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Quantifying the Roles of Conscious and Unconscious Processing in Insight-Related Memory Effectiveness within Standard and Creative Advertising

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Abstract

To maximize marketing effectiveness many conscious and unconscious elements are simultaneously employed within campaign advertising. However, little is known about the individual contributions that conscious and unconscious processes make to the cognitive effectiveness of creative advertisements, some of which may also induce insight experiences. To quantify the roles of conscious and unconscious processes in memory effectiveness within commercial advertising, a dual-process, signal-detection technique was adopted to separate the contributions of conscious recollection and unconscious discrimination induced by 80 printed advertisements, among which half were considered standard and the other half creative. A total of 51 participants completed immediate (5 minutes later) and delayed (3 days later) memory recognition tests. In contrast to standard advertising, creative advertising was found to enhance recognition and to demonstrate advantages in both conscious and unconscious memory, which decreased across the test-time intervals. Further analyses showed that a moment of insight induced by an advertisement, regardless of whether it is standard or creative, can consolidate unconscious memory, whereas advertisements that do not induce insight improve conscious memory. The implications of these findings are discussed.

Keywords: creative advertising, memory, unconscious memory, conscious memory, insight

Quantifying the Roles of Conscious and Unconscious Processing in Insight-Related Memory Effectiveness within Standard and Creative Advertising

Introduction

Advertising pervades daily life, playing vital roles in commercial marketing, brand extension and even publicity propaganda. Research has indicated that advertising guides many customers' brand choices and purchase decisions (e.g., Kover, Goldberg, & James, 1995; Percy & Rossiter, 1992), although most individuals show little deliberate willingness to either seek out advertising or to resist it when it is present (e.g., Mehta, 2000; Shavitt, Lowrey, & Haefner, 1998). What makes advertising work? Accumulating evidence (e.g., Krishnan & Shapiro, 1996; Lee, 2002; Yoo, 2007) suggests that advertising facilitates purchase intentions, brand preferences and decision making at least in part through unconscious processes that arise during the viewing of an advertisement, even if the observer does not deliberately engage with the advertisement, perhaps only giving it a brief and transient glance. The importance of unconscious processing in marketing and advertising is also illustrated by three common advertising approaches, which are termed soft advertising (e.g., corporate social responsibility advertisements), implanted advertising (e.g., products' logos or brands implanted in movies) and subliminal advertising (e.g., subliminally projecting the words ‘‘eat popcorn’’ and ‘‘drink Coca-Cola’’ on the screen during showing movies, for details see Broyles, 2006; Theus, 1994; Wei, 2017), all of which have been developed to attract customers and promote the advertised product or brand. Naturally, as a utilitarian business, advertising is designed for maximum marketing effectiveness (e.g., purchase intent). To achieve such effectiveness, although unconscious and conscious advertising strategies are sometimes used in isolation, it is more often the case that they are

combined. In this sense, the effectiveness of many advertisements is a product of both conscious and unconscious elements.

Across two experiments, Muscarella, Brintazzoli, Gordts, Soetens, and Van den Bussche (2013) found that when real-life information is presented minimally either consciously or unconsciously, it can affect subsequent behaviors, even when more than five seconds pass between the presentation of the minimally conscious or unconscious information and the behavior on which it exerts its influence. In another study, Yang, Roskos-Ewoldsen, Dinu, and Arpan (2006) immersed participants in computer games and then interspersed "in-game" advertisements. They found that word fragment completion tests exhibited robust unconscious priming effects. Likewise, the mere exposure effect also suggests the same unconscious influence, revealing better effectiveness for advertisements that are repeatedly presented to consumers (Cox, & Cox, 1988; Grimes, & Kitchen, 2007).

To respond to increasingly intense market or business competition, most companies have to publish many advertisements to attract consumers' attention. This means that advertisements are ubiquitous, appearing on TV, on the radio, in newspapers and magazines, in mailboxes, on streets, and on the Internet. Consequently, citizens are exposed to an unprecedented number of advertising messages, all of which compete to attract limited attention. In this context, not all advertisements can successfully attract sufficient attention to be consciously processed or encoded. Individuals may not spend enough time paying attention to advertising even if the viewed advertisement is novel or interesting, which means that many advertisements are reliant on being processed automatically rather than deliberately to have an impact on attitudes and behaviours. Previous studies (e.g., Shapiro, 1999; Shapiro & Krishnan, 2001; Yoo, 2007) indicate that incidental exposure to advertisements can increase an audience's preference for the

advertised product or brand despite an inability to recognize consciously the previously viewed information. Accordingly, the (marketing) memory effectiveness of an advertisement relies not only on conscious and deliberate encoding but also on unconscious and automatic processing.

To facilitate successful advertising, it is valuable to identify the role of unconscious processing in advertising memory effectiveness, in particular, by separating the role of unconscious processing from that of conscious processing across different types of advertisements. Although unconscious processing, as the "grey" side of the hierarchical construct of consciousness, is very difficult to separate from conscious processing, some pioneering studies have attempted to probe the role of the unconscious in advertising effectiveness (Duke & Carlson, 1994; Krishnan & Shapiro, 1996, 2004). Such studies have demonstrated the appropriateness of indirect or implicit memory measures in isolating the effectiveness of unconscious memory in advertising, which we discuss in more detail in the following section. The distinction between unconscious and conscious processes that is invoked in this study is, therefore, operationalized in terms of the distinction between implicit or indirect memory retrieval versus explicit or direct memory retrieval.

Techniques to separate unconscious and conscious memory

Identifying the contribution of unconscious memory processes in advertising effectiveness is a vital issue of emerging interest. Due to the invisible nature of such unconscious processing, numerous techniques have been developed in an attempt to separate unconscious and conscious memory. The process dissociation procedure (PDP) developed by Jacoby (1991) was a breakthrough technique to dissociate unconscious contributions to memory from conscious ones. The rationale behind the PDP is that conscious and unconscious processing are entirely independent cognitive operations that can be detected through the deployment of inclusion and

exclusion tasks. In inclusion tasks, unconscious and conscious processes work in synergy to promote memory performance; on the other hand, in exclusion tasks, they work in opposition with respect to memory performance. The contribution of conscious and unconscious processing in memory effectiveness can be isolated by calculating the following (see Joordens, Wilson, Spalek, & Paré, 2010), where 1 is the probability of recollection (Jacoby, 1991):

$$P(conscious) = P(inclusion) - P(exclusion)$$

$$P(unconscious) = P(exclusion)/(1 - P(conscious))$$

Adopting the PDP, Yoo (2008) used peripherally placed web advertising to explore the magnitude of conscious processing versus unconscious processing in relation to the effectiveness of memory retrieval (induced by verbal instruction) across different attention conditions. Yoo's study revealed that both explicit and implicit memory performance were enhanced by participants engaging in increased attention to web advertisements. In contrast, only implicit memory performance was enhanced if minimal or no attention was paid to web advertisements. Likewise, Shapiro, and Krishnan (2001) examined potential dissociations between unconscious processing (as indicated by implicit memory) and conscious processing (as indicated by explicit memory) in a study of advertising effectiveness under "full" or "divided" attention conditions. Shapiro and Krishnan corroborated the hypothesis that the explicit memory results would align with the conscious component of the PDP and that the implicit memory results would align with the unconscious component. Confirming the superiority of conscious contributions during participants' full attention as compared to divided attention, Liu and Johnson (2005) also revealed the constant contribution of unconscious processing in advertising effectiveness across both attention conditions.

Creative advertising, insight and the roles of unconscious and conscious memory

Creative advertising refers to advertisements that are rated as highly creative by the general public or by advertising campaigners or that have been commended through national and international awards in well-known competitions. This kind of advertising encapsulates exceptional creativity and is considered a key product-based illustration of advertising creativity that aims implicitly to communicate the message through an unusual but conceptually associated carrier. Creative advertisements tend to leave a deep impression on the audience by virtue of their novelty or unique design, although their basis on extraordinary ideas often makes such advertising difficult to comprehend (Shen, Bai et al., 2020).

Previous studies have demonstrated that creative advertisements can easily penetrate a viewer's mind and capture their initial attention (Sasser & Koslow, 2008; Smith & Yang, 2004). Likewise, such advertisements can interest the viewer and hold their attention long enough for a successful appreciation (Baack, Wilson, & Till, 2008) and can build a long-term and positively preferred brand attitude (e.g., Pieters, Warlop, & Wedel 2002; Till & Baack 2005). Given the importance of advertising creativity in gaining people's attention, the role of unconscious operations in the processing of creative advertisements is likely to vary and might itself be modulated by levels of advertising creativity, which can be considered a prerequisite for creative advertisements. Indeed, conscious operations would likely play a more important role in the processing of creative advertisements owing to the unique characteristics of such advertisements (e.g., novel expressions or concepts and the utility of distinctive styles or visual appearances). This view aligns with findings showing an enhanced contribution of conscious processing under

full attention conditions, as revealed by the studies noted above by Liu and Johnson (2005) and Shapiro and Krishnan (2001).

It is also noteworthy, however, that the novel and unusual concepts and designs incorporated into creative advertising (Morrisson & Dainoff 1972; Pieters et al., 2002) would likely make such advertisements difficult to understand such that they might induce a mental "impasse" or "dead end" similar to that which an individual often encounters when attempting to solve a creative problem (e.g., Ohlsson, 2011). However, the curiosity that these advertisements invoke will often lead the individual to persevere in trying to interpret the embedded clues and hints. If the individual continues to work towards comprehending the intended meaning of the advertisement, they may experience a moment of sudden and deep understanding, termed "insight", when they suddenly comprehend the intention behind the advertisement (Salvi et al., 2016; Wu et al., 2017; Shen, Bai et al., 2020). Moreover, such insight is more likely to be invoked by creative advertisements than standard advertisements simply because the former are more likely to induce a state of impasse.

Insight has long been considered to be either entirely or partially unconscious. The case for insight being a purely unconscious process is supported by evidence for a close association between insight and unconscious awareness (see Bowden, 1997; Kounios & Beeman, 2014; Siegler, 2000). On the other hand, the case for insight being only partially unconscious is captured by dual-process models, which claim that both conscious and unconscious processes are associated with insight (e.g., Weisberg, 2014; Yuan & Shen, 2016). Irrespective of whether insight is entirely or partially unconscious, creative advertising that induces insight may be different from standard advertising and may thus produce a trade-off between unconscious with conscious processes that is distinct from that previously observed for standard advertising. At

present, there is more support in academic circles for the view that advertisements that induce insight are processed entirely unconsciously, so this forms the working assumption for our reported study (e.g., Paker, Ang, & Koslow., 2018).

Motivation for the current study

From the literature reviewed above, there appear to be some gaps in our understanding of the contributions of unconscious and conscious processing to advertising effectiveness when assessed in terms of memorability. First, the studies that have attempted to isolate the contributions of conscious and unconscious processing in advertising effectiveness have primarily drawn their conclusions based on the application of the PDP, which has been widely criticized for its contamination of unconscious contributions because of participants' distinct response criteria (Yonelinas, 1994; Yonelinas, Regehr, & Jacoby, 1995; Yonelinas, Aly, Wang, & Koen, 2010). That is, the participants may have different response criteria in the inclusion and exclusion tests, which would result in inconsistent effects of unconscious processing in the two tests, thereby rendering the measure of unconscious processing unreliable (Yonelinas et al., 1995).

Second, the majority of previous studies have examined the contribution of unconscious and conscious processing in the effectiveness of advertising by surveying respondents using a small number of advertising stimuli (e.g., Shapiro, 1999; Vandeberg, Murre, Voorveld, & Smit, 2015), resulting in findings that lack generalizability. Importantly, numerous studies have only compared the induced differences between full and divided attention conditions (Liu & Johnson, 2005; Shapiro & Krishnan, 2001), limiting the generalizability of results to real life situations. As such, findings relating to artificially induced differences between conscious and unconscious processing only provide limited implications for advertising effectiveness in real-life marketing,

where no pre-determined attentional instructions are provided relating to the conscious or unconscious processing of advertisements. Consistent with this view, Yoo (2009) has argued that most real-life advertisements do not engender intentional or effortful processing, such that it is necessary to understand the nature of incidental exposure to advertising and its effects. Finally, most existing studies are concerned with feature advertising (e.g., Shapiro, 1999), without considering advertisements that either: (1) spontaneously capture viewers' attention or cognitive resources because of their unusual or unique characteristics in conceptualization, performance or execution; or (2) induce insight as participants persist in trying to understand fully the initially difficult-to-comprehend advertisement.

To our knowledge, no study has addressed the gaps that we have identified in our current understanding relating to whether the roles of conscious and unconscious processing in creative advertising are different from those in standard advertising and whether insight influences the relative contributions of unconscious and conscious processing in advertising memory. To fill these gaps, we designed the current study, drawing on the dual-process signal detection (DPSD) approach that has been developed from the traditional PDP in a way that circumvents the shortcomings of the latter technique in terms of the interference that arises form subjective response criteria in relation to the measurement of unconscious contributions to processing (Yonelinas, 1994). We adopted the DPSD approach to extend prior findings by empirically dissociating the roles of conscious and unconscious processing in standard and creative advertising, with a further focus on the consequences arising from the induction of insight during the appreciation of advertisements

We also note that previous studies of positive effects on advertising memory performance have paid limited attention to the long-term memory effectiveness of advertisements, with very

few studies having examined whether and how unconscious processing versus conscious deliberation impact advertising memory effectiveness over time delays. Shapiro and Krishnan (2001) examined conscious and unconscious aspects of memory for advertisements after a delay of a week. They observed that relative to conscious memory, unconscious memory was preserved even under the delayed condition, and conscious memory was adversely affected by such conditions. Baack et al. (2008) utilized four time-delay intervals (no delay versus delays of one week, three weeks, and five weeks) to investigate the characteristics of conscious memory in creative advertising and showed that the advantage for creative advertising manifested as the delay increased. In addition, some studies examining the role of delay interval on subsequent long-term memory effectiveness have revealed inconsistent findings (e.g., Ludmer, Dudai, & Rubin, 2011; Shen, Zhao, et al., 2019), with the particular duration of the retrieval interval likely being an important influencing factor. Building on these findings, the present study attempted to dissociate the memory effectiveness of creative advertising for the first time and further determine the potential differences between immediate memory for advertisements and memory after a three-day delay.

The study examined memory processes in relation to two types of advertisements: international award-winning advertisements (i.e., those that had achieved Cannes Lions or Clio awards) and advertisements that had not won awards. These two types of advertisements were used as proxies for creative and standard advertising, respectively. The study also assessed participants' self-rated judgments of the creativity of presented advertisements in an effort to reconcile findings from two distinct approaches to categorizing advertisements as either creative or standard. The study additionally investigated for the first time the distinction between participants' conscious and unconscious memory for advertisements as implemented by the

DPSD model. Three hypotheses were formulated for the study, as follows: (1) the memory effectiveness of creative advertising reflects a hybrid combination of conscious and unconscious processing; (2) compared to standard advertising, creative advertising has a memory advantage, regardless of whether it is unconscious or conscious; and (3) advertisements that provoke a moment of insight are better remembered through unconscious processes, whereas those that do not induce such insight are better remembered through conscious memory processes.

Methods

Participants

Referring to previous studies (e.g., Hutton & Nolte, 2011; Jin, Kerr, & Suh, 2019; Simola, Kuisma, & Kaakinen, 2020), fifty-one undergraduate students (21 males) aged from 18 to 24 years (M_{age} = 19.32 ± 1.75 years) voluntarily participated in this study. The study was approved by the institutional ethical committee and all participants signed informed consent forms. All volunteers were right-handed, with normal or corrected-to-normal vision, without any impairment in color perception (color weakness/blindness) or a history of neurological disorder or psychiatric illness. They received appropriate compensation after the experiment.

Design

A 2 (test time: immediate vs. delayed) × 2 (creativity: creative vs. standard) × 2 (insight: present vs. absent) within-subjects design was used. The presence versus absence of insight was not directly manipulated by the experimenters and was largely determined according to the participants' responses, although we note that materials that were more likely to induce an insight were used in the insight present condition compared to the materials used in the insight absent condition. The dependent variables were participants' R scores and d' scores, which denoted the levels of (conscious) recollection and (unconscious) discrimination, respectively.

Materials

The 80 printed advertisements that were used for the study session were selected from the Standardized Print Advertising Gallery and included 40 creative commercial advertisements (i.e., award-winning) and 40 standard commercial advertisements that were not award-winning (Kover, Goldberg, & James, 1995). The materials in the recognition test session consisted of 40 original images from the study session (20 creative and 20 standard advertisements) and 40 new images (20 creative and 20 standard advertisements). The product categories of advertisements mainly involved daily necessities such as coffee, condiments and the like. We also examined the familiarity of the products associated with the 80 target advertisements by collecting product-familiarity ratings (using a nine-point scale) from 60 homogeneous participants. We found that there was no significant difference between the product familiarity of creative advertisements (M = 6.55, SD = 1.14) and standard advertisements (M = 6.78, SD = 1.08), $t(78) = -0.89$, $p = .38$, Cohen's $d = -.10$. All advertisements were standardized and presented as 300×400-pixel *black-and-white* images, with visual angles as follows: $\beta_{width} = 4.41°$ and $\beta_{length} = 6.11°$.

Two versions of the advertisements were presented to participants during the study session. Initially, picture-only advertisements were presented, and participants were asked to think about the idea that the advertisements conveyed. Subsequently, the same advertisement was presented together with a brief description that summarized the idea behind the advertisement. These brief descriptions were provided as way to ensure that the participants entirely understood the advertisements, with the description functioning to trigger insight (i.e., an insight or "Aha!" experience) for those advertisements where there was little or no initial understanding. The appropriateness of this latter manipulation for triggering insight has been validated by previous

studies (e.g., Amir, Biederman, Wang, & Xu, 2015). The lengths of the descriptions ($\leqslant$ 9 words) were similar, $t(78) = -.40$, $p = .70$, Cohen's $d = -.09$, for both the creative ($M = 6.73$, $SD = 1.11$) and the standard advertisements ($M = 6.83$, $SD = 1.12$).

Procedure

The experimental procedure was programmed and implemented in E-prime 2.0 software. The materials were presented on a 21-inch Lenovo display with a resolution of 1024×768, a refresh rate of 85 Hz and a white background. The participants sat 75 cm away from the monitor screen and their eyes looked at the center of the screen horizontally. The participants were allowed to practice before the formal experiment and familiarize themselves with the experimental procedure. The formal experiment comprised three sessions: the study session, the interference session, and the recognition test session. The full procedure is illustrated in Fig.1.

[INSERT FIG. 1 ABOUT HERE]

Study session. The session consisted of 80 trials. At the beginning of a trial, a fixation cross appeared in the center of the screen for 300 ms, which was followed by a 200 ms pause and then an advertisement image was shown for 8 s; participants were asked to consider the idea behind the advertisement when viewing it. After a 200 ms pause, the same image with a brief description of the advertisement was presented again for 6 s. Participants were asked to press a button to indicate how they had processed the advertisement. If they transitioned from "correct inference" to "inference confirmed", namely the brief description that was presented was actually consistent with what the participants had thought, reflecting no moment of insight, then they should press "1" key (see Luo & Niki, 2003, p. 317); If the participants had a sudden comprehension after a glance at the subsequent brief description (i.e., they transitioned from

"puzzled" to "understanding", reflecting an insight; see Bowden & Jung-Beeman, 2003, p. 732), then they should press the "2" key. Insight is the feeling that arises when people suddenly understand an incomprehensible problem or idea. When it appears, the creative idea of the advertisement will suddenly appear in the minds of the participants. If the participants' idea of the advertisement was inconsistent with the brief description, but the participants understood this description promptly (i.e., they transitioned from "incorrect inference" to "cognitive conflict" to "understanding", reflecting an insight experience; see Sandkuhler & Bhattacharya, 2008), then they were required to press the "3" key. If the participants' idea of the advertisement proved to be incorrect, and they didn't understand the description provided or consider it convincing (i.e., they transitioned from "incorrect inference" to "cognitive conflict" to "incomprehension", reflecting no insight experience; see Schooler, Ohlsson, & Brooks, 1993, p. 170), then they were instructed to press the "4" key. If the participants did not understand the advert or the description (i.e., they transitioned from "puzzled" to "incomprehension", reflecting no insight experience; see Luo, Niki, & Phillips, 2004, p. 2014), then they were asked to press the "5" key. The printed advertisements were presented in a random order for each participant.

Subsequently, the participants were required to report subjectively on the insight intensity and the creativity of the advertisement; the response range for both insight intensity and advertising creativity was 1-7. The stronger the perceived intensity or creativity, the higher the value. After these responses a blank screen appeared for 200-600 ms, before the commencement of the next trial. During the experiment, key presses were automatically recorded by the E-prime 2.0 software.

Interference session. All participants were asked to perform a commonly used interference task, which involves repeatedly subtracting three from a number given at the start of the

procedure until the result is zero or less (or five minutes have elapsed). This task aimed to distract participants and prevent them from rehearsing the images that they had just seen. It is worth noting that participants underwent the same interference session whether they were in the immediate or the delayed recognition test conditions.

Recognition test session. During the recognition test session, 80 pictures were randomly presented, including 40 old images that had been studied previously (20 creative and 20 standard advertisements) and 40 new images that had not been studied previously (20 creative and 20 standard advertisements). Each participant received two different tests: an inclusion test and an exclusion test (see Fig. 1). In the inclusion test, participants were asked to judge whether each picture had previously been seen. If they thought that the image had previously been "presented" or they were "not sure", they were instructed to respond "old" and press the "F" key; if they thought the image was "not presented" then they were instructed to respond "new" and press the "J" key. In the exclusion test, if they confirmed the picture was "not presented" or they were "not sure", they were instructed to respond "new" and press "F" key; if they confirmed it had previously been "presented", they were instructed to respond "old" and press "J" key. To provide an immediate measure of recognition, participants performed the inclusion and exclusion tests immediately after the interference session, whereas in the delayed condition they performed the inclusion and exclusion tests after 3 days. The purpose of the delayed test after 3 days was to demonstrate the impacts of unconscious versus conscious processing on advertising effectiveness as assessed via long-term memory.

The DPSD model integrating both the PDP and SDT was used as a framework to dissociate conscious and unconscious components of immediate and delayed memory for advertising across different levels of advertising creativity (Yonelinas, 1994). During the recognition process,

participants set their own response criteria (C). If an item's familiarity reflecting the unconscious level exceeded a participant's own C, the item was judged by the participant as "old". The familiarity of items follows a normal distribution and can be expressed as Φ(d'/2-C) (see Yonelinas et al., 1995). The probability of judging studied items as "old" (Hit) was $P(H_I) = R + \Phi(d'/2-C_I) - R*\Phi(d'/2-C_I)$ in the inclusion test and $P(H_E) = R + \Phi(d'/2-C_E) - R*\Phi(d'/2-C_E)$ in the exclusion test. The probability of judging the interference items as "old" (False Alarm) was $P(FA_I) = \Phi(-d'/2-C_I)$ in the inclusion test and $P(FA_E) = \Phi(-d'/2-C_E)$ in the exclusion test. The familiarity is described by logistics, and the approximation of R and d' can be drawn. Additionally, in relation to the receiver operating characteristic (ROC) curve, the conscious recollection is the intercept at the y-axis. Therefore, the value of R should be 0-1. Assuming that the familiarity is normally distributed and has the ability to distinguish between old and new items, it can be quantified according to d'. The d' is the distance between the old and new item familiarity distributions (Ghetti & Angelini, 2008). When the familiarity of an item exceeds a certain standard, the individual will identify the item as an old item. Since familiarity (unconscious processing) and conscious recollection (conscious processing) are two independent processes, the R and d' are independent of each other, and the larger their value, the better the effect of conscious and unconscious processing. Compared to the PDP, the DPSP can provide a better estimate of the effects of conscious and unconscious processing (Wixted, 2007).

In the following equations, R (recollection) represents the probability of conscious recollection, whereas d' (familiarity) indicates the level of unconscious discrimination. H_I and H_E individually represent the probability of considering the studied image as an "old" image in the inclusion and exclusion tests. FA_I and FA_E individually denote the probability of considering an unstudied image as "old" in the inclusion and exclusion tests.

$$R = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

a = 1; b = $H_E - H_I - 1$

$$c = H_I(1 - H_E) - H_E(1 - H_I) \times \frac{FA_I(1 - FA_E)}{FA_E(1 - FA_I)}$$

$$d' = \ln[\frac{(H_I - R)(1 - FA_I)}{FA_I(1 - H_I)}] = \ln[\frac{H_E(1 - FA_E)}{FA_E(1 - R - H_E)}]$$

Results

A total of five participants were excluded from the ANOVA due to missing data for H_I, H_E, FA_I or FA_E, leaving a final sample of 46 participants. The results showed that the average number of responses for each keypress type (standard deviations are provided in the parenthesis) were as follows: 33.61 (±9.46) for the "1" keypress; 23.96 (±7.38) for the "2" keypress; 11.71 (±8.50) for the "3" keypress; 4.69 (±2.81) for the "4" keypress; and 7.00 (±4.57) for the "5" keypress. Among these, the "1" keypress represents "non-insight" (1713, 41.99%), the "2" and "3" keypresses both denote "insight" (1810, 44.61%), while the "4" and "5" keypresses indicate "incomprehension" (547, 13.41%), which was excluded from the subsequent analysis. As can be seen, the percentage of insight and non-insight responses was almost equivalent, $\chi^2 = 1.31$, $p = .25 > .05$.

[INSERT TABLE 1 HERE]

Conscious and unconscious memory

Table 1 shows descriptive data for conscious memory (R) and unconscious memory (d') for advertisements as a function of creativity, insight and test time. As can be seen in Table 1, both conscious and unconscious memory appeared to be better for creative advertisements than for standard advertisements. In most cases, conscious and unconscious memory performance was

also better under immediate than delayed conditions. Moreover, for conscious memory the best memory performance occurred for immediate memory for creative advertisements where insight was absent. In contrast, for unconscious memory the best performance occurred for immediate memory for creative advertisements where insight was present.

A 2 (test time: immediate vs. delayed) × 2 (creativity: creative vs. standard) × 2 (insight: present vs. absent) repeated measures ANOVA was used to determine the differences in conscious memory (R) for advertisements with respect to the manipulated variables. As Table 2 illustrates, the results revealed a significant main effect of test time, indicating that conscious memory for advertisements was better when immediate than after a delay, $F_{(1,44)} = 11.48$, $p = .001$, $\eta_p^2 = .20$. In addition, conscious memory was also significantly better for creative advertisements than for standard advertisements, $F_{(1,44)} = 17.50$, $p < .001$, $\eta_p^2 = .28$. Furthermore, there was a significant main effect of insight, with conscious memory for advertisements being superior when insight was absent than when it was present, $F_{(1,44)} = 5.14$, $p = .03$, $\eta_p^2 = .10$.

[INSERT TABLE 2 HERE]

The interaction between creativity and insight was significant, $F_{(1,44)} = 66.39$, $p < .001$, $\eta_p^2 = .60$. Simple effects testing showed that the advertisements where insight was absent benefited conscious memory for creative advertisements relative to standard advertisements, $F_{(1,44)} = 47.56$, $p < .001$, $\eta_p^2 = .52$, whereas advertisements where insight was present benefited conscious memory for standard advertisements relative creative advertisements, $F_{(1,44)} = 31.14$, $p < .001$, $\eta_p^2 = .41$. The three-way interaction was also significant, $F_{(1,44)} = 5.29$, $p = .04$, $\eta_p^2 = .11$, which reflects the fact that the differences observed in the two-way interaction between creativity and insight were weaker in the delayed condition relative to the immediate condition. Of particular

note is the significant simple main effect ($p < .05$) across time delays for the insight present condition for the standard advertisements, indicating a substantial weakening of the benefit of insight for the conscious memory of these advertisements over time.

[INSERT TABLE 3 HERE]

An equivalent 2 (test time: immediate vs. delayed) × 2 (creativity: creative vs. standard) × 2 (insight: present vs. absent) repeated measures ANOVA was conducted with d' (unconscious discrimination). The main effect of test time was significant, showing a greater d' in the immediate than in the delayed test, $F_{(1,44)} = 92.49$, $p < .001$, $\eta_p^2 = .67$. Unconscious memory was also better for creative advertisements than for standard ones, $F_{(1,44)} = 34.07$, $p < .001$, $\eta_p^2 = .43$. The main effect of insight was also reliable, with a greater contribution of unconscious memory for advertisements that induced insight than those that did not, $F_{(1,44)} = 6.56$, $p = .03$, $\eta_p^2 = .13$.

The interaction between creativity and test time was significant, $F_{(1,44)} = 12.93$, $p = .001$, $\eta_p^2 = .22$. Further simple effects analysis revealed that, regardless of whether under immediate [$F_{(1,44)} = 8.68$, $p = .01$, $\eta_p^2 = .16$] or delayed [$F_{(1,44)} = 49.86$, $p < .001$, $\eta_p^2 = .53$] conditions, the unconscious memory contribution was greater for creative than standard advertisements. In addition, a significant interaction between creativity and insight was observed, $F_{(1,44)} = 10.61$, $p = .01$, $\eta_p^2 = .19$, with a significantly stronger role of unconscious memory for standard advertisements inducing insight than those that did not, $F_{(1,44)} = 11.95$, $p < .001$, $\eta_p^2 = .21$, and equal contributions of unconscious memory for creative advertisements irrespective of whether insight was induced or not ($F_{(1,44)} = .57$, $p = .91$, $\eta_p^2 = .02$). Regarding the significant interaction of test time with insight ($F_{(1,44)} = 7.92$, $p = .01$, $\eta_p^2 = .15$), the stronger contribution of unconscious memory was observed for advertisements inducing insight than those that did not

under the immediate test condition, $F_{(1,44)} = 12.72$, $p < .001$, $\eta_p^2 = .22$, but not under the delayed test condition, $F_{(1,44)} = .08$, $p = .44$, $\eta_p^2 < .01$. The complex three-way interaction between creativity, insight, and test time was significant, $F_{(1,44)} = 15.44$, $p < .001$, $\eta_p^2 = .26$, with nearly all simple effect comparisons emerging as significant (ps < .05), with the exception of the time effect for creative advertisements when insight was absent, $F_{(1,44)} = .43$, $p = .97$, $\eta_p^2 = .01$.

[INSERT FIG. 2 ABOUT HERE]

Creativity and insight intensity

All participants rated advertisements for advertising creativity on a 7-point Likert scale, which allowed us to determine the appropriateness of ascribing the status of "creativity" to advertisements that had received professional awards whilst also enabling an exploration of the association between advertising creativity and viewers' self-reported insight intensity. As expected, there was a significant difference in self-reported advertising creativity between the award-winning advertisements and those that had not won an award, $t_{(78)} = 15.76$, $p < .001$, Cohen's $d = 3.54$, showing that award-winning advertisements ($M = 4.20$, $SD = .45$) are indeed perceived as more creative than those without an award ($M = 2.34$, $SD = .59$). This finding consolidates the appropriateness of the award-winning method in identifying creative advertising.

[INSERT FIG. 3 ABOUT HERE]

We note that participants were also required to rate the intensity of insight for each advertisement using a 7-point scale, with advertisements that did not induce insight for an

individual always being rated as 1 and with advertisements that did induce insight varying in their insight intensity between 2 and 7. In other words, the intensity of insight corresponding to the “1”, “4”, and “5” keys involved in the study session was 1, whereas the intensity of insight corresponding to the “2” and “3” keys was between 2 and 7. As Fig. 2 shows, the intensity of self-rated insight between creative and standard advertisements was significantly different, $t_{(78)} = 14.37$, $p < .001$, Cohen’s $d = 3.24$, with an average insight intensity of 3.42 ($SD = .48$) for creative advertisements and 1.88 ($SD = .47$) for standard advertisements. Furthermore, a significant and positive correlation was found between advertising creativity level and average insight intensity, $r = .94$, $p < .001$ (Fig. 2), demonstrating that an advertisement rated to be highly creative tends to have a greater insight intensity.

To illustrate the influence of advertising creativity and insight intensity on the memory effectiveness of creative and standard advertisements, the Hit rate (H) and False Alarm rate (FA) of each advert under the immediate and delayed conditions was calculated using the following equations, respectively:

$$H_{ad} = \frac{\sum_{k=1}^{46} H_k}{46} \text{ and } FA_{ad} = \frac{\sum_{k=1}^{46} FA_k}{46}$$

Pearson correlation analysis was individually conducted to explore the association between insight intensity or advertising creativity and immediate or delayed memory performance, which was individually measured using the H and FA in relation to the inclusion and exclusion tasks. Significant correlations between insight intensity and memory recognition performance and between advertising creativity and memory recognition performance were observed for the delayed inclusion and exclusion tests, but not for the immediate inclusion or exclusion tests. As shown in Fig. 3, in the delayed inclusion and exclusion test, H was positively correlated with

advertising creativity (r = .43, p = .005) and insight intensity (r = .46, p = .003), whereas FA was negatively correlated with advertising creativity (r = - .39, p = .012) and insight intensity (r = - .38, p = .015), indicating that advertising creativity and insight intensity could foster better delayed memory effectiveness in advertising.

General Discussion

The present study aimed to dissociate and quantify the individual contributions of conscious and unconscious processing in the memory effectiveness of creative and standard advertisements, both of which are sometimes reported to induce insight during the appreciation of the advertising. Our application of the DPSD method has two major advantages over the PDP approach. First, it solves the problem of the potential heterogeneity in task dissociation involving two tasks that are qualitatively distinct and can both produce errors (Buchner & Wippich, 2000; Shapiro & Krishnan, 2001). Second, it also excludes – or at least substantially reduces – the inferences resulting from the response criteria of the PDP in separating unconscious from conscious processing, thereby reducing the potential distortion of performance indicators measuring the effects of the unconscious due to individual differences in response criteria. To the best of our knowledge, the present study is the first to isolate the relative contributions of conscious and unconscious processing in memory effectiveness for different types of advertising, especially creative advertising, as well as the first to elucidate the association between advertising insight and advertising creativity and their roles in conscious and unconscious memory effectiveness.

The separation between conscious and unconscious processing in advertising effectiveness

In accordance with previous studies (Duke & Carlson, 1994; Lee, 2002; Shapiro & Krishnan, 2001; Yoo, 2010), our findings demonstrate the relative importance of conscious and

unconscious processing in advertising effectiveness. Critically, the effects of conscious and unconscious processing for memory were more dominant for creative advertisements (i.e., those that had won international advertising awards) than standard advertisements (i.e., those that had not received such professional awards). These findings align with our hypotheses and provide powerful evidence for the value of developing creative advertising for brand extension and marketing.

In relation to the time-course of the effects of conscious and unconscious processing with respect to advertising effectiveness, Shapiro and Krishnan (2001) observed that the extent of the conscious influence decreased as the time delay between exposure and the test increased, whereas the extent of the unconscious influence remained unaffected across the experimental conditions. Our findings partially confirmed this result by showing that the conscious contribution decreased between immediate and delayed test times; however, a broadly similar effect was also observed for the unconscious contribution, which likewise decreased over test times, albeit less markedly than was the case for the conscious contribution. Importantly, the present results deepen and clarify Shapiro and Krishnan's (2001) findings by additionally revealing the moderating roles of advertising type (creative vs. standard) and whether an advertisement could evoke an insight (insight present vs. insight absent). For example, for creative advertising that induced insight and standard advertising that did not induce insight, the role of conscious processing in advertising effectiveness was seen to be constant across test time intervals. In contrast, for the standard advertisements that induced an insight there was a significant reduction in conscious memory across time delays.

Regarding the general roles of conscious and unconscious processing in memory for advertisements, some similar findings to those arising in the present study derive from a study by

Zhong, Dijksterhuis, and Galinsky (2008), where the Remote Associate Task (RAT) was used to determine the role of unconscious processing in creative problem solving. The RAT is considered to involve similar cognitive mechanism (i.e., remote association) to the present creative advertisements (Reid & Rotfeld, 1976). Across two experiments, Zhong et al. (2008) observed that a short period of unconscious thought increased the *accessibility* of RAT solutions (revealed as fast response latencies) but did not increase the number of correct solutions compared with an equal duration of conscious thought or mere distraction. In our study, irrespective of the test time, conscious processing was found to play a fairly constant role in memory for creative advertising; in contrast, unconscious processing was observed to play a less important role in delayed memory compared to immediate memory. Consequently, unconscious processing may be pivotal in conceptually accessing or semantically activating the kinds of information involved in creative advertising, whereas conscious processing may be more critical in facilitating the successful recognition of creative advertising.

To quantify the relative contribution of conscious and unconscious processes in memory for advertisements, the value of d' was rescaled to the range of 0 to 1 by using the original value divided by four; our results showed that, regardless of the specific type of advertising, unconscious processing plays a key role in advertising memory effectiveness far beyond that expected. One possible explanation is that unconscious processes may have many advantages over conscious processes, including but not limited to accessing conceptual associations rooted in previous experience or consciously collected information as a knowledge base on which to make a conclusion or conscious decision (Dijksterhuis & Nordgren, 2006). As the unconscious cannot create new knowledge without the help of consciousness (e.g., Zhong et al., 2008), conscious processing may be critical in making an eventual decision regarding whether

advertising has previously been encountered. Additionally, consciousness may be a catalyst that facilitates access to unconscious conceptual associations, establishing memory traces and distinguishing previously seen items from "new" ones (Ghetti & Angelini, 2008). Taken together, unconscious processing seems to play a crucial role in all types of advertising, although there are similar patterns of change in the time intervals between initial exposure and recognition test for conscious and unconscious processes in advertising memory effectiveness.

The present findings have significant implications for advertising researchers and practitioners. In contrast to previous, artificially designed studies involving conditions with distinct levels of attention or consciousness, the present research did not create full or partial attention conditions to trigger different levels of conscious or unconscious processing. As mentioned previously, much real-world advertising does not receive any intentional or effortful processing (Yoo, 2009). The present research isolated the relative contributions of conscious and unconscious processes in the memory effectiveness of different advertisements in a highly authentic and ecological context, with findings supporting the value of developing unconscious advertising strategies or techniques to bolster advertising effectiveness (Zhou et al., 2018).

Memory advantage of creative advertising

Our findings support the view that creative advertising dominates both conscious and unconscious memory. Following prior research, creative advertisements have greater dominance in gaining viewers' initial attention and in persistently directing their attention (Dahlén, Rosengren, & Törn, 2008; Smith, Chen, & Yang, 2008; Wilson, Baack, & Till, 2015) because of their novel visual appearance or their unique perspective. Moreover, creative advertising usually encompasses visual metaphors which tend to occupy cognitive resources and require attention and mental effort (Baack et al., 2008; Till & Baack, 2005). We therefore suggest that the

difficulty in understanding such metaphors likely triggers the activation of conscious encoding and retrieval. These proposals attest to the likely importance of attentional mechanisms as being key to transforming unconsciousness into consciousness (cf. Dijksterhuis, 2006; Salvi, Bricolo, Franconeri, Kounios, & Beeman, 2015). Attention would be attracted by creative advertising and would, in turn, consolidate the effectiveness of conscious memory in relation to such advertisements (Pieters, Warlop, & Wedel, 2002; Till & Baack, 2005).

Notwithstanding the probable role of attentional mechanisms in transforming unconsciousness into consciousness, we note that in the present study it was the effectiveness of unconscious memory that was most positively impacted by creative advertising, which we believe can be accounted for by several factors. First, when consumers or audiences initially encounter advertisements they often allocate minimal voluntary attention to them, implying that in the present study participants may not have expended energy or time engaging in remembering details of the presented advertisements and instead only directed brief glances at them, primarily processing them unconsciously or subliminally.

Second, along with novelty and uniqueness, creative advertising can enhance viewers' familiarity because this type of advertising requires viewers to break their inflexible or rigid thought and instead experience something unexpected. If the idea that familiarity is an important proxy for the unconscious is true – as highlighted by the DPSD theory (Yonelinas, 1994; Yonelinas, Regehr, & Jacoby, 1995) – then the importance of unconscious memory for creative advertisements would increase with their growing familiarity. In fact, substantial evidence does indeed indicate not only that the novelty of advertising images can improve conceptual fluency but also that the ingenuity and complexity of advertising ideas can likewise improve such conceptual fluency (Dijksterhuis & Nordgren, 2006; Northup & Mulligan, 2012; Shapiro, 1999;

for related suggestions see Ball, Threadgold, Marsh, & Christensen, 2018). Conceptual fluency allows for a more unconscious association to become activated or accessed, typically illustrated by the observed role of creative advertising on unconscious memory.

Furthermore, Yang, Chattopadhyay, Zhang, and Dahl (2012) have advocated that the superiority of the unconscious pertains only to the novelty aspect of creativity. Instead, our research suggests that the *associative* aspects of creativity play an indispensable role in unconscious memory for creative advertising. Consistent with our findings, the available evidence shows that associative aspects of creative advertising could trigger consumers' previously stored knowledge and activate their life experience to help them develop an unconscious affinity for brands or products (Yoo, 2007). These activated memory episodes would likely be used as "primes" to encode or appreciate creative advertising that shares something in common with previous experiences, which together facilitates both the unconscious processing of creative advertising as well as enabling such advertising to enter into the conscious memory system. This phenomenon is very similar to priming effects commonly demonstrated in unconscious memory (see Tulving, Schacter, & Stark, 1982).

In addition, our data reveal the close, positive association between participants' self-ratings of advertising creativity and memory effectiveness. The more creative an advertisement was perceived to be then the higher the Hit rate during subsequent recognition and the lower the False Alarm rate. These findings presumably arise because advertisements with high levels of creativity have more obvious characteristics differentiating them from standard advertisements, including, but not limited to, more novel expressions, unique ideas or ingenious contents (Baack et al., 2008). Consequently, the conscious contributions (e.g., attention, mental effort) and the

unconscious contributions (e.g., familiarity) to advertising memory effectiveness both increase such that creative advertising is highly memorable.

The roles of insight and insight intensity

Interestingly – and in alignment with what was predicted – the advertisements that evoked insight as participants viewed them were more dominant in *unconscious* memory, whereas those that did not induce insight showed a reverse advantage in relation to *conscious* memory. One explanation for this phenomenon is that insight enhances unconscious activation (Bowden & Jung-Beeman, 2003), which may drive a solution-priming effect (Bowden, 1997; Bowden & Jung-Beeman, 1998). More specifically, creative advertising is often difficult to comprehend on an initial encounter such that consumers commit to finding possible clues or hints to try to "crack" the advertisement. In the process, they have often automatically incorporated these clues or hints (i.e., solution primes) into their unconscious system. The underlying solution priming accumulates power and rapidly links with the unconscious once the insight occurs, with the unconscious memory being consolidated and retained.

As an alternative and potentially complementary account, we note that Danek and Wiley (2020) have proposed that the so-called "insight memory advantage" in problem solving is a joint consequence of finding a correct solution, the subjective feeling that one has found a correct solution and the emotional experience of pleasure that manifests in the "Aha!" moment. The subjective feeling of certainty that arises with insight or "Aha!" moments (see also Threadgold, Marsh, & Ball, 2018) appears to originate in the unconscious system. Indeed, Salvi et al. (2015) found that insight in problem solving was associated with an "internal focus" rather than a focus on the problem stimulus, and involved moving the eyes away from a problem stimulus just before the solution bursts into consciousness (see also Salvi & Bowden, 2016). In contrast, the

general approachability of standard advertisements means that they are less likely to yield insights than creative advertisements and therefore have a reduced impact on the unconscious memory system. As a consequence, audiences may be more susceptible to the direct and transparent information that is present in standard advertising (Tellis, Chandy, & Thaivanich, 2000).

The emotional component of the insight memory advantage that is discussed by Danek and Wiley (2020) has extensive support in the literature, with evidence demonstrating that insight is inherently rewarding (Oh, Chesebrough, Erickson, Zhang, & Kounios, 2020) and is accompanied by positive emotional experiences such as pleasure (Chermahini & Hommel, 2010; Salvi et al., 2015; Shen, Yuan, Liu, & Luo, 2016; Shen et al., 2017). Indeed, evidence suggests that insight-induced positive emotional experiences arise from activation of the brain's dopamine-based reward system, which is itself known to strengthen memory consolidation (see Oh et al., 2020; Salvi et al., 2015; Tik et al., 2018). As such, there is a compelling causal link from insight-induced reward to enhanced memory, potentially largely driven through unconscious processing systems albeit with conscious correlates in terms of phenomenological experiences of confidence and pleasure.

Another key finding from our study was that the conscious contribution to memory for creative advertisements that evoked an experience of insight did not differ significantly between the immediate and delayed test times, whereas for standard advertising that elicited insights the conscious contribution to memory was significantly stronger in the immediate memory condition compared to the delayed condition. One possible interpretation of this observation is that despite conscious memory usually being time-limited, the insight arising with creative advertisements

strengthens their memorability but only fosters immediate, conscious effectiveness for standard advertising.

Notably, too, we observed a correlation between insight intensity and memory effectiveness for delayed memory performance, whereby the learnt items could easily be differentiated from the unlearnt ones. Insight intensity scores for all presented advertising images were found to be positively correlated with the Hit rate scores. One interpretation of this finding is that insight involves the restructuring of representations, which may contribute to breaking mental impasses and spontaneously consolidating memories about insight-related items (Auble, Franks, & Soraci, 1979; Ludmer et al., 2011; Shen, Zhao et al., 2019; Wills, Soraci, Chechile, & Taylor, 2000). Specifically, creative advertisements are initially confusing or misdirect comprehension owing to their novel or unique characteristics, causing audiences to become persistently immersed in trying to understand them. As a result, audiences have to restructure prior representations and break any mental impasses encountered to obtain an eventual insight, which is a process that is widely reported to facilitate subsequent memory (Jarman, 2014). In other words, if viewers experience an intense insight during their understanding of an advertisement, especially a creative one, their memory about such an item would be likely to be highly durable (cf. Kizilirmak, Galvao, Imamoglu, & Richardson-Klavehn, 2015).

We also reiterate here the likely mediating role than attention plays in memory consolidation for advertisements that are associated with intense insight experiences. In this respect there is emerging evidence (e.g., Salvi, Simoncini, Grafman, & Beeman 2020) indicating that when creative insights enter awareness they are associated with the involvement of the locus coeruleus-norepinephrine system, which innervates brain areas involved in selective attention,

thereby alerting cortical areas to switch focus and heed the relevance to new stimuli or concepts (e.g., Sara & Bouret, 2012).

In addition, and as discussed above, once viewers suddenly understand what at first seemed to be incomprehensible, they will experience pleasure, which will further enhance their subsequent long-term memory of this understanding (cf. Danek & Wiley, 2020; Shen et al., 2016, 2017). As such, this process could engender an association between insight intensity and the intensity of emotion accompanying the insight induced by appreciating the creative advertisement. This accompanying emotion would, in turn, help consolidate long-term memory about the emotion-induced advertisement, which has also been supported by neuroimaging findings concerning emotion-related activation in the amygdala and memory-related hippocampus that are both implicated in the occurrence of insight (Balderston, Schultz, & Helmstetter, 2011; Kizilirmak et al, 2019; Lumder et al., 2011). Taken together, our findings suggest that the magnitude of the insight intensity that is associated with an advertisement is likely to be a key factor in determining advertising memory effectiveness.

Conclusion

As hypothesized, advertising memory effectiveness is a consequence of the synergy between conscious and unconscious processing. Creative advertising has significant advantages for both conscious and unconscious memory. The occurrence of insight is more likely to appear when viewing creative advertisements and leads to an advantage of unconscious processing in advertising effectiveness. In contrast, the absence of insight is associated with advantages in conscious memory for advertisements.

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Table 1 Descriptive results *(M±SD)* for conscious memory (R) and unconscious memory (d') for advertisements as a function of creativity, insight, and test time

		Conscious memory (R)		Unconscious memory(d')	
		Immediate (5 min)	Delayed (3 days)	Immediate (5 min)	Delayed (3days)
Creative	Insight present	0.11±0.30	0.10±0.26	3.77±1.15	2.69±0.86
	Insight absent	0.65±0.46	0.49±0.48	3.24±0.80	3.37±1.34
Standard	Insight present	0.44±0.46	0.25±0.37	3.26±1.27	2.24±1.36
	Insight absent	0.07±0.20	0.04±0.07	2.78±0.85	1.63±0.82

Table 2 Results from a repeated measures ANOVA conducted for conscious memory

Source	*MSE*	*F*	η_p^2
Test time	0.08	11.48**	0.20
Creativity	0.11	17.50***	0.28
Insight	0.14	5.14*	0.10
Creativity × Test time	0.13	0.75	< 0.01
Insight × Test time	0.11	0.90	< 0.01
Creativity × Insight	0.20	66.39***	0.60
Creativity × Insight × Test time	0.10	5.29*	0.11

Note：*p < .05, **p < .01, ***p < .001 and similarly hereinafter.

Table 3 Results from a repeated measures ANOVA conducted for unconscious memory

Source	*MSE*	*F*	η_p^2
Test time	0.60	92.49***	0.67
Creativity	1.67	34.07***	0.43
Insight	0.77	6.56*	0.13
Creativity × Test time	0.66	12.93**	0.22
Insight × Test time	0.84	7.92**	0.15
Creativity × Insight	0.83	10.61**	0.19
Creativity × Insight × Test time	0.68	15.44***	0.26

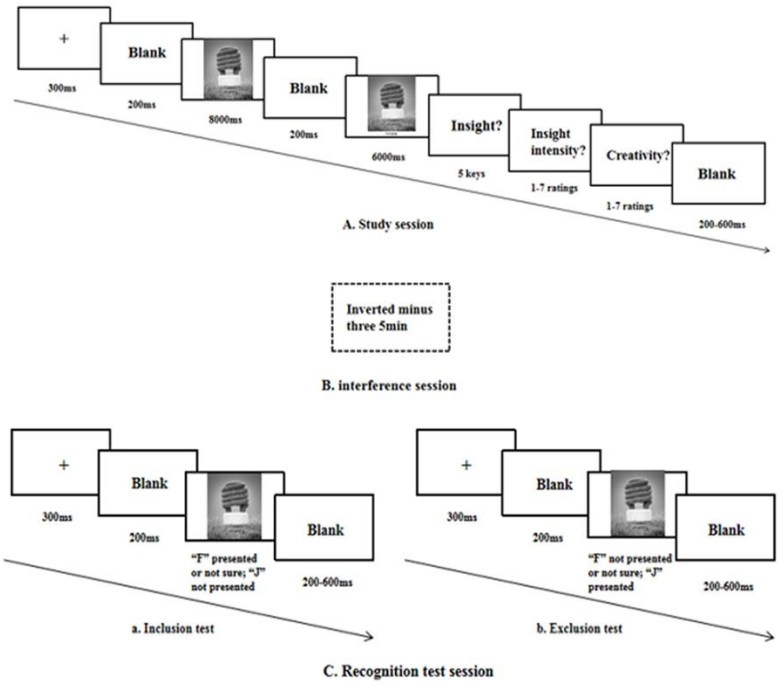

Fig. 1 An illustration of a single, complete trial from the memory experiment, extending across the study session (A), the interference session (B) and the recognition test session (C) for both the inclusion test (a) and the exclusion test (b). Please refer to the text for full details.

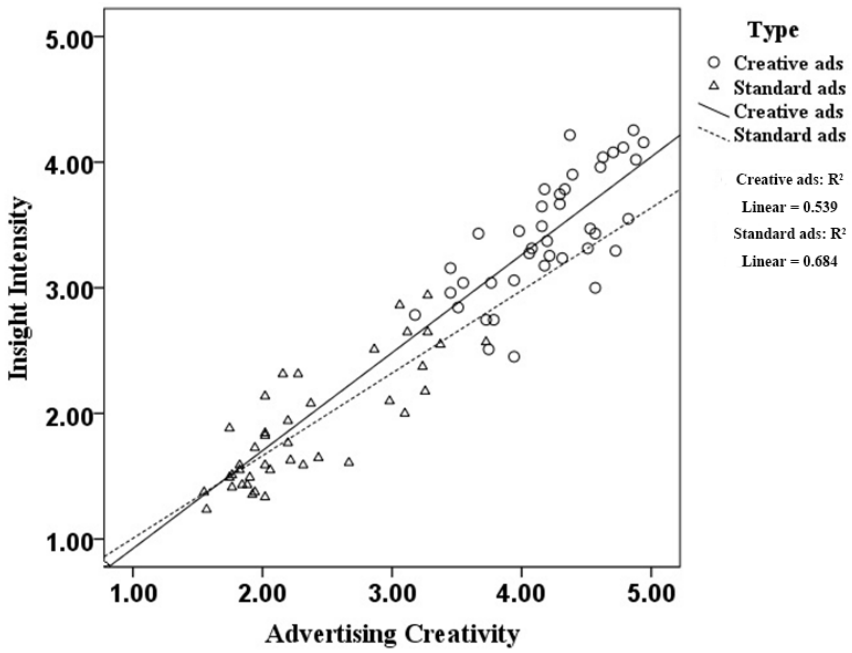

Fig. 2 The correlation between participants' self-report ratings of the advertising creativity of each advertisement and their self-report ratings of the insight intensity of each advertisement. Both ratings were made using a 7-point scale ranging from very low to very high.

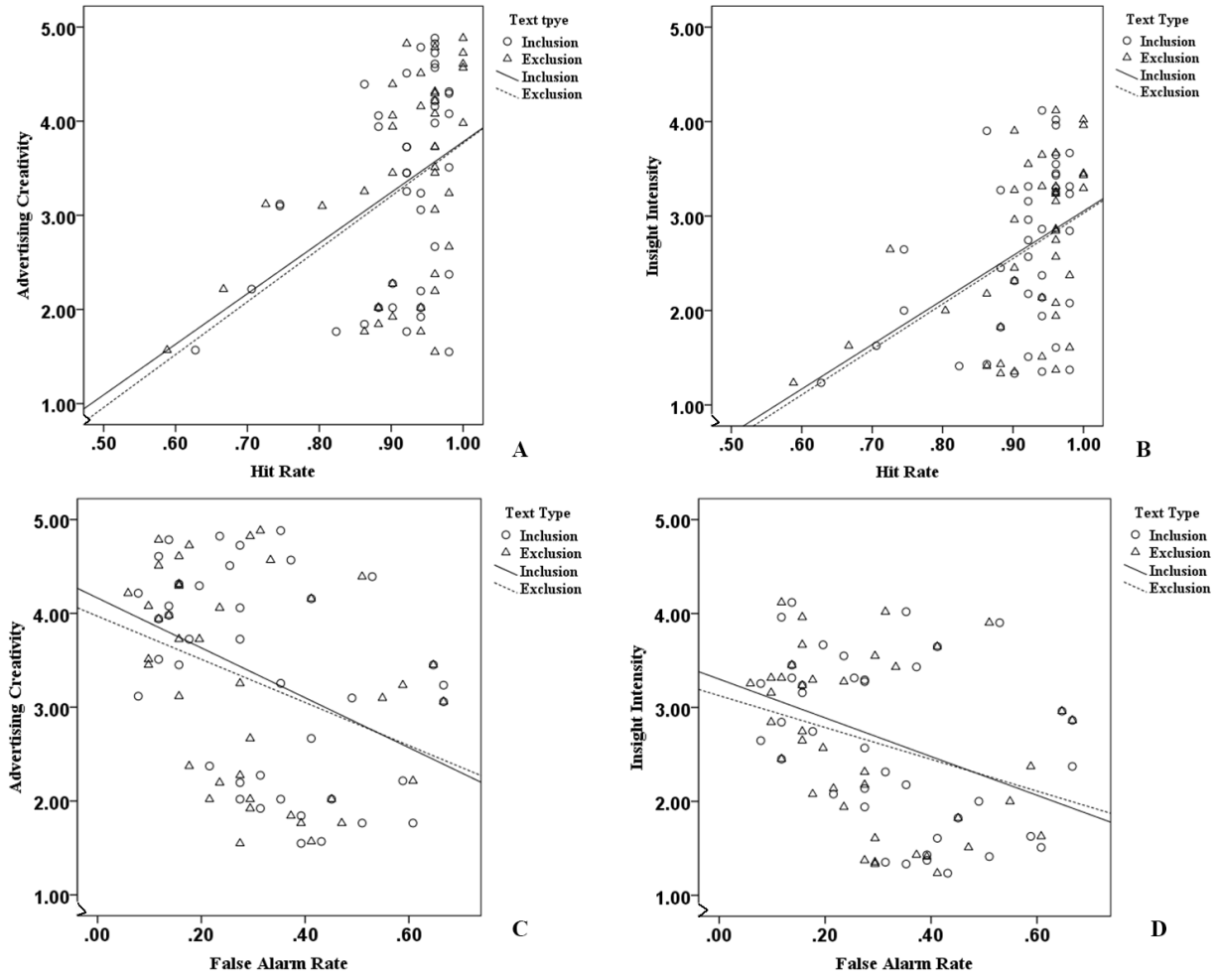

Fig. 3 Panel A shows the correlation between Hit rate (H_I, H_E) and self-report ratings of advertising creativity; Panel B shows the correlation between Hit rate (H_I, H_E) and self-report ratings of insight intensity; Panel C shows the correlation between False Alarm rate (FA_I, FA_E) and self-report ratings of advertising creativity; and Panel D shows the correlation between False Alarm rate (FA_I, FA_E) and self-report ratings of insight intensity. The self-report ratings were made using a 7-point scale ranging from very low to very high.