming paradigm are likely driven by information that rests on a continuum (Kihlstrom, 1993), exclusion failure (i.e., unconscious priming) may reflect a participant's *decision* not to exclude briefly flashed information, rather than *inability*.

1.1. Current investigation

Three experiments employed variable on-line prime report instructions in order to explore the role of response thresholds in masked semantic priming. All experiments used an exclusion stem completion task as the indirect measure with an on-line, trial-by-trial, prime-report "report the prime if you saw it." Trials in which participants failed to report the prime were used to measure priming effects. Experiment 1 allowed us to observe the relation between prime report and semantic priming as an individual difference. In Experiment 2, participants' prime-report thresholds were made more liberal by instructing them to "give your best guess" when reporting the prime. These variable instructions were implemented to manipulate not conscious access itself, but the likelihood of participants to report consciously accessed information. Experiment 3 replicated Experiment 2 except different liberal prime-report instructions were employed along with an on-line measure of confidence. This was done in order to demonstrate that the rise in prime-report is in fact a result of participants' increased likelihood of responding with consciously accessed information. This multi-pronged approach was implemented in order to observe the variable effects of decision criteria on the ability to report and act upon (via exclusion performance) information

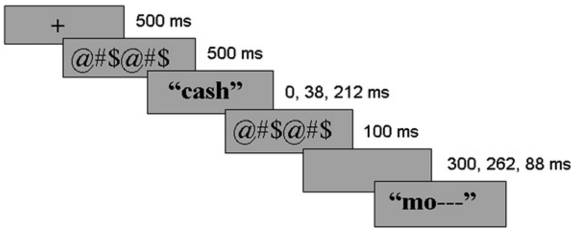

Fig. 1. A graphical representation of the trial sequence for all three experiments.

as an individual difference and as an independent variable (Experiment 1 verses 2) in a masked semantic priming paradigm.

2. Experiment 1

Experiment 1 sought to produce a semantic priming effect using a trial-by-trial measure of conscious access in order to observe the role of individual differences in prime-report in a masked semantic exclusion paradigm. The methodology employed by Hutchison et al. (2004) was adopted using a stem completion task as the indirect measure.

2.1. Methods

2.1.1. Design

Each stem (*mo*—) was preceded by a masked prime (*cash*) semantically related to one of the possible stem completions (*money*). The primes were presented for 0, 38 or 212 ms. The 0 ms condition served as a baseline to determine how often participants completed the stem with the target word in the absence of a prime, and the 212 ms condition served as a compliance check to ensure that the participants followed exclusion instructions. Stem completion rates and prime identification rates were reported from the three within-participant duration conditions (0, 38, and 212 ms).

2.1.2. Stimuli

Primes that share only a semantic relationship with the target stem completion were presented. The MRC psycholinguistic database (Coltheart, 1981) was consulted to select 108 words with at least three possible valid stem completions, with an overall mean of 25 possible completions across all stems. Primes were selected by taking the strongest forward (prime-to-target) associations according to the Nelson, McEvoy, and Schreiber (1999) norms. Three different lists were constructed in order to counterbalance items across durations. The 0, 38, and 212 ms conditions were randomly presented for the 108 trials in order to minimize habituation. This produced 36 observations per duration.

2.1.3. Procedure

Participants were tested one at a time in an isolated room and were seated approximately 60 cm from a computer screen. Instructions were verbally reported to the participant and also provided on the computer screen. E-prime (Schneider, Eschman, & Zuccolotto, 2001) was used to construct a series of trials in which a centrally positioned 500 ms fixation point preceded a forward pattern mask presented for 500 ms (#@#@#@). After the forward mask, the prime appeared for either 0 (no prime), 38 or 212 ms and was immediately followed by a backward mask (@#@#@#).[1] Following a variable inter-stimulus interval (300, 262, 88 ms), participants were presented with a word stem (See Fig. 1). The variable ISI was used to maintain a stimulus onset asynchrony of 300 ms between the prime and word stem. Upon presentation of the word stem,

[1] For all experiments, the actual average duration adjusted for onset delay of the backward mask is 45.6 ms, a duration typical of masked priming paradigms.

participants were instructed to "report the flashed word if you saw it." Incorrect identifications occurred when participants provided an incorrect response to the flashed word. Participants were also instructed to complete the stem with the first word that came to mind that was not related to the meaning of the flashed word. They were instructed that if they did not see the prime, they should complete the stem with the first word that came to mind. Participants could proceed when ready and were instructed to begin each trial by pressing the "s" key. Each participant was given a series of 10 practice trials with the experimenter present to ensure (s)he understood the nature of the exclusion task and the general instructions.

2.1.4. Participants

Sixty Montana State University undergraduates participated for credit as part of an Introductory Psychology class. All participants had normal or corrected-to-normal vision and were native English speakers. The data from three participants were eliminated prior to analyses for failure to follow instructions.

2.2. Results

Table 1 displays mean stem completion and prime identification percentages for Experiments 1–3. Unless otherwise noted, a paired-samples t test ($p < .05$) was conducted upon prime report failure to test for the priming effect across the baseline and 38 ms conditions.

2.2.1. Prime identification

In the 212 ms condition, participants correctly identified the prime on 96% of the trials. In the 38 ms condition, participants correctly identified the prime on 16% of the trials and incorrectly identified (provided incorrect responses) the prime on 2.5% of the trials. On the trials where participants correctly identified the prime, the stem was completed with the target word only 5% of the time, suggesting that participants were able to follow exclusion instructions.

Table 1
Mean prime identification and stem completion percentages in Experiments 1–3

	212 ms (%)	38 ms (%)	0 ms (baseline) (%)	Priming (%)
Experiment 1				
Prime identification	96	16	0	N/A
Overall stem completion	5	18	18	0.2
Target stem completion upon prime-report failure (priming)				
Item analysis	N/A	21	18	2.8*
Participant analysis	N/A	20	18	2.0
Experiment 2				
Prime identification	95	21	0	N/A
Overall stem completion		18	15	−3*
Target stem completion upon prime-report failure (priming)				
Item analysis	N/A	18	18	−0.3
Participant analysis	N/A	18	18	0.3
Experiment 3				
Prime identification	97	21	0	N/A
Overall stem completion	4	17	15	−2
Target stem completion upon prime-report failure (priming)				
Item analysis	N/A	17	17	0.2
Participant analysis	N/A	17	17	0.3

Note. Priming refers to the difference in mean stem completion between the 0 and 38 ms conditions.
* $p < .05$.

2.2.2. Overall target stem completion

The target stem completion means are presented in Table 1 in order to comparatively demonstrate the efficacy of an online prime report in an exclusion paradigm. In the baseline condition (0 ms) the stem was completed with the target 18% of the time. In the 38 ms condition, the percentage of target stem completions did not change from baseline (18%), producing no significant difference, $t(56) < 1$.

2.2.3. Target stem completion following prime-report failure

To assess unconscious semantic priming, only the trials on which participants failed to report the prime were analyzed. An items analysis was conducted where target stem completion data for each item were averaged across all participants. As shown in Table 1, stem completion (following prime-report failure) in the baseline condition was compared to the 38 ms condition producing a significant $2.8 \pm 2.5\%$ (95% confidence interval) priming effect, $t(107) = 2.33$ $p < .018$, $d = .30$.

In the participants' analysis, when data were averaged over items, participants completed the stem with the target word 18% of the time in the baseline condition. This percentage increased to 20% in the 38 ms condition, suggesting that participants were more likely to complete the stem with the target word when the related prime was briefly presented. However, this $2.0 \pm 3.0\%$ difference was not significant, $t(56) = 1.52$, $p = .135$, $d = .20$.

The finding of significant priming in the item analysis, but not in the participant analysis, suggests the intriguing possibility that the demonstrated priming effect may be driven by a subset of the participants (as suggested by Pollatsek & Well, 1995). In order to further explore this possibility, we examined participants' ability to report the prime in the 38 ms condition. Participants, overall prime detection ability in the 38 ms condition was negatively correlated with exclusion failures on trials where the prime was not identified ($r = -.242$, $p < .070$). To further examine this correlation, we next conducted a tertile split according to participants' ability to report the prime. A mixed ANOVA with duration (0 verses 38 ms) as a within-subjects variable and prime-report ability (top third verses bottom third) as a between subjects variable revealed a significant interaction, [$F(1, 37) = 7.57$, MSE = 57]. Participants who performed in the top third on prime-report ($M = 35\%$ detection at 38 ms) showed priming of -1% whereas those who performed in the bottom third ($M = 2\%$ detection) demonstrated a significant 8% priming effect $t(19) = 3.23$, $p < .005$. Examination of the number of participants that showed positive priming in each group revealed that a significant 14 out of 19 low prime-report participants (74%) showed positive semantic priming upon prime-report failure ($z = 2.06$, $p < .040$), whereas a non-significant 11 out of 20 high prime-report participants (55%) showed such priming ($z = .45$, $p > .650$). These results provide converging evidence that participants who are less likely to report the identity of a prime in the 38 ms condition are also more likely to demonstrate priming via exclusion failure upon prime-report failure.

2.3. Discussion

In Experiment 1, significant priming was demonstrated when the data were aggregated by items and averaged across all participants; however, no significant priming was found when the data were aggregated by participants and averaged across items. Individual differences may account for this discrepancy. Some participants demonstrated strong priming effects whereas others did not, and these individual differences may have minimized the ability of the participant analysis to reveal priming.

The results of Experiment 1 suggest that unconscious semantic priming may be the result of individual differences in response criterion. In fact, a further analysis of performance at the 38 ms condition demonstrated that those in the top third of prime-report performance produced significantly more false alarms (responding with an incorrect word) than those in the bottom third of prime-report performance [$t(19) = 2.41$, $p < .021$], suggesting a more liberal response strategy. According to this response threshold account, participants who are less likely to report a prime have a good conscious guess of what the prime might be, but operate under a strict decision criterion where this information is not reported or acted upon. As a result, this conscious, but un-reported, information may produce exclusion failure. In order to further test the relation between response criterion and exclusion performance, Experiment 2 was conducted as a manipulation of subjective response thresholds via liberal prime-report instructions.

3. Experiment 2

The same methodology and stimuli from Experiment 1 were used in Experiment 2; however, prime-report response thresholds were made more liberal by instructing participants to "give your best guess" when reporting the prime. Under the previously stated operational definition of conscious access, if participants can be made to act upon, or report information, this information can be defined as conscious. The manipulation of response thresholds via prime-report instructions allows participants to report the prime even under conditions of uncertainty, thus enabling the analysis of prime-report thresholds as a between subjects variable (Experiment 1 verses 2). If the response threshold account of the priming found in Experiment 1 is accurate, then under more liberal prime-report conditions, the significant semantic priming found in the items analysis of Experiment 1 should disappear and be replaced by a corresponding increase in prime-report.

3.1. Methods

3.1.1. Materials and procedure

The same materials and procedure from Experiment 1 were used in Experiment 2 with one exception: participants' response thresholds were made more liberal by instructing them to "give your best guess," when completing the prime-report task.

3.1.2. Participants

Sixty-two Montana State University undergraduates participated for credit as part of an Introduction to Psychology class. All participants had normal or corrected-to-normal vision and were native English speakers. Data from three participants were removed due to failure to follow exclusion instructions.

3.2. Results

3.2.1. Prime identification

The middle of Table 1 displays mean stem completion response percentages and prime identification percentages for Experiment 2. In the 212 ms condition, participants correctly identified the prime on 95% of the trials. In the 38 ms condition, participants' correct prime identification increased from 16% in Experiment 1 to 21% in Experiment 2 suggesting that participants were more likely to report uncertain information at their conscious disposal. This increase in correct prime report was driven by a statistically significant increase in overall prime-report response from Experiment 1 to Experiment 2, $t(115) = 35.2$, $p < .001$, $d = 6.5$. On the trials on which participants correctly identified the prime, the stem was completed with the target word only 4% of the time, suggesting that participants followed exclusion instructions.

3.2.2. Target stem completion following prime-report failure

To assess unconscious semantic priming, only the trials on which participants failed to correctly report the prime were analyzed. An items analysis was conducted where target stem completion data for each item were averaged across all participants. As shown in Table 1, stem completion (following prime-report failure) in the baseline condition (18%) did not differ from stem completion at 38 ms (18%), $-0.3 \pm 2.3\%$, $t(107) = 0.66$, $p > .50$, $d = .12$. This null finding contrasts with the significant priming found in Experiment 1 under more strict prime-report conditions in which participants were less likely to report the prime.

In the participants' analysis, when data were averaged over items, participants completed the stem with the target word 18% of the time in the baseline condition. This percentage remained constant at 18% in the 38 ms condition, suggesting that participants were not influenced by the masked prime. This $0.3 \pm 3.0\%$ difference was not significant, $t(58) = 0.55$, $p > .587$, $d = .14$.

A 2 (Condition) x 2 (Experiment) ANOVA was conducted in order to examine whether more liberal prime-report instructions significantly influenced the occurrence of exclusion failure in the predicted direction. In the items analysis of Experiment 1, participants demonstrated a significant ($p < .025$) $2.8 \pm 2.5\%$ priming effect, whereas in Experiment 2, participants demonstrated no difference in priming, $0.3 \pm 2.8\%$. The ANOVA revealed a significant interaction between priming and experiment [$F(1,107) = 4.56$, $p < .035$] revealing that liberal prime-report instructions eliminated exclusion failure (i.e., unconscious priming).

3.3. Discussion

When prime-report thresholds are made more liberal, participants are more likely to respond with valid representations of the information at their conscious disposal. The increase in prime-report performance and the concurrent elimination of priming in Experiment 2 is in accordance with the response threshold account of unconscious semantic priming in an exclusion task. If the exclusion failures in Experiment 1 were a result of residual conscious awareness and participants' hesitancy to report the prime under uncertain conditions, then we would expect priming to be eliminated under more liberal response conditions, as Experiment 2 demonstrated. The results suggest that under more liberal prime-report conditions, a briefly flashed prime, often assumed to be unconscious, can be reported and acted upon.

There is a concern that the rise in prime-report observed in Experiment 2 from Experiment 1 may be a product of an unconscious process itself rather than a decisional process, since the participants were instructed to "give your best guess." In order to minimize the strength of such a concern, Experiment 3 employed different liberal prime-report instructions while instructing participants to perform an online trial by trial report of their confidence. According to Kunimoto et al. (2001), if participants have conscious access to a set of stimuli presented at a specific duration, then there should be a positive relationship between confidence and identification accuracy. Experiment 3 also served as a replication of the null results in Experiment 2 in order to strengthen the claim that decisional thresholds influence exclusion performance in a masked semantic priming paradigm.

4. Experiment 3

The same overall methodology and stimuli from Experiments 1 and 2 were used in Experiment 3; however, participants prime-report response thresholds were made more liberal by instructing participants to "report any information you saw" (instead of "give your best guess") when reporting the prime. In addition, participants were asked to report their confidence ranging from 1 ("pure guess") to 4 ("very sure") which allowed us to tap into the continuum of information between the objective and subjective thresholds on each trial and determine whether the increase in prime-report is due to an increased likelihood of participants to respond with uncertain but consciously represented information. A demonstrated positive relationship between confidence and correct prime identification even under uncertain conditions would suggest that participants' rise in prime-report under more liberal instructions is a product of increased likelihood of responding to conscious but uncertain information.

4.1. Methods

4.1.1. Materials and procedure

The same materials and procedure from Experiment 1 and 2 were used in Experiment 3 with two exceptions. First participants' response thresholds were made more liberal by instructing them to "report any information you saw," when completing the prime-report task. Second, they were asked to provide confidence ratings of their prime-report on a scale of 1–4 (from "pure guess" to "very sure").

4.1.2. Participants

Sixty-four Montana State University undergraduates participated for credit as part of an Introductory Psychology class. All participants had normal or corrected-to-normal vision and were native English speakers. The data from eight participants was eliminated prior to analyses for failure to follow instructions.[2]

[2] It was brought to our attention early in the semester that a laboratory assistant was giving incorrect experimental instructions to participants. Data from those initial participants was not analyzed.

4.2. Results

4.2.1. Prime identification

The bottom of Table 1 displays mean stem completion response percentages and prime identification percentages for Experiment 3. In the 212 ms condition, participants correctly identified the prime on 97% of the trials. In the 38 ms condition, prime identification increased by 5% from Experiment 1 to 21% in Experiment 3 (replicating the increase in prime-report percentages from Experiment 1 to 2). This increase in correct prime-report was again driven by a statistically significant increase in overall prime-report response from Experiment 1–3, $t(112) = 3.5$, $p < .001$, $d = .67$. On the trials where participants were able to identify the primes, the stem was completed with the target word only 4% of the time, suggesting that participants were able to follow exclusion instructions.

4.2.2. Confidence and prime identification

Table 2 displays the relationship between confidence and prime identification. Of the 2016 trials (36 trials × 56 subjects) where participants were exposed to the 38 ms condition, participants correctly reported the identity of the prime 421 times. In addition to the 421 correct prime-report trials, participants reported incorrect words or letter fragments on 461 trials for a total of 882 trials that included confidence ratings. Table 2 displays confidence trials and correct verses incorrect identifications. Overall, confidence was positively correlated with prime identification, $r = .432$, $p < .001$.

As shown in Table 2, there was a relatively strong relationship between prime identification and confidence at prime exposure durations of 38 ms. The difference in accuracy between the two lowest levels of confidence was also compared for the 28 participants who responded with both confidence levels "1" and "2." Of importance, even among the two lowest levels of confidence, participants were significantly more accurate when responding at confidence level of "2" (unsure) than "1" (pure guess), $t(27) = 2.89$, $p < .010$.

4.2.3. Target stem completion following prime-report failure

To assess unconscious semantic priming, only the trials where participants failed to report the prime were analyzed. An items analysis was conducted for Experiment 3 in which priming was averaged across all participants. Participants responded with a word related to the meaning of the prime 17% of the time in the baseline condition. This percentage remained stable (0.2 ± 2.5%) in the 38 ms condition at 17%, $t(107) = 0.14$, $p > .890$, $d = .02$. When data were aggregated by participant and averaged over trials, participants completed the stem with the target word 17% of the time in the baseline condition. This percentage remained the same (0.3 ± 2.5%) at 17% in the 38 ms condition suggesting that the masked prime did not influence participants' responding, $t(55) = 0.21$, $p > .835$, $d = .03$.

4.3. Discussion

The first notable finding of Experiment 3 is the demonstrated relationship between confidence and prime identification at the 38 ms exposure duration. Because there is a significantly strong relationship between confidence and correct determination of prime presence, we can infer that the identification and report of the briefly flashed prime is primarily driven by consciously represented information. It is unlikely that participants are able to reliably infer the nature of their own certainty via confidence ratings without a conscious represen-

Table 2
Confidence and corresponding prime identification trials at 38 ms in Experiment 3

	Confidence				
	1 (pure guess)	2 (unsure)	3 (pretty sure)	4 (very sure)	Total
Incorrect	120	262	57	22	461
Correct	38	125	178	80	421
Total	158	387	235	102	882
Percent correct (%)	24	32	76	78	48

tation of the information driving this judgment. Since confidence ratings and prime identification are strongly associated in Experiment 3, we can reasonably conclude that the rise in prime-report percentage from 16% to 21% in Experiment 3 is primarily a result of the increased probability of participants to respond with conscious but uncertain information.

The second notable finding of Experiment 3 is the replication of the null semantic priming found in Experiment 2. The power of Experiments 2 and 3 combined (at $N = 114$) to detect the small-to-moderate priming effect ($d = .30$) found in Experiment 1 was calculated to be .85 (one-tailed). In addition, the significant interaction of priming with experiment shows that the prime-report instructions, rather than low statistical power, caused the elimination of priming in Experiments 2 and 3. If the data were simply too noisy or the design too weak, then the between-experiment ANOVA (Experiment 1 verses 2) would not have been significant. Thus, we are confident that the difference in priming across experiments is due to the manipulation of prime-report instructions and not insufficient power.

A level-by-level observation of confidence reveals a convincing relationship between response criterion and priming. As shown in Table 2, 38 primes were correctly identified in the 38 ms condition under confidence levels of "1." If participants had not reported these primes and instead completed the stem with a related word, a 1.9% exclusion failure (unconscious priming) effect would have been produced [38/2016 (total trials presented at 38 ms)] and prime-report percentage would have been 19%. Under confidence levels of "2," participants correctly reported 125 primes. If participants had not reported primes at or below a confidence level of "2" and used related words to complete the target stems, an 8.1% exclusion failure effect would have occurred [(125 + 38)/2016] and prime identification would have fallen to 12% [Note that this exclusion failure rate is similar to that of the low prime identification participants in Experiment 1.]. At confidence levels of "3," participants correctly reported the prime 178 times. If participants had set their response criterion at this level, a 16.9% priming effect could have been produced and correct prime identification would have fallen to 4%. However, as shown in Table 1, under the liberal prime-report instructions of Experiment 3, where participants included all of the above trials, prime-report was at 21% and there was no significant exclusion failure upon prime-report failure.

5. General discussion

The negative relationship between participants' ability to detect the prime and "subliminal" priming in Experiment 1 accompanied by the elimination of priming under more liberal prime-report conditions in Experiments 2 and 3, demonstrate that differences in response criteria can account for significant exclusion failure (unconscious priming) effects. Experiment 3 further demonstrated that the rise in prime-report under more liberal instructions is significantly related to phenomenal awareness. Exclusion failures can result when participants are aware of the prime on some level, but not confident enough in the accuracy of this information to report and act upon it. If participants are at least partially aware of the prime but fail to report this information, it is likely that this information will influence their performance in the exclusion task. According to Block (2001), working under exclusion instructions is difficult, and exclusion failure (priming) could simply reflect participants' performance under conditions of uncertainty.

In Experiment 1, those participants who were more likely to report the prime were less prone to exclusion failure upon prime-report failure. Because these participants' objective and subjective thresholds were more similar, they did not show priming. However, those participants who demonstrated decreased prime-report performance were more likely to show priming upon prime-report failure. For these participants, the objective and subjective thresholds may be quite different. According to Lupker (1986), there is a continuum of increasing information between the objective and subjective thresholds. As this fuzzy area between actual awareness and report increases as a result of strict response criteria, participants have more conscious but unreported information available for use on the indirect measure (stem completion) which produces exclusion failures. A simple thought experiment should help clarify this issue. Imagine an experimenter wished to produce a stronger manipulation of response criterion by including a condition in which participants were told to report the prime "only if they are very sure of its identity." Inevitably the participant would then ask, "what if I think I know it, but I'm not sure? Do I still have to exclude it?" This dilemma on the part of the participant highlights the main point of the present paper, which is that as the disparity between awareness and response thresholds increases so does the probability that exclusion failures reflect conscious, rather than unconscious, information.

The stated interpretation of the present results relies on the assumption that the manipulation of participants' prime-report instructions ("report the prime if you saw it" vs. "give your best guess") influenced the criteria by which participants choose to respond with consciously represented information. The relationship between confidence and accuracy and the replication of a 5% rise in prime report under different instructions (from Experiment1) in Experiment 3 suggests that an increase in prime-report under more liberal instructions is driven by conscious information. If the rise in prime report in Experiment 2 was a task-dependent result of forcing guesses, then the exact replication of the prime-report percentage (21%) under the instructions of Experiment 3 ("report any information you saw") would not be expected because these instructions allow the subject to withhold a response. Thus, Experiments 2 and 3 demonstrate that the information presented in a briefly presented masked prime can be reported and acted upon given more optimal reporting conditions, such as a liberal prime-report threshold.

The most feasible candidate for an operational definition of consciousness is the ability to report or act upon information. The present results demonstrate that this ability is determined by response criteria. This conclusion is in accordance with a number of other recent findings (Fisk & Haase, 2006; Haase & Fisk, 2001; Snodgrass, 2002). The present analysis also demonstrates that individual differences exist in prime-report and susceptibility to exclusion failure (unconscious priming): Those who are *less* likely to report a briefly flashed prime demonstrate significant exclusion failure effects while those who are *more* likely to report the prime show no significant exclusion failure on trials where the prime was not reported. The decisional criteria driving these individual differences was further demonstrated as an independent variable (Experiment 1 verses 2) to determine prime report and exclusion failure effects, and Experiment 3 supported the conclusion that more liberal prime-report instructions influenced participants' decision to act upon uncertain but conscious information. The results reveal that the role of variability in response criteria should be considered as an addendum to existing models and methods of measuring subjective conscious access (as suggested by Schooler & Fiore, 1997; Holender & Duscherer, 2004; and others) and as a contributing factor to the design, analysis, and interpretation of results in semantic exclusion paradigms.

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