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Conscious, but not unconscious, logo priming of brands and related words

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ABSTRACT

This study assessed whether real-life stimulus material can elicit conscious and unconscious priming. A typical masked priming paradigm was used, with brand logo primes. We used a rigorous method to assess participants' awareness of the subliminal information. Our results show that shortly presented and masked brand logos (e.g., logo of McDonald's) have the power to prime their brand names (e.g., "McDonald's") and, remarkably, words associated to the brand (e.g., "hamburger"). However, this only occurred when the logos could be categorized clearly above the consciousness threshold. Once the primes were presented close to the consciousness threshold, no subliminal influences on behavior were observed.

1. Introduction

In an experimental context, the existence of subliminal perception is no longer questioned. However, a lot of controversy exists about the applicability of unconscious perception in everyday life. In this study we therefore assessed whether more real-life stimulus material also possesses the power to elicit conscious and unconscious priming.

In order to measure subliminal influences on behavior, Marcel (1983) developed the masked priming paradigm. In this paradigm, the impact of a prime stimulus on the subjects' response on a subsequent target stimulus is examined. Crucially, the prime stimulus is rendered subliminal by presenting it for a very short duration and by reducing its visibility even further by visually masking it. Using this paradigm, Marcel observed that target words were responded to faster when they were preceded by a semantically related prime word (e.g., *cat–dog*) than by an unrelated word (e.g., *book–dog*), even when the primes were subliminally presented. This faster (and/or more accurate) response to related compared to unrelated trials is referred to as the masked or subliminal priming effect.

During the past decades, the masked priming paradigm has gone through some drastic methodological improvements (e.g., Dehaene et al., 1998; Greenwald, Draine, & Abrams, 1996), making it a very useful experimental tool to study unconscious processing today. Many studies using this paradigm have confirmed that subliminal perception exists and that subliminal information can influence our behavior. Recently, Van den Bussche, Van den Noortgate, and Reynvoet (2009) conducted a large-scale meta-analysis and found that in the masked priming literature published between 1983 and 2006, robust masked priming effects have been observed. Thus, the existence of unconscious or subliminal perception is no longer questioned in an experimental context.

Subliminal messages have also been regularly used in advertising. The first, and very famous, study was the one of a private market researcher, James Vicary, conducted in 1957. He claimed that the sales of Coca-Cola and popcorn increased substantially after subliminally flashing the messages "Drink Coca-Cola" and "Eat popcorn" in a movie theatre (in Karremans, Stroebe, & Claus, 2006). Several researchers tried to replicate his striking findings, but all failed. At last, Vicary himself

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admitted that he had falsified the results of his study. But from then on, the idea of unconscious influencing has had a large impact on the public and the technique is still being used today (Pratkanis, 1992). In 2007, for example, the McDonald's logo was shown subliminally during a cooking show on TV.[1]

Generalizing the conclusions made in an *experimental* context with regards to the existence of subliminal influences to a more *everyday life* situation, however, might be problematic. In an experimental context the subliminal information (the prime) and the behavior undergoing the influence of this information (the response to the target) follow each other very closely in time. Van den Bussche, Van den Noortgate, et al. (2009)[2] noted that the average Stimulus Onset Asynchrony (SOA, i.e., the interval between the onset of the prime and the onset of the target), across the masked priming literature, is 128 ms, with a maximum observed SOA of 784 ms. This implies that the prime exerts its influence almost immediately. Indeed, it has often been suggested that subliminal or masked priming is very short-lived. For example, Forster and Davis (1984) showed that masked priming was reduced to a small 13 ms effect when delays of about 1–2 s were inserted between the masked prime and the subsequent target and that priming was even completely eliminated when the delay was extended to 8.5 s (see also Ferrand (1996) and Greenwald et al. (1996) for similar observations). These studies imply that the mental representation of subliminal information vanishes dramatically as time passes (Dehaene & Naccache, 2001). The short-lived nature of masked priming is in striking contrast to the longer term effects seen in experimental research when primes are presented clearly visible. Indeed, these unmasked priming effects can endure over substantial delays (minutes or even days) between the prime event and presentation of a target (Masson & Bodner, 2003).

The short-lived nature of the influence of subliminal information casts serious doubt on its effectiveness in everyday life and advertising. In more real-life situations, the time gap between the presentation of the subliminal information (e.g., an advertisement of McDonald's) and the execution of the behavior undergoing its influence (e.g., buying a hamburger), is much larger than a few seconds. Therefore, there is a lot of controversy about the applicability of unconscious perception in everyday life and advertising and many authors openly question its existence (see for example Brannon & Brock, 1994; Goldiamond, 1959; Pratkanis & Aronson, 2001). In a meta-analysis, Trappey (1996) investigated the relationship between consumer choice and subliminal advertising. After statistically combining 23 studies in his analysis, he showed that the effect of subliminal advertising on choice behavior was negligible. Broyles (2006) also reviewed nearly 50 years of research on subliminal advertising and concluded that most effects are only obtained in highly artificial situations, and no research has yet convincingly shown an effect of changed attitudes or influenced consumer behavior.

Nevertheless, researchers have recently rekindled the interest in subliminal influencing and have been wondering whether Vicary's claims might become reality after all. Karremans et al. (2006) repeatedly primed participants with the brand name "Lipton Ice" or the neutral letter string "Npeic Tol". These primes were masked and presented for a very short duration (23 ms). The group that was primed with Lipton Ice showed increased choice for, and intention to, drink this brand as compared to the control group. However, this effect only emerged when the participants were thirsty. The authors argued that consumer choices can be influenced by subliminal primes that could help fulfill a need (i.e., the name of a drink), but only if the consumer is already deprived (i.e., thirsty) (see Bermeitinger et al. (2009) and Strahan, Spencer, & Zanna, 2002, 2005 for similar claims).

Although these recent studies seem to imply that subliminal information can influence our consumer behavior, they suffer from a common important methodological problem, related to how the awareness of the subliminal primes is measured. Historically, introspection or *subjective report* was the first method to assess whether the presented information was not perceived consciously by the participants. However, Eriksen (1960) argued against the use of introspection as a valid measure of awareness, because they might reflect response bias owing to the "underconfidence phenomenon" (Bjorkman, Juslin, & Winman, 1993). Subjects may partially or even fully see the stimulus, yet claim that they have not seen it because they need a higher level of certainty. This would lead to a serious underestimation of prime awareness. Farah, Monheit, Brunn, and Wallace (1991) argued that this problem of underestimation also arises when *prime identification* is used as a measure of prime awareness. Rather than requiring identification, a *prime discrimination* task should be used, such as making same/different judgments to pairs of primes, prime detection (present/absent decisions) or prime categorization. Indeed, less visual information about a subliminal stimulus is needed to discriminate a prime than to identify it. For example, Farah et al. (1991) found that reaching the conclusion of chance performance on the prime awareness task, and thus of the unconscious nature of the stimuli, is considerably more likely in an identification task than in a same/different matching task. Eriksen (1960) argued that the objective threshold for consciousness should be defined as a situation where forced-choice prime discrimination is at chance. According to a long psychophysical tradition, grounded in signal-detection theory, a stimulus should be accepted as unconscious only if subjects are unable to perform above chance on some direct task of stimulus discrimination (Dehaene & Changeux, 2011). This method is most often used in recent experimental masked priming studies, where, for example, subjects are asked to perform a forced-choice categorization task on the subliminal primes after the actual exper-

[1] The Associated Press (2007, January 26). McDonald's Logo Flashes on 'Iron Chef'. *The Washington Post*. Retrieved July 14, 2011, from http://www.washingtonpost.com/wp-dyn/content/article/2007/01/26/AR2007012600420.html.

[2] The authors of the meta-analysis used several criteria to exclude studies where the primes were not subliminally presented. More specifically, studies were excluded when the prime was presented for 100 ms or more, when a task was performed on the prime, when participants were explicitly aware of the primes, or when a prime was insufficiently masked because a long blank (and no backward mask) occurred between prime and target. Furthermore, several variables which determine the visibility of the primes (prime duration, SOA, nature of masking, whether and how prime visibility was measured, d', etc.) were included in the analyses to examine their influence on masked priming effects. The meta-analyses clearly indicated the importance of including a visibility test (and preferably a d' measure) in subliminal priming experiments.

iment. It has been argued that this is an extremely conservative measure of conscious access which could lead to overestimation of the prime awareness (Cheesman & Merikle, 1986). However, if we want to claim measuring truly unconscious or subliminal influences, we should opt for the most strict method possible which will enable us to reliably conclude that the information was indeed presented below the conscious threshold.

The recent studies examining subliminal advertising (e.g., Bermeitinger et al., 2009; Karremans et al., 2006; Strahan et al., 2002; Veltkamp, Custers, & Aarts, 2011; Verwijmeren, Karremans, Stroebe, & Wigboldus, 2011) have all used subjective report and/or prime identification to assess prime awareness. As discussed above, this is not in line with the more experimental field where the more strict prime discrimination is preferred. Furthermore, these methods of measuring the prime awareness cast doubt on whether these studies were indeed examining truly subliminal influencing.

Thus, the question remains: does subliminal influencing in a more real-life or advertising context actually work? The goal of the present study is therefore to provide a first step towards examining whether subliminal influencing can be effectively and reliably implemented in more everyday life and advertising situations. Before investigating whether unconscious advertising material can influence our consumer choices, it's crucial that we first assess whether this kind of information can influence our behavior subliminally *at all*. In order to achieve this, we conducted a typical masked priming study with a strict prime awareness assessment, but using stimulus material from an advertising context. More specifically, we assessed whether well-known brand logos, selected in a pilot study, have the power to influence behavior. In order to select the brand logos used in this study, a pilot study was first conducted.

2. Pilot study

In order to obtain an efficient prime stimulus set to be used in the actual experiments, we first conducted a pilot study. In this pilot study, participants had to judge the familiarity and recognizability of brand logos. Based on this pilot study, the most familiar and recognizable logos were selected.

2.1. Method

2.1.1. Participants

Thirteen volunteers participated in this pilot study (six men). Their mean age was 26.5 (SD = 1.90, range 23–30).

2.1.2. Material

A questionnaire was constructed to assess which brand logos were highly familiar and easy to recognize. The questionnaire contained pictures of the logos of 16 brands. These logos were selected based on the following criteria: (a) the logo was suspected to be very well-known to our group of participants (i.e., young Belgian adults); (b) the logos did not contain the brand name; (c) color was not a central feature of the logo. Based on these criteria we selected the logos of the following brands: Apple, Telenet, O'Neill, Nike, Mercedes, Lacoste, Ferrari, Delhaize, Diesel, Unilever, Côte d'or, Michelin, Bacardi, Playboy, McDonald's and Disney. The logos were depicted in grayscale and ranged from 0.95 cm to 2.62 cm in height and from 1.88 cm to 2.62 cm in width to respect their original proportions. For each of these logos participants received six questions. First, they were asked whether they knew the logo (yes or no). Second, they were asked to write down the name of the brand which uses the logo if they knew it. Third, they were asked to indicate how familiar they were with the logo on a 4-point scale (''Not at all'', ''A little'', ''Quite strongly'' to ''Completely''). Fourth, they were asked to indicate how fast they recognized the logo on a 4-point scale (''Immediately'', ''Fast'', ''It took a while'', ''I do not recognize the logo''). Fifth, they were asked to indicate whether they thought this logo is familiar to many people of their age group (yes or no). Finally they were asked to provide three key words they associated with the logo.

2.1.3. Procedure

The participants received a questionnaire via e-mail and they were told that it was meant to assess how well-known the logos of brands were. They were asked not to look up the logos, but simply to answer the questions honestly and spontaneously.

2.2. Results

Based on the first two questions of the questionnaire (''Do you know the logo?'' and ''If so, which brand uses this logo according to you?''), it becomes clear that the logos of 10 brands (i.e., Apple, Nike, Mercedes, Côte d'or, Michelin, Playboy, McDonald's, Lacoste, Telenet and Delhaize) were clearly recognized more accurately by the participants than the other six logos (on average 98% versus 46% correct recognition, $F(1,14) = 33.10$, $p < .001$).

This pattern of results was confirmed by the other questions of the questionnaire: these 10 logos were scored as more familiar than the other six logos (average score of 3.02 versus 1.92, $F(1,14) = 20.47$, $p < .001$), more easy to recognize than the other six logos (reversed average score of 2.58 versus 1.16, $F(1,14) = 27.57$, $p < .001$) and were thought to be more familiar to many people of their age group than the other six logos (average score of 0.94 versus 0.36, $F(1,14) = 29.25$, $p < .001$).

2.3. Discussion

Based on these results 10 brand logos were selected to be used in the actual experiments (i.e., Apple, Nike, Mercedes, Côte d'or, Michelin, Playboy, McDonald's, Lacoste, Telenet and Delhaize). The 10 logos and their brand names can be found in Appendix A.

3. Method

In the actual masked priming experiment, participants were asked to perform a lexical decision task on target letter strings. These targets were preceded by the masked prime logos selected in the pilot study. Participants were randomly assigned to two conditions: one group received the conscious condition where primes were presented above the consciousness threshold. The other group received the unconscious condition where primes were presented close to the consciousness threshold.

3.1. Participants

Seventy-five psychology students participated in the experiment as partial fulfillment of a course requirement. Forty-two participants were assigned to the *conscious* condition. Three of them responded significantly (+2*SD*s) slower than the mean and were therefore eliminated from the analyses. Thus, the final sample for the conscious condition consisted of 39 participants (11 men). Their mean age was 21.4 (*SD* = 4.90, range 18–35). Thirty-three students participated in the *unconscious* condition. One subject responded significantly (+2*SD*s) slower than the mean and was therefore eliminated from the analyses. Thus, the final sample for the unconscious condition consisted of 32 participants (15 men). Their mean age was 21.9 (*SD* = 3.99, range 17–32).

3.2. Apparatus

Participants were seated in a dimly lit room, approximately 60 cm from a 15-in. color CRT monitor connected to a computer running the Windows operating system. Stimulus delivery and the recording of behavioral data (reaction time and accuracy) were controlled by E-prime (www.pstnet.com; Psychology Software Tools).

3.3. Stimuli

The prime stimuli consisted of 10 brand logos selected in the pilot study (see Appendix A). The dimensions of the picture stimuli ranged from 2.7 cm to 3.9 cm in width and 1.2 cm to 3.9 cm in height. The targets consisted of 20 words and 20 non-words, ranging from 1.7 cm to 5.4 cm in width and 0.7 cm in height. The word targets could be a brand name or a non-brand Dutch word. The 10 brand targets consisted of the names of the prime logos. The 10 non-brand target words were selected based on the sixth question of the pilot study, where we asked the participants to generate three key words they associated with the logo, and based on our own intuition. The non-brand target words were all medium to high frequency words (log frequencies ranging from 0.30 to 2.32; based on the WordGen program of Duyck, Desmet, Verbeke, and Brysbaert (2004)). The non-words were generated using WordGen (Duyck et al., 2004). Word length was matched in the brand and the non-brand word conditions (on average respectively 7.0 and 7.1). Word length of the target words and the target non-words was also matched (on average 7.0 for both the words and the non-words). Forward and backward masks existed of random dot patterns, 8.5 cm in width and 8.5 cm in height, and constructed such that 4×4 pixels were always chosen randomly to be white or black.

The word targets could either be related or unrelated to the prime. Thus, four target word conditions were created: (a) a *related brand condition* where prime and target were related and both described a brand (e.g., McDonald's logo followed by the word "McDonald's"); (b) an *unrelated brand condition* where prime and target were not related and both described a brand (e.g., McDonald's logo followed by the word "Lacoste"); (c) a *related non-brand condition* where prime and target were related but the target word was not a brand (e.g., McDonald's logo followed by the word "hamburger"); (d) an *unrelated non-brand condition* where prime and target were not related and the target word was not a brand (e.g., McDonald's logo followed by the word "car"). Besides these four target word conditions, a target *non-word condition* was also created, where the prime logos were paired with non-word targets. Each logo prime was paired with a word target from each of the aforementioned four target word conditions. This way, 40 prime–target pairs were created (see Appendix B). Furthermore, each prime was also paired with four non-words to match the number of word and non-word trials. This led to a total of 80 prime–target pairs. These pairs were presented five times leading to 400 experimental trials.

3.4. Procedure

The procedure is based on a procedure used in several previous studies and has proven to elicit unconscious priming effects for non-brand stimulus material (Dell'Acqua & Grainger, 1999; Van den Bussche, Notebaert, & Reynvoet, 2009; Van den

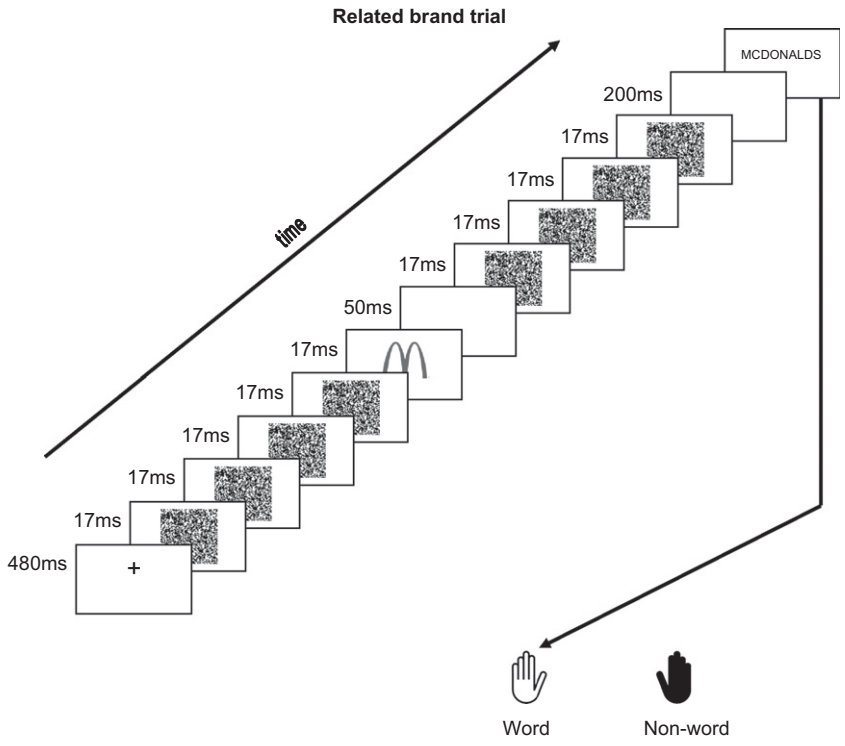


Fig. 1. Example of a conscious related brand trial.

Bussche, Smets, Sasanguie, & Reynvoet, 2012). Fig. 1 depicts the sequence of a conscious trial. First, a fixation cross was centrally shown for 480 ms, followed by a forward mask existing of four different random dot patterns with a total duration of 67 ms (4 × 16.7 ms). Following the mask, a picture prime was presented for 17 ms. After the prime, a blank screen was presented for 50 ms. The blank was then followed by a backward mask, again existing of four different random dot patterns for 67 ms. Subsequently, a blank of 200 ms followed the mask. Finally, the target was presented until the participants' response was registered. All targets were presented as black capital letters on a white background. The inter-trial interval was 1000 ms. All presentations were synchronized with the vertical refresh cycle of the screen (16.7 ms).

To determine priming, a lexical decision paradigm was used: participants were told that they would see letter strings and they were instructed to decide on each trial whether the target letter string was a word or a nonsensical non-word. When the target was a word they had to press "q", when it was a non-word they had to press "p" on the keyboard. Participants were instructed to respond as quickly as possible and to avoid mistakes. They were not informed about the presence of the primes.

The experiment started with 10 practice trials where no prime was shown (instead of the prime a blank screen was presented). During these practice trials subjects received feedback about their accuracy on the lexical decision task (the message "correct" or "incorrect"). After these practice trials the 400 experimental trials were presented in five blocks of 80 trials. During the experiment, feedback was no longer provided. After each block the participants were able to take a short break.

The unconscious condition was identical to the conscious condition, except that now the refresh cycle of the screen was 13.3 ms, leading to slightly shorter stimulus durations.[3] More specifically, the prime logos were now presented for 13 ms and the blank after the prime for 40 ms. The forward and backward masks were presented for 53 ms. Thus, the visibility of the primes was jointly determined by the prime duration and the length of the subsequent blank.

3.5. Prime visibility

Prime visibility was assessed using an objective visibility test. After the experiment, participants were informed about the presence of the prime logos and were asked to participate in a post-test in order to assess how well they were able to identify the masked logos. In order to create a prime discrimination task, 10 grayscale non-brand pictures were also randomly presented, next to the 10 logos, in this post-test with the same dimensions as the logos (see Appendix C). The procedure used in this post-test was similar as in the actual experiment with this difference that the participants were asked to categorize the prime: if they thought the prime was a brand logo they had to press "q"; if they thought it was not a logo they had to press

[3] We only noticed while running the 17 ms experiment that the primes could be perceived significantly above chance level under these conditions. Therefore, we decided to include an additional condition where the primes were presented for only 13 ms.

Table 1
Means (*SD*) of the median RTs (in ms) and mean error rates (in %) for the related and unrelated trials and the amount of priming (unrelated–related) as a function of condition (conscious or unconscious) and brand (brand target or non-brand target).

	Related	Unrelated	Priming
Conscious			
Brand	529 (53.5)	538 (50.4)	9**
	4.3 (4.2)	4.3 (4.6)	0
Non-Brand	508 (52.0)	520 (55.8)	12**
	2.6 (4.4)	2.5 (3.3)	−0.1
Unconscious			
Brand	506 (51.1)	507 (46.6)	1
	6.1 (4.2)	6.6 (5.1)	0.5
Non-Brand	484 (45.9)	482 (48.7)	−2
	3.6 (3.6)	2.6 (2.9)	−1.0*

* $p < .05$.
** $p < .01$.

"p" on the keyboard. If the participants were unable to categorize the primes, they were forced to guess. Only word target trials were presented in this post-test. Forty of these word trials were identical to the ones in the actual experiment described above (word targets preceded by a brand logo). In addition, the same 40 word targets were presented with a non-brand picture. This led to a total of 80 trials in this post-test which were presented once. All the other conditions were identical to the actual experiment.

4. Results

Only the trials where the target was a word were included in the analyses. The non-word trials, where no relation is present between the primes and targets, were omitted. Median RTs of correct responses and mean error rates were submitted to a repeated measures analysis with two within-subjects factors: prime–target relatedness (2 levels: related or unrelated) and brand (2 levels: brand target or non-brand target) and one between-subjects factor: condition (2 levels: conscious or unconscious). Median RTs and mean error rates as a function of these factors are reported in Table 1.

4.1. RT analysis

Inaccurate responses (on average 4.0%) were discarded for the RT analyses. The repeated measures analysis revealed a main effect of brand ($F(1,69) = 103.82$, $p < .001$): subjects responded significantly faster on trials where the target was a non-brand (498.5 ms) as compared to trials where the target was a brand (520 ms). The main effect of prime–target relatedness was also significant ($F(1,69) = 7.30$, $p = .009$): subjects responded significantly faster on related trials (507 ms) as compared to unrelated trials (512 ms). Most importantly, the interaction between prime–target relatedness and condition proved highly significant ($F(1,69) = 9.41$, $p = .003$): the priming effect (faster response when prime and target are related) was more prominent in the conscious than in the unconscious condition. Post hoc *t*-tests against the null mean indicated that only the priming effect of the conscious condition (10 ms) was significantly different from 0 ($t(38) = 4.31$, $p < .001$). The priming effect of the unconscious condition (−1 ms) was not significantly different from 0 ($t(31) = -0.24$, $p = .81$). The three-way interaction between prime–target relatedness, brand and condition was not significant ($F(1,69) = 0.21$, $p = .65$), indicating that the priming effect was very similar when the target was a brand and when the target was a non-brand for both the conscious and the unconscious conditions. Indeed, for the conscious condition a significant priming effect was observed for both the brand (9 ms, $t(38) = 2.70$, $p = .010$) and non-brand targets (12 ms, $t(38) = 3.17$, $p = .003$). For the unconscious condition, no priming effect was observed for neither brand (0 ms, $t(31) = -0.44$, $p = .91$) nor non-brand targets (−2 ms, $t(31) = 0.98$, $p = .66$). None of the other effects reached significance.

4.2. Error rate analysis

The same repeated measures analysis conducted on the mean error rates revealed a main effect of brand ($F(1,69) = 48.31$, $p < .001$): subjects made significantly more errors on trials where the target was a brand (5.3%) as compared to trials where the target was a non-brand (2.8%). The interaction between brand and condition also reached significance ($F(1,69) = 4.52$, $p = .037$): subjects made more errors on trials where the target was a brand as compared to trials where the target was a non-brand, but this was even more prominent in the unconscious condition. None of the other effects reached significance.

4.3. Prime visibility

Analyses of the post-test revealed that for the *conscious* condition, on average, subjects were able to correctly categorize the primes on 75% of the trials. This percentage of prime visibility differed significantly from chance level ($t(38) = 10.76$,

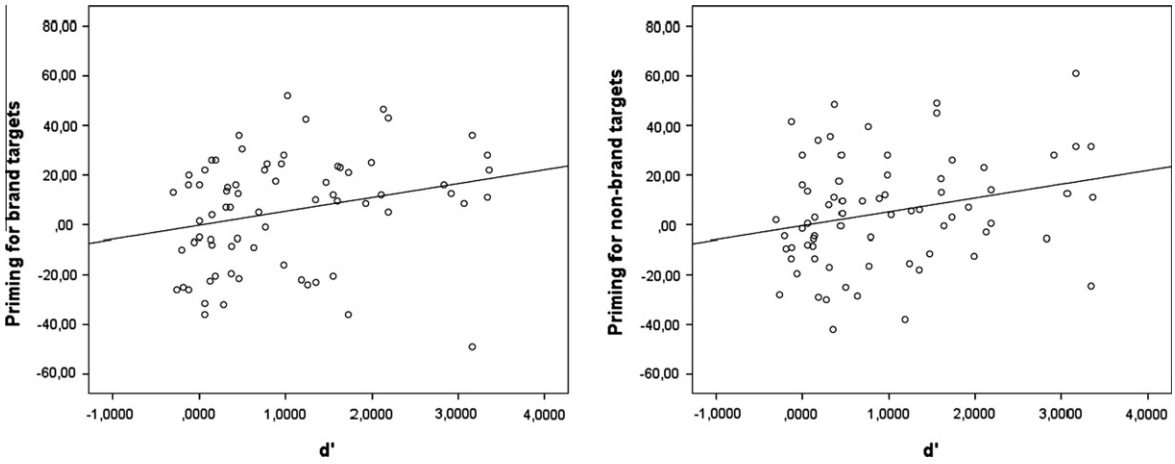


Fig. 2. Scatter plots illustrating the significant positive correlations between d' and the amount of priming observed for brand targets (left panel) and non-brand targets (right panel) for the pooled conscious and unconscious conditions.

$p < .001$). A direct measure of prime visibility (d') was calculated for each subject. The measures are obtained by treating one level of the response category (i.e., brand logos) as signal and the other level (i.e., non-brand pictures) as noise. The overall mean d' value was 1.56. A t-test against the null mean indicated that this d' value was significantly higher than 0 ($t(38) = 9.43$, $p < .001$), indicating that the primes were consciously perceived.

Analyses of the post-test revealed that for the *unconscious* condition, on average, subjects were able to correctly categorize the primes on 54% of the trials. The percentage of prime visibility differed significantly from chance level ($t(31) = 3.51$, $p = .001$). A direct measure of prime visibility (d') was again calculated for each subject. The overall mean d' value was 0.29. A t-test against the null mean indicated that this d' value was significantly different from 0 ($t(31) = 3.91$, $p < .001$), indicating that the primes could be categorized slightly above chance level. Crucially, regression analyses showed that the priming index at the $d' = 0$ intercept was not significant for the brand targets (intercept = −6 ms; $t(31) = -1.40$, $p = .17$), and for the non-brand targets (intercept = −0.5 ms; $t(31) = -0.085$, $p = .93$), demonstrating that no significant priming was observed in the absence of prime perceptibility. To compare the results for the participants with higher and lower d' values within this unconscious condition, a median split-half strategy was used and participants were divided in two groups based on their d' value. For the 16 participants with the lowest average d' values, the visibility of the primes did not differ from chance level (mean $d' = -0.01$, $t(15) = -0.29$, $p = .77$). For this group of participants, no significant priming effects were observed (RTs: −8 ms, $t(15) = -1.50$, $p = .15$ for brand targets; 0 ms, $t(15) = 0.03$, p=.98 for non-brand targets; error rates: 0%, $t(15) = 0.00$, $p = 1.00$ for brand targets; −0.5%, $t(15) = -0.94$, $p = .36$ for non-brand targets). For the 16 participants with the highest average d' values, the visibility of the primes did differ from chance level (mean $d' = 0.59$, $t(15) = 6.13$, $p < .001$). However, for this group of participants, again no significant priming effects were observed, except for a reversed priming effect for non-brand targets in the error analysis (RTs: 9 ms, $t(15) = 1.51$, $p = .15$ for brand targets; −3 ms, $t(15) = -0.59$, $p = .56$ for non-brand targets; Error rates: 1.0%, $t(15) = 0.74$, $p = .47$ for brand targets; −1.6%, $t(15) = -2.45$, $p = .03$ for non-brand targets).

Finally, regression analyses were conducted across the pooled conscious and unconscious conditions in order to reveal the relation between priming and prime visibility (d'). A significant positive correlation was observed between priming and d' for both the brand targets ($r = .26$, $F(1,69) = 4.91$, $p = .030$) and the non-brand targets ($r = .26$, $F(1,69) = 5.06$, $p = .028$). These correlations are depicted in Fig. 2. However, the priming index at the $d' = 0$ intercept was not significant for the brand targets (intercept = 0 ms; $t(69) = -0.06$, $p = .95$) and the non-brand targets (intercept = 0 ms; $t(69) = -0.12$, $p = .91$). These analyses show that no priming is observed at zero prime visibility, but that the amount of priming linearly increases with increasing prime visibility.

5. Discussion

The debate on whether subliminal influencing can be reliably implemented in everyday life or advertising situations is ongoing. The aim of our study was therefore to scrutinously assess whether more real-life stimulus material possesses the power to elicit conscious and unconscious priming.

In order to achieve this, a masked priming experiment was used in which 10 masked brand logos were either consciously or unconsciously presented to participants and the influence of these primes on their responses to a subsequent target were examined. Our results show that in the conscious condition a significant priming effect was present in both the brand (e.g., McDonald's logo followed by the word "McDonald's") and the non-brand (e.g., McDonald's logo followed by the word "hamburger") condition. This implies that brand logos (e.g., logo of McDonald's) possess the power to prime their brand names (e.g., "McDonald's") and, remarkably, also words associated to the brand (e.g., "hamburger"). This indicates that the logo

primes trigger a spreading of activation to semantic neighbors (see for example Collins & Loftus, 1975). However, in the unconscious condition, no significant priming could be observed. We note that our unconscious condition was not completely "unconscious" since some participants were still able to identify the primes above chance level. Interestingly, even when participants were able to identify the primes to some extent in the unconscious condition, no priming effects were observed. Thus, brand logos could only influence behavior when they were presented clearly above the consciousness threshold. We also found that the non-brand condition was responded to faster and more accurate than the brand condition. This is probably due to the fact that non-brand words (e.g., "hamburger") are more familiar than brand words (e.g., "McDonald's"), which we do not encounter that often in their written out form.

Based on these results it becomes clear that if we want to claim studying truly subliminal or unconscious processes, a rigorous prime awareness check is mandatory. Recently, researchers have claimed that our consumer choices can be influenced unconsciously (e.g., Karremans et al., 2006). However, the assessment of the subliminal nature of the primes in these studies was not as strict as it should be. In the experimental literature on subliminal perception, a strict prime awareness assessment (e.g., prime categorization) is standard nowadays. However, this is often lacking in studies generalizing subliminal priming findings to a more real-life or advertising context. These studies often use a post hoc subjective measure and/or prime identification, both of which have been related to underestimation of prime awareness (Bjorkman et al., 1993; Farah et al., 1991). As a consequence, we can hypothesize that these studies likely overestimated the unconscious nature of the primes, while in fact they were perceived above the consciousness threshold to some extent, which would invalidate the conclusions drawn from these studies. Using a stringent prime awareness method (i.e., a prime categorization task), our current study shows that even presenting the primes for a very short duration and masking them is not sufficient to guarantee the unconscious nature of the primes. Thus, future studies aimed at studying the influence of truly subliminal information on our behavior should incorporate a more strict method to assess prime awareness.

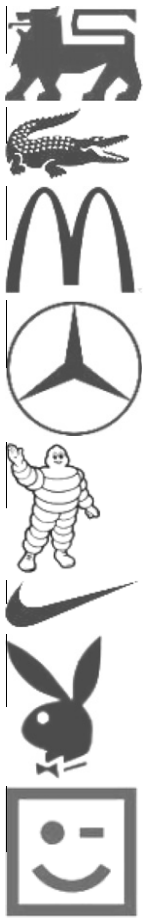
One might question the implications of the present findings for consumer choices. However, before studying whether truly unconscious advertising material can influence our consumer behavior, we first have to assess whether they can influence our behavior *at all*, in a very strict typical masked priming design. Furthermore, we note that in the present study and in previous studies on this issue, an artificial, laboratory context was created where prime and target follow each other closely in time. Thus, the question with regards to the longevity of subliminal influencing, and thus its applicability in daily life situations, remains. However, if immediate unconscious effects are not obtained (as demonstrated in the present study), this automatically casts doubt on the occurrence of longer-lasting effects. Thus, our study can be seen as an important first step towards the rigorous study of unconscious influencing in daily life. It is crucial that future studies focus on the longevity of subliminal influences in order to finally determine whether they can be reliably implemented in our daily life.

Although we failed to observe unconscious priming in the present study, we do not exclude the possibility that future studies will, even when using a more rigorous prime awareness test. Our failure to obtain unconscious effects might be due to the stimulus material. Subliminal priming effects from picture primes using a very similar procedure as the one used in the present study proved to be only small (Van den Bussche, Notebaert, et al., 2009). Using different stimulus material, such as words, might lead to stronger subliminal priming effects. However, in this case important confounding factors have to be considered (e.g., orthographic overlap between primes and targets, see Van den Bussche, Notebaert, et al., 2009).

We can conclude that shortly presented and masked brand logos have the power to prime their brand names and, remarkably, words associated to the brand. However, this only occurred when the logos could be categorized clearly above the consciousness threshold. Once the primes were presented close to the consciousness threshold, no subliminal influences on behavior were observed. These results confirm the necessity of a strict prime awareness measure to ensure that observed effects are indeed truly subliminal. Future research should now focus on whether truly subliminal influencing can be observed in more daily life contexts and whether those influences are indeed as short-lived as often claimed, which would prohibit their usefulness in everyday life situations.

Appendix A. Prime logos used in the experiment and their brand names

Prime logo	Brand name
	APPLE
	CÔTE D'OR



DELHAIZE

LACOSTE

MCDONALD'S

MERCEDES

MICHELIN

NIKE

PLAYBOY

TELENET

Appendix B. Prime-word target pairs used in the experiment (and their English translations if different from the Dutch word)

Prime logo	Related brand target	Unrelated brand target	Related non-brand target	Unrelated non-brand target
Mercedes	MERCEDES	CÔTE D'OR	AUTO (car)	INTERNET
Apple	APPLE	MICHELIN	COMPUTER	NAAKT (nudity)
Nike	NIKE	TELENET	SPORT (sports)	CHOCOLADE (chocolate)
McDonald's	MCDONALD'S	LACOSTE	HAMBURGER	AUTO (car)
Playboy	PLAYBOY	NIKE	NAAKT (nudity)	HAMBURGER
Delhaize	DELHAIZE	MERCEDES	SUPERMARKT (supermarket)	SPORT (sports)
Lacoste	LACOSTE	APPLE	KLEDING (clothing)	BANDEN (tires)
Michelin	MICHELIN	DELHAIZE	BANDEN (tires)	COMPUTER
Côte d'or	CÔTE D'OR	PLAYBOY	CHOCOLADE (chocolate)	KLEDING (clothing)
Telenet	TELENET	MCDONALD'S	INTERNET	SUPERMARKT supermarket)

Appendix C. Non-brand pictures used in the prime visibility test and their names

Non-brand picture	Name
	CHAIR
	CUP
	FLAG
	FORK
	GLASS
	GLASSES
	LOCK
	SCISSORS
	TABLE
	VIOLIN

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