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The effect of emotionally-arousing ad appeals on memory: time and fit matter

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ABSTRACT

This research studies the effect of emotional arousal communicated in ad appeals on consumers' memory of the ad. Isolating and studying the level of arousal – one dimension of affect communicated in the ad, as opposed to valence – we examine the moderating roles of two factors: retention time (i.e., immediate vs. delayed memory) and the fit between ad-arousal and the ad claim. The results of three experiments show that ad-arousal inhibits immediate memory but enhances delayed memory. These effects, however, occur only when the level of arousal communicated in the ad fits the ad claim; whereas when the level of arousal does not fit the claim, ad-arousal does not influence memory. Insights from this research shed light on the boundary conditions of the effect of ad emotional arousal on memory, contributing to the development of an integrative theory on such effects, which can serve as a guide to advertisers in developing effective message strategies in different circumstances.

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Arousal; emotion; affect and cognition; advertising; memory

Emotionally arousing appeals have long been used in advertising. Many studies have examined their influence on judgement and decision making (e.g. Batra and Ray 1986; Das, Galekh, and Vonkeman 2015; Dickinson and Holmes 2008; Duff and Sar 2015; Edell and Burke 1987; Eisend 2018; Faseur and Geuens, 2006; Hamelin, El Moujahid, and Thaichon 2017; Hartmann, Apaolaza, and Alija 2013; Henthorne, LaTour, and Nataraajan 1993; Hong and Chang 2015; Keller Anand and Block 1996; Kemp, Bui, and Chapa 2012; Krishen and Bui 2015; LaTour, Pitts, and Snook-Luther 1990; Mathur and Chattopadhyay 1991; Steenkamp, Baumgartner, and van der Wulp 1996; Strong and Dubas 1993; Warren, Carter, and McGraw 2019; Wu and Wen 2019; Yoon and Lee 2019). However, the impact of these appeals on memorability is still unclear (see Bakalash and Riemer 2013). Some studies suggest that memory is better for emotionally arousing (vs. neutral) messages (Akram, McClelland, and Furnham 2018; Bakalash and Riemer 2013; Bolls, Lang, and Potter 2001; Hartmann, Apaolaza, and Alija 2013; Kemp, Min, and Joint 2015; Kroeber-Riel 1979; Pavelchak, Antil, and Munch 1988;

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Srull 1983), whereas others show that emotionally arousing appeals may not always be advantageous for remembering the content of an ad (Bennett 1998; Bushman and Bonacci 2002; Lull and Bushman 2015; Newell, Henderson, and Wu 2001; Pham 1992; Picallo 2018; Shapiro, MacInnis, and Park 2002). Such conflicting results require the examination of boundary conditions.

In examining emotionally arousing appeals we rely on the two-dimensional view of affect (Russell 1980), suggesting that any affective state can be represented using two dimensions: valence – the direction of affect, ranging from negative to positive, and arousal – the level of activation, ranged from low to high. The combination of values on both valence and arousal dimensions determine the specific affective state. Such that sadness, for example, is considered an affective state of negative valence and low arousal, whereas stress is a state of negative valence and high arousal; excitement is a state of positive valence and high arousal, and relaxation is a state of positive valence and low arousal. This approach is taken by studies in various fields, such as psychology (e.g., Libkuman, Stabler, and Otani 2004), marketing (Di Muro and Murray 2012; Riemer and Viswanathan 2013), and advertising (e.g., Das, Galekh, and Vonkeman. 2015; Gorn, Pham, and Sin 2001; Shapiro, MacInnis, and Park 2002).

In the current research, we focus on the arousal dimension of the emotional ad appeal, as opposed to the valence dimension, in order to avoid potential confounding across affect dimensions. Isolating and studying the arousal dimension is necessary as research suggests that the two dimensions have distinct effects (Das, Galekh, and Vonkeman 2015; Yan, Liu, Chen, & Shi, G. 2016; Zhu, Cesar, and Los 2015). Disentangling the effects of arousal and valence might assist in understanding the effect of specific emotions, particularly those of similar valence but different levels of arousal, an area of growing interest (Poels and Dewitte 2019). Examining the effect of arousal (rather than valence) on memory is particularly valuable, as research suggests that it is the arousal dimension that accounts for memory effects (Mather and Sutherland 2009). Further, classic research suggests that arousal (i.e., the level of excitation or physiological activity) is non-specific, in the sense that one cannot accurately identify the source of one's arousal, e.g., time pressure, physical activity, emotional stimulus; Bryant and Miron, 2003; Cantor, Bryant, & Zillmann, 1974; Cantor, Zillmann, & Bryant, 1975; Schachter & Singer, 1962; Bryant and Zillmann, 1983). As arousal can be elicited by a variety of sources, uncovering effects of arousal may be generalizable to various types of stimuli.

A specific examination of arousal and memory in the context of advertising (which goes beyond relying merely on knowledge from the psychology literature) is needed for several reasons. First, despite the general view of arousal as a non-specific increment in physiological activity, Eysenck (1982) suggested that arousal generated from various sources (e.g., ads vs. white noise) may influence memory in different ways. Second, one theory proposes an inverted-U relationship between arousal and memory (Yerkes and Dodson 1908). Yet, researchers posit that marketing stimuli may not be capable of creating levels of arousal high enough to exhibit inverted-U relationships (Kroeber-Riel 1979). For these reasons, along with the widespread use of arousing messages in adverting, it is essential to conduct an in-depth examination of arousal effects in advertising.

The conflicting findings on the effect of ad emotional arousal on memory suggest that the effect is contingent upon additional factors. We study the moderating roles of two factors: retention time (i.e., immediate vs. delayed memory), and the fit between the emotional arousal communicated in the ad and the ad claim.

The role of retention time in the effect of arousal on memory attracted much interest in the psychology literature. Kleinsmith and Kaplan's classic studies (Kleinsmith and Kaplan 1963, 1964) showed that low-arousal stimuli are better remembered in the short term, whereas high-arousal stimuli are better remembered in the long term. Park (2005) argued that 'in spite of a number of empirical studies dealing with this issue, robustness of such an effect does not seem to be clear' (p. 339), and therefore conducted two meta-analyses, whose goals were to assess whether the effect is robust and to determine whether the effect varies as a function of the source of arousal. Park's meta-analysis concluded that the effect of the interaction between retention time and arousal on memory, leading to short-run negative effect and to long-run positive effect of arousal on memory, is substantial. Additionally, comparing various arousers (stimulus material, white noise, diurnal rhythms, personality, observation, and drugs), Park's meta-analyses suggested that the type of arousing method might play a role in the effect of retention time. Yet, the meta-analyses did not examine differences among specific stimulating materials, nor did they include studies in an advertising context. Because of these deficiencies, and due to the lack of research on retention time and arousal-memory effects in advertising, it is necessary to examine this issue in the context of advertising.

Fit between the emotionally arousing ad appeal and the ad claim refers to the extent to which the emotional arousal communicated in the ad is congruent with (or relevant to) the claim it intends to communicate (Heckler and Childers 1992). Under this definition, both low and high arousal ad appeals can either fit or not fit the ad claim. For example, when a car ad claims that the car is exciting to drive, an emotional appeal of high arousal (i.e., excitement) would fit the claim, whereas an emotional appeal of low arousal (i.e., relaxation) would not fit it. Similarly, when a car ad claims that the car's many safety features will contribute to the consumer's peace of mind, then an emotional appeal of low arousal (i.e., relaxation) would fit the claim, but one of high arousal (i.e., excitement) would not fit it. So far, no research has examined the role of ad-arousal fit in the effect of arousal on memory. Research in other contexts, however, demonstrates differential effects of arousal on various types of information (e.g., Belanche, Flavián, and Pérez-Rueda 2017; Sanbonmatsu and Kardes, 1988; Pham 1996; Wirtz, Sparks, and Zimbres 2018). Such evidence, along with theoretical accounts of arousal-memory effects involving attention-narrowing processes (Easterbrook 1959; Kahneman, 1973) and interpretation processes (Bakalash and Riemer 2013; Lazarus 1991; Murty et al. 2010) as discussed in the next section, has led us to propose that the fit factor also plays a moderating role.

We tested the moderating roles of retention time and fit in three experiments. Utilizing varied methods, our experiments consistently demonstrate that ad emotional arousal has a negative effect on immediate memory and a positive effect on delayed memory. These effects occur only when the emotional arousal elicited by the ad fits with the ad claim; unfitting arousal does not influence memory.

With this research, we contribute to the development of an integrative theory of the effect of emotional arousal on memory in general, and particularly in an advertising context. Currently, consumers are exposed to extensive advertising efforts. Recognizing that for an ad to be effective it needs to be memorable, marketers often use high-intensity appeals. Therefore, the theoretical contribution is coupled with practical implications for advertisers interested in developing message strategies suitable for various circumstances.

The effect of arousal on memory

Various theories have been suggested for the effect of arousal on memory; several have yielded contrasting predictions. Researchers recently acknowledged that various theories should be considered complementary rather than contradictory, and that various processes may take place simultaneously (Bakalash and Riemer 2013; Murty et al. 2010). These processes are classified into three main categories (Bakalash and Riemer 2013): elaboration-based processes, attention-based processes, and social cognition (interpretation)-based processes. Elaboration-based processes posit that arousal increases the level of information processing, which improves encoding, consequently enhancing memory (Craik and Lockhart 1972). Attention-based processes assume that arousal deteriorates processing capacity, leading to selective attention allocation (Easterbrook 1959; Kahneman 1973). Interpretation-based processes suggest that exposure to emotionally arousing stimuli involves thoughts and appraisals to generate meaning, potentially influencing how the stimuli are encoded and thus influencing memory (Bakalash and Riemer 2013; Lazarus 1991; LeDoux 1996).

The co-occurrence of various mechanisms suggests that the arousal-memory effect is complex, involving various boundary conditions. To better understand the effect of arousal on memory, a focussed consideration of the possible boundary consideration is necessary. In the following section, we discuss the details of the processes involved in the arousal-memory effects while focussing on the mechanisms that determine the moderating roles of the two factors under focus in the current research: retention time and fit of the ad-arousal.

The role of retention time

Walker's classic theory of action decrement (1958) claims that arousal negatively affects immediate memory but positively affects delayed memory. More recent research may shed more light on this issue.

According to neuroscientific theorizing, emotional arousal leads to neurohormonal changes, which activate (β-adrenergic) receptors in the amygdala – an almond-shaped region of the medial temporal lobe. The amygdala is strongly connected with the rest of the brain, and thus activates other brain regions, such as the hippocampus – a major component of the brain that plays a role in memory consolidation (Young 1993). Consequently, amygdala activation enhances memory consolidation, resulting in improved memory (Cahill and McGaugh 1995; Cahill and van Stegeren 2003; McGaugh 2000).

Nevertheless, immediate and delayed memory involve distinct mechanisms (Izquierdo et al. 1998, 1999; Quevedo et al. 2003). Amygdala activation is related to delayed memory but not to immediate memory (Bianchin et al. 1999; Izquierdo et al. 1998; 1999). The release of adrenal hormones, which enhance delayed memory, decreases information accessibility in the short term, and thus may *impair* immediate memory (McIntyre and Roozendaal 2007; Sharot and Phelps 2004).

These neuroscientific premises are consistent with other cognitive theories. The 'tick rate hypothesis' (Revelle 1989; Revelle and Loftus 1990, 1992) predicts that arousal increases the rate of information sampling, which is expected to facilitate delayed memory. This rapid information sampling, however, leads to interference, which decreases information availability in the short term (see also Walker 1958). Altogether, based on neuroscientific and cognitive approaches, we predict:

H1: Ad-arousal and retention time will interact to influence memory of the ad claim, such that:

H1a: Ad-arousal will negatively influence immediate memory of the ad claim,

H1b: Ad-arousal will positively influence delayed memory of the ad claim.

The role of fit of the ad-arousal

Of the three processes underlying the effect of arousal on memory, the elaboration process assumes enhancement of processing capacity considering only the quantity of processing rather than the quality of processing. Elaboration-based processes thus posit that information processing is unified in the sense that it does not distinguish between types of information, and therefore cannot account for the role of fit in the effect of ad-arousal on memory. Detailed consideration of the two other types of processes – the interpretation-based and the attention-based – may shed light on the role of fit, as discussed below.

Interpretation-based processes underlying the role of fit

fMRI studies show that the effect of emotional stimuli on amygdala activation is contingent upon the extent to which the stimuli is goal-relevant (that is, relevant to the person's current active goal). Specifically, emotional stimuli activate the amygdala only if they are goal-relevant (Cunningham, Van Bavel, and Johnsen 2008; Smith et al. 2006). Since amygdala activation leads to hippocampus activation, which in turn increases memory, the effect of emotional arousal on memory is expected to take place only when arousal is goal-relevant. When arousal is irrelevant, no increased amygdala activation should occur, and thus, no effect of hippocampus activation on memory is expected.

In the context of advertising, goal relevance of the ad emotional arousal might be linked to the extent to which the emotional arousal fits with the ad claim. The claim may activate a particular goal (e.g., if the ad focuses on the exciting benefits of a car, it may activate the goal of experiencing excitement; if the ad focuses on the safety benefits of the car, it may activate the goal of being secure). This goal activation may be automatic in the sense that it can be unintentional. In other words, the content of the ad may automatically activate a goal even if the consumer did not have this

goal in mind when exposed to the ad (Marien et al. 2012). Ad emotional arousal may thus fit or not fit with the claim and the goal elicited by the claim. In this vein, it is only when the emotional arousal elicited by the ad fits with the ad claim and the goal activated by it that amygdala activation will result, eventually enhancing memory.

Attention-based processes underlying the role of fit

Neuroscientific research also provides evidence for the involvement of attention allocation processes in emotional memory (Corbetta and Shulman 2002; Murty et al. 2010). Such processes may lead to memory-narrowing effects. Indeed, in line with the cue utilization theory (Easterbrook 1959), Levine and Edelstein (2009) propose that the same adrenergic mechanisms underlying the effect of emotional arousal, which enhance memory of central information, in fact decrease memory of peripheral information (Kensinger, Garoff-Eaton, and Schacter 2007; Strange, Hurlemann, and Dolan 2003).

Attention-based processes will thus result in enhanced memory of part of the information in the ad. Which information will be better remembered? Emotionally-arousing elements are usually salient; they attract attention and are consequently more memorable than other non-arousing elements in the ad (Christianson 1992; Pham 1996). In line with associative-network models of memory (Baddeley 1976; Wyer and Srull 2014), when the arousing elements are associated with the ad claim (i.e., they fit with the claim), they may later serve as retrieval cues for the claim (Friestad and Thorson 1993). Conversely, if the arousing elements do not fit with the claim, their association with it will be weak or non-existent, making them unhelpful in cued retrieval processes. Therefore, only ad-arousal that fits with the ad claim will enhance memory of the ad; ad-arousal that does not fit with the claim will not enhance such memory. Together, the interpretation-based and the attention-based processes suggest that fit of the ad-arousal with the ad claim will moderate the effect of ad-arousal on memory:

H2: Fit of the ad-arousal with the ad claim will interact with the level of the ad-arousal to influence memory of the ad claim, as follows:

H2a: When the ad-arousal fits the claim, the level of ad-arousal will influence memory of the ad claim.

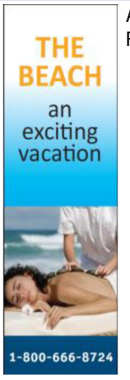
H2b: When the ad-arousal does not fit the claim, the level of ad-arousal will not influence memory of the ad claim.

To summarize, analysis of the mechanisms underlying the effect of arousal on memory in the context of advertising suggests that ad-arousal will enhance memory of the ad claim only in the long run but not in the short run and that this effect will occur only when the ad-arousal fits with the ad claim. We now proceed to presenting three experimental studies which demonstrate the predicted effects.

Methodological overview

To enhance the generalization and reinforce our findings, we ran three lab experiments utilizing various methods. All experiments used 2 (ad-arousal: low vs. high) $\times$ 2

Table 1. Ads in experiment 2.

	Low fit	High fit
Low arousal	 Arousal = 2.3, Fit = 3.3	 Arousal = 2.2, Fit = 5.7
High arousal	 Arousal = 4.6, Fit = 2.9	 Arousal = 4.7, Fit = 5.1

(fit: low vs. high) × 2 (retention time: immediate vs. delayed) designs. In experiment 1, ad-arousal and fit were manipulated within subjects using 40 ads equally divided into four arousal × fit conditions, and retention time was manipulated between subjects. In experiment 2 and 3, all factors were manipulated between subjects, and each of the four conditions used one target ad.

Experiment 1 used real print ads from a database of ads from the UK and Australia to ensure they were unfamiliar to our US participants (unfamiliarity was verified on pre-tests). To enhance control for possible confounds, experiments 2 and 3 used print and video ads, respectively, which we designed according to the experimental design requirements, and assessed using pre-tests. It is noteworthy that to enable testing the interaction between the level of ad-arousal and its fit with the ad claim, ad-arousal in all of our experiments was elicited by the creative elements of the ad, rather than by the ad claim. When using print ads (experiments 1 and 2), such elements included pictures, figures, or colours (see, for example, Table 1); when using video ads (experiment 3), the element in question was the background music. All experimental ads were chosen based on pretesting for manipulation and confounding checks.

In line with the literature on the role of retention time in arousal-memory effects (see Park 2005), immediate memory was tested up to 15 minutes after exposure; delayed memory was tested one or two days after exposure; the difference in time

frames for delayed memory tests was due to logistic consideration in recruiting participants to our lab. In experiments 1 and 2, fit of the ad-arousal was operationalized by the congruity between the claim and the affective tone (based on measures administered in pre-test). In experiment 3, fit was operationalized by the congruity between the affective tone and the product: water or energy drink, matched with low and high arousal, respectively, based on pretesting. Finally, similar to the assumption made in Park's meta-analysis, we treated 'memory as a unitary phenomenon' (Park 2005, p. 341); that is, all types of memory were treated as different indications of one factor, and we used different measures of memory. In experiment 1 memory was measured using an aided recall where participants viewed a version of the ad without any written information and were asked to write everything they remembered about the ad. In experiment 2 we used cued multi-item recognition test for the ad claim. In experiment 3, we used cued recall test in which participants were asked to write everything they remembered about the beverage ad they viewed. The consistent findings throughout our different experiments, as will be described in the following section, reinforce the conclusion of our research.

Experiment 1

Method

Sample and design

Seventy-five U.S. undergraduate business students (57.3% males, M_{age}=20.6) received course credit for participating in a 2 (ad-arousal: low vs. high) × 2 (fit: low vs. high) × 2 (retention time: immediate vs. delayed) mixed-design experiment. Retention time was manipulated between subjects; arousal and fit were manipulated within subjects using different ads.

Stimuli

Forty actual print ads were selected from a collection of professional ads from the UK and Australia (to ensure that the ads were in English, but unfamiliar to students from the US). Pre-tests were conducted to choose 10 ads of unfamiliar brands for each of four arousal × fit conditions. All ads contained one main claim (which was explicitly or implicitly communicated; for example: '*perfectly organized' (for an organization solution)* or *'let us keep dreaming of a better world' (for a men's magazine), for explicit and implicit messages, respectively*)[1].

The pre-tests assessed 63 ads, which were selected after an initial screening identifying ads likely to elicit different levels of arousal that either fit or do not fit with the ad claim. The ads were assessed in three similar sessions; different ads were assessed in each session (session 1: 17 ads, N = 15; session 2: 23 ads, N = 27; session 3: 23 ads, N = 28; all participants were US business students 56% males, M_{age}=20.8). The order of the ad presentation was counterbalanced in all pre-test sessions. The level of arousal was determined in the pre-test using the six nine-point semantic differential items referring to the arousal dimension in Mehrabian and Russell (1974) established scale ($\alpha = .918$). Fit of the ad-arousal with the ad claim was assessed by asking participants to indicate the extent to which the emotional arousal elicited by the ad was

relevant to the ad claim (on a 7-point scale: 1= 'not relevant at all' to 7= 'very relevant')[2]. The pre-test also assessed whether the participants understood what the ad was about. This was done by asking the participants to write down what the ad was about; coders read their responses and determined whether or not they understood the ad correctly. The participants were also asked in the pre-test if they were familiar with the brands and with the ads.

Of the pretested ads, we selected only those that were not familiar to participants, and seemed to be understood by the vast majority of the participants. Forty ads were selected, which enabled us to achieve equal representation of ads across the arousal and fit factors, with a significant difference in arousal between the low and high arousal conditions, and a significant difference in fit between the low and high fit conditions. The mean arousal and fit scores, and the results of ANOVA, which compared these values in the various arousal × fit conditions, were as follows (arousal scores, hereafter noted as A, are on a 1-9 scale as used in the original Mehrabian and Russell (1974) scale; fit scores, hereafter noted as FT, are on a 1-7 scale,): $A_{\text{low-arousal, nonfit}} = 4.31$, $A_{\text{high-arousal, nonfit}} = 6.45$, $p < .001$; $A_{\text{low-arousal, fit}} = 4.17$, $A_{\text{high-arousal, fit}} = 6.54$, $p < .001$; $FT_{\text{low arousal, nonfit}} = 4.04$, $FT_{\text{low arousal, fit}} = 5.19$, $p < .001$; $FT_{\text{high arousal, nonfit}} = 3.94$, $FT_{\text{high arousal, fit}} = 5.12$, ($p < .001$). Arousal did not differ significantly across fit conditions (for low arousal ads: $A_{\text{low-arousal, nonfit}} = 4.31$, $A_{\text{low-arousal, fit}} = 4.17$, $p = .523$; for high arousal ads: $A_{\text{high-arousal, nonfit}} = 6.45$, $A_{\text{high-arousal, fit}} = 6.54$, $p = .681$). Fit did not differ significantly across arousal conditions (for low fit ads: $FT_{\text{low arousal, nonfit}} = 3.94$, $FT_{\text{high arousal, nonfit}} = 4.04$, $p = .431$; for high fit ads: $FT_{\text{low arousal, fit}} = 5.19$, $FT_{\text{high arousal, fit}} = 5.12$, $p = .580$).

Procedure

Participants of the main experiment viewed the ads on computer screens. To mirror real-life exposure to ads, wherein consumers usually do not utilize significant cognitive resources in considering ads, the participants were told there would be 40 ads presented on the screen, each for 10 seconds, and they were instructed to focus on the ad design. There were no additional instructions nor expectations regarding the next stages in the session. The order of presentation was counterbalanced. After viewing the ads, the participants performed a filler task, spending 15 minutes reading three affective-neutral passages. The participants completed the memory measure either immediately or two days after the filler task (for the immediate and delayed memory conditions, respectively).

Memory measure

The memory measure presented each ad with no written information (e.g., slogan, claim). The order of presentation was counterbalanced. Participants were asked to write anything they remembered about each ad. Two independent coders, unfamiliar with the hypotheses and experimental conditions, read the responses, compared them with a protocol for each ad, and indicated whether the participant had remembered the general (explicit or implicit) ad claim. The protocol and the instructions to the coders referred to the general meaning conveyed in the ad, and not necessarily to the exact wording. The coders agreed on 92.7% of all ratings; the Cohen's kappa

coefficient was $\kappa = .86$. Disagreements were resolved through discussion. The memory score on each condition was based on the percentage of ads (out of the 10 ads in each condition) for which the participants had remembered the claim.

Results

ANOVA for the mixed design revealed a significant three-way interaction F (1, 73) = 11.469, $p < 0.05$. In the immediate memory condition, the arousal × fit interaction was significant (F (1, 73) = 4.647, $p < 0.05$), with a significant negative effect of fit arousal on memory: $M_{\text{low arousal}} = .72$, $M_{\text{high arousal}} = .64$, F (1, 73) = 7.273; $p < .05$, and an insignificant effect of unfit arousal on memory: F (1, 73) = 0, $p = .997$. In the delayed memory condition, the arousal × fit interaction was significant (F (1, 73) = 7.0, $p < .05$), with a significant positive effect of fit arousal on memory ($M_{\text{low arousal}} = .39$, $M_{\text{high arousal}} = .52$, F (1, 73) = 11.818; $p < .05$), and an insignificant effect of unfit arousal on memory (F (1, 73) = 0; $p = .928$; Figure 1). These results are consistent with our hypotheses. We recognize that this experiment may have limitations due to the within-subjects design and the use of real stimuli, in which we cannot control for the content of the ads. The ads included in this research are of different valence, and no measure for valence was included to allow controlling for it. Our subsequent experiments use different methods that address these limitations and also enhance generalization and reinforce the findings.

Experiment 2

Method

Sample, design, and procedure

One hundred and sixteen undergraduate business students in an Israeli university (24.1% males, M_{age}=24.7) received course credit for participating in a 2 (ad-arousal: low vs. high) × 2 (fit: low vs. high) × 2 (retention time: immediate vs. delayed) fully between-subjects experiment. Four target ads, varying across the arousal and fit factors, were placed in a 'special edition' of a student magazine. This magazine was produced especially for our research, in four versions, each containing one of the target ads. Aside from the ads, the four versions of the magazine were identical. Each ad was a half-page in length and was placed on page 9 (of 16) in the magazine.

Participants were asked to review the magazine for 10 minutes. They were told we were interested in the general impression of the magazine, and that it was not essential to read the articles thoroughly. They performed filler tasks (matching familiar brand names with countries of origin and with slogans) and completed the memory measure either immediately after the filler task or one day later (for the immediate and delayed memory conditions, respectively).

Stimuli

The ads for this experiment appear in Table 1[3]. They were developed based on pretesting. We created ads that contained pictures intended to elicit either low or high emotional arousal while controlling for positive valence (i.e. relaxation or excitement

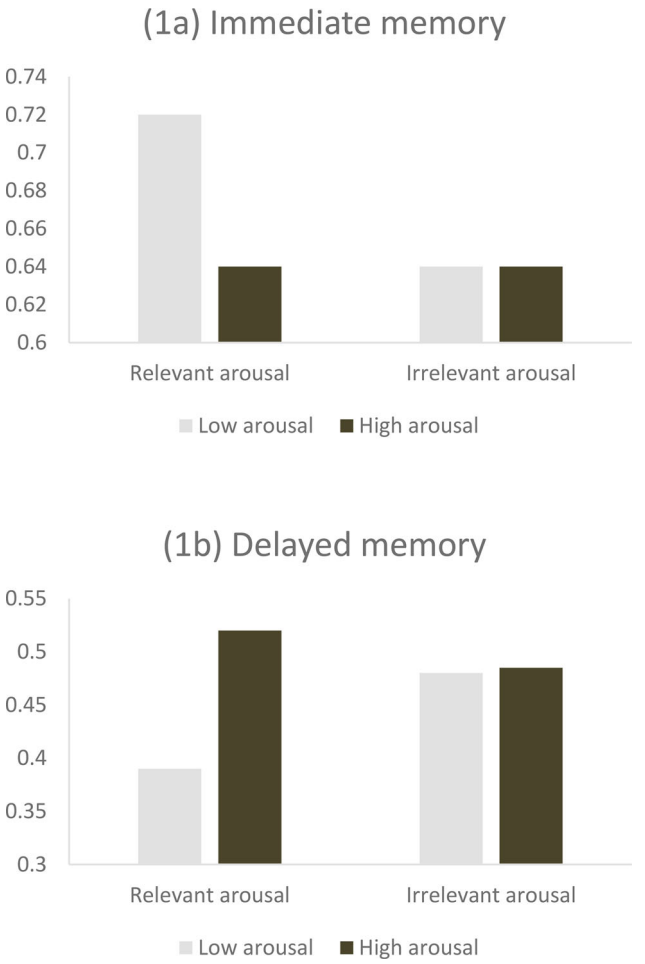


Figure 1. Results of Experiment 1: The effect of fit and nonfit arousal on (1a) immediate memory and (1b) delayed memory.
Values on the Y-axis refer to the fraction of ads (out of the 10 ads in each condition) for which the participants had remembered the claim (0-1 scale).

for low vs. high arousal, respectively). All ads had one claim. Ads with fit low (high) arousal contained a claim that mentioned a relaxing (exciting) benefit; ads with unfit low (high) arousal contained a claim that mentioned an exciting (relaxing) benefit.

The ad pre-test was conducted online. Two hundred and seventy-four business students from the same Israeli university received a link to the study (none of them participated in the main experiment); only 240 completed it (27% male; M_{age}=29.8). They were randomly assigned to view one of 12 ads. After viewing the ad, they completed scales to measure their emotional response to the ad and the fit of the emotional response with the ad claim. Two dimensions of the emotional response were measured: valence and arousal, each using the respective six items of the semantic differential of Mehrabian and Russell (1974; $\alpha_{arousal} = .893$; $\alpha_{valence} = .932$). Fit was measured using three 7-point items: to what extent the feelings portrayed in the ad are relevant to the ad claim: 1 = extremely irrelevant – 7 = extremely relevant; whether the

feelings portrayed in the ad convey the ad claim in a good way: 1 = disagree – 7= agree; and whether the feelings in the ad match the content of the ad: 1 = disagree – 7 = agree; $\alpha_{fit} = .857$.

Based on the pre-test, we identified four ads that demonstrated the optimal arousal (A) and fit (FT) values for our needs while controlling for valence (V). Valence did not differ significantly across all four ads ($V = 4.7$, F (3, 90) = 1.598; $p = .195$)[4]. Arousal scores differed significantly between low and high arousal conditions (in the low fit conditions: $A_{low\text{-}arousal,\ nonfit} = 2.3$, $A_{high\text{-}arousal,\ nonfit} = 4.6$, $F(1, 90) = 98.84$, $p < .001$; in the high fit conditions: $A_{low\text{-}arousal,\ fit} = 2.2$, $A_{high\text{-}arousal,\ fit} = 4.7$, $F(1, 90) = 96.82$, $p < .001$). Fit differed significantly between the low and high fit conditions (in the low arousal conditions: $FT_{low\ arousal,\ nonfit} = 3.3$, $FT_{low\ arousal,\ fit} = 5.7$, $F(1, 90) = 53.247$, $p < .001$; in the high arousal conditions: $FT_{high\ arousal,\ nonfit} = 2.9$, $FT_{high\ arousal,\ fit} = 5.1$, F (1, 90) = 41.6, $p < .001$). Arousal did not differ significantly across fit conditions (F (1, 90) = .003, $p = .956$); however, there was a marginally significant difference in fit between the low and high arousal conditions ($FT_{low\ arousal} = 4.521$, $FT_{high\ arousal} = 3.981$, F (1, 90) = 3.962, $p = .05$). Although this difference reached significance, the values across conditions met our needs.

Memory measure

Memory was measured using a cued multi-item recognition task. The participants were first provided with a list of brands, including the brand in the target ad (the order of brand names was counterbalanced). For each brand, they were asked to indicate whether it had appeared in one of the magazine ads. They were then given a list of claims and were asked to indicate which claim was linked to the brand from the target ad (the order of claims was counterbalanced). The rate of recognition in each condition was calculated as the percentage of participants in that condition who remembered the ad claim.

Results

The results of this experiment are presented in Figure 2. We used both logistic regression and Chi-square analysis. The regression revealed a significant three-way interaction between arousal, fit, and time on memory (B = 4.362, $p = .016$, Exp (B) = 78.426). In the immediate memory condition, fit and arousal showed a marginally significant interaction on memory (B = −1.905, $p = .077$, Exp (B) = .149), yet – as predicted – fit arousal produced a significant negative effect on claim memory ($M_{fit,\ low\ arousal} = 61.1\%$, $M_{fit,\ high\ arousal} = 22.2\%$, $\chi^2 = 5.6$, $p < .05$), and unfit arousal produced an insignificant effect ($M_{nonfit,\ low\ arousal} = 31.2\%$, $M_{nonfit,\ high\ arousal} = 35.7\%$, $\chi^2 = .067$, $p = .796$). In the delayed memory condition, fit and arousal showed a marginally significant interaction on memory (B = 2.457, $p = .092$, Exp (B) = 11.667), yet – as predicted here too – fit arousal produced a significant positive effect on claim memory ($M_{fit,\ low\ arousal} = 10\%$, $M_{fit,\ high\ arousal} = 53.8\%$, $\chi^2 = 4.790$, $p < .05$), and unfit arousal produced an insignificant effect ($M_{nonfit,\ low\ arousal} = 30.8\%$, $M_{nonfit,\ high\ arousal} = 28.6\%$, $\chi^2 = .016$, $p = .901$). This experiment reinforces the findings from Experiment 1. To

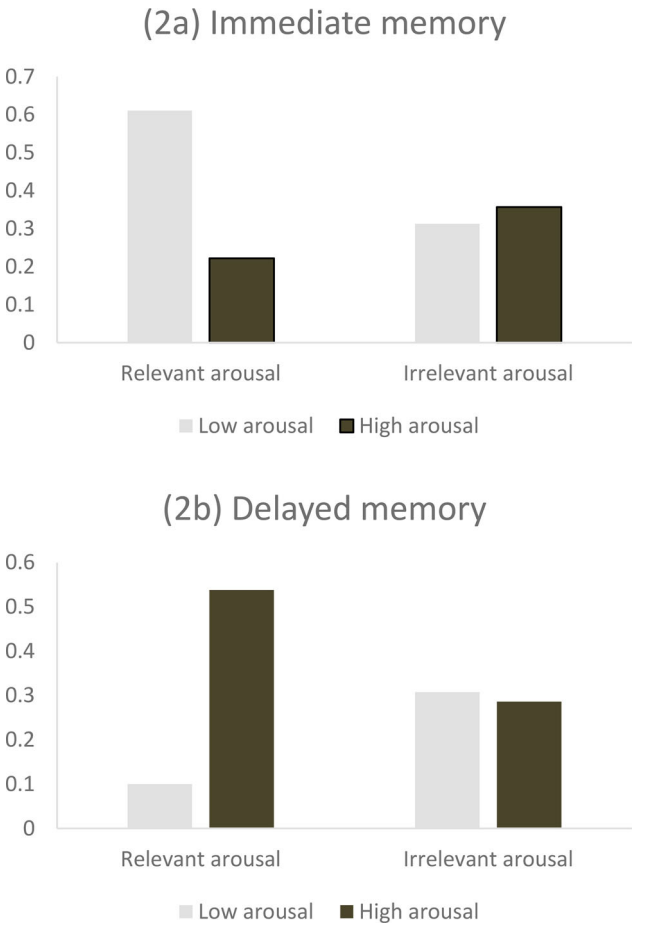


Figure 2. Results of Experiment 2: The effect of fit and nonfit arousal on (1a) immediate memory and (1b) delayed memory.
Values of the Y-axis refer to the fraction of participants in that condition who remembered the ad claim (0-1 scale).

extend the support and external validity, Experiment 3 tests our predictions using additional methods, including a different operationalization of fit.

Experiment 3

Method

Sample and design

One hundred and fifty-eight business students in an Israeli university (27.8% males, M_{age}= 24.5) received course credit for participating in a 2 (ad-arousal: low vs. high) × 2 (fit: low vs. high) × 2 (retention time: immediate vs. delayed) fully between-subjects experiment.

All participants were requested to take part in two sessions, which took place two days apart. In the first session, the participants were asked to review a 'pilot TV program' (a short talk show). Before viewing the 'pilot TV program,' the participants were

told that after watching the show they would be asked to express their opinion about it, and were provided with sample questions that they would be given later (e.g., What would interest people in such a show?). The show included a commercial break with three video ads—the first and last commercials were fillers, and the second was the target ad.

In the immediate memory conditions, after watching the program the participants completed a filler task for 15 minutes (answering questions about their opinion of the show), and then they completed the memory measure. These participants were asked to return for the second session, which included tasks unrelated to this study.[5] In the delayed memory conditions, the participants performed the same tasks as in the immediate memory conditions, with one exception: the memory measure was included in the second (rather than the first) session.

Stimuli

Fit of ad-arousal was manipulated by using ads for two products: one associated with low arousal and another associated with high arousal, and then having either low-arousal or high-arousal ads for each product.

A pre-test was conducted to select low- and high-arousal products. Pre-test participants were 62 undergraduate business students from the same Israeli university (33.9% males, M_{age}=25.4), who could not participate in the main experiment. They were asked to think about several specific products and to rate each of them based on the extent to which it is associated with the affective states listed in Mehrabian and Russell (1974) nine-point scale. Participants rated the following products: an amusement park, a spa, fashionable/going-out clothing, professional clothing, a soft drink, an energy drink, mineral drinking water, a spa resort, a family resort, a motorcycle, a family vehicle, and an extreme sport. These products were chosen in an attempt to determine pairs of products from similar categories (e.g., resorts, beverages, clothing). We compared levels of arousal and valence of products from similar categories, intending to find pairs of products associated with low versus high arousal but with a similar level of affect valence. Results of the pre-test revealed that water and energy drinks significantly differ in the level of arousal they are associated with ($A_{water} = 4.04$, $A_{energy\ drink} = 7.41$, $p < .001$), with no significant difference in valence ($V_{water} = 6.29$, $V_{energy\ drink} = 5.82$, $p = .092$). We then moved on to develop low-arousal and high-arousal ads for these products.

We created several versions of video ads for water and an energy drink. The ads were of similar length and contained images of the products or people using the products. To manipulate the level of ad-arousal, each ad was produced in different versions by varying the background music, while maintaining all other features. The musical pieces were selected based on the recommendation of a music expert, as well as on previous research (Gorn, Pham, and Sin 2001; Riemer and Viswanathan 2013). A pre-test was conducted to choose two ad versions for each product: a low-arousal version and a high-arousal version while controlling for valence. The ad design pre-test was conducted between-subjects. We present the results of the two pairs of ads that best meet our requirements: low- and high-arousal ads for water and for an energy drink. A total of 61 Israeli business students (26.2% male, M_{age}=28.5) participated in

Table 2. Description of ads in experiment 3[1].

	Low-fit ad	High-fit ad
Low-arousal ad	A low-arousal ad for an energy drink	A low-arousal ad for water
High-arousal ad	A high-arousal ad for water	A high-arousal ad for an energy drink

(*) For each product, the low- and high-arousal ads were identical but with different background music. The background music from the selected low- and high-arousal ads were similar ('Closing Time' by Tom Waits and 'Binary Finary' by Ricky Grant, for low- and high-arousal, respectively; used also in research by Riemer and Viswanathan 2013).

the pre-test sessions, which included the four conditions (i.e., 2 (product/fit) x 2 (arousal) between-subjects design). We ensured that pre-test participants would not participate in the main experiment. pre-test participants were randomly assigned to the four conditions. They were asked to watch the ad on a computer screen using headphones. They then completed scales to measure the affective response elicited by the ad and its fit with the ad. The valence and arousal dimensions of the affect elicited by the ad were measured using Mehrabian and Russell (1974) scale ($\alpha_{valence} = .897$; $\alpha_{arousal} = .946$). To measure the fit of ad-arousal with the ad, participants were asked to think about the feelings elicited by the ads and to indicate the extent to which they fit or did not fit (1) the product, (2) the ad claim, (3) the content of the ad, and (4) the communication of the message. Each of these four items was rated on a seven-point scale (1 = not at all; 7 = very much; $\alpha_{fit} = .901$). Results of the pre-test showed significant differences in the level of arousal between the low-arousal ads when aggregating levels of fit ($A_{low\ arousal} = 4.17$, $A_{high\ arousal} = 6.84$, F (1, 57) = 53.447, $p < .001$), and also when analyzing low-fit ads ($A_{low\ arousal,\ nonfit} = 4.43$, $A_{high\ arousal,\ nonfit} = 6.22$, F (1, 57) = 11.77, $p < .05$) and high-fit ads ($A_{low\ arousal,\ fit} = 3.91$, $A_{high\ arousal,\ fit} = 7.47$, F (1, 57) = 48.1, $p < .001$). Results also showed significant differences in the level of fit between low- and high-fit ads, when aggregating low- and high-arousal ads ($FT_{nonfit} = 2.933$, $FT_{fit} = 4.388$, F (1, 57) = 20.879, $p < .001$), and also when analyzing separately low-arousal ads ($FT_{low\ arousal,\ nonfit} = 2.90$, $FT_{low\ arousal,\ fit} = 4.36$, F (1, 57) = 10.63, $p < .05$) and high-arousal ads ($FT_{high\ arousal,\ nonfit} = 2.97$, $R_{high\ arousal,\ fit} = 4.42$, F (1, 57) = 10.17, $p < .05$). Arousal condition was found to have an insignificant effect on fit score ($FT_{low\ arousal} = 3.65$, $FT_{high\ arousal} = 3.96$, F (1, 59) = .011, $p = .917$), and fit condition had an insignificant effect on arousal score ($A_{nonfit} = 5.33$, $A_{fit} = 5.63$, F (1, 59) = .342, $p = .561$). There was an insignificant difference in the level of valence between all ads (F (3, 57) = .599, $p = .618$). Table 2 describes the selected ads.

Memory measure

To measure memory, participants were asked to refer to 'an ad for a beverage that appeared during the commercial break of the pilot TV program.[6] Also, they were asked to write down as many details as they could remember about the ad, including the product, brand name, the content of the ad, and any other details. Two independent coders, unfamiliar with the hypotheses, read these descriptions and provided scores from 0 to 2 (0 = not at all, 2 = very much, with intervals of .5, as needed) pertaining to the extent to which the participant remembered four items: the product, the brand, the ad claim, and the ad in general. The coders agreed on 82.1% of all

ratings. Disagreements were resolved by discussion. In the analysis, we summed up the scores on these four items for each participant to achieve a total memory score ranging from 0 to 8.

Results

ANOVA revealed a significant 3-way interaction F (1, 150) = 7.147, $p < 0.05$. In the immediate memory condition, the 2-way arousal × fit interaction was marginally significant (F (1, 150) = 2.801, p = .096), with a significant negative effect of arousal on immediate memory under high fit: $M_{\text{low arousal}} = 4.90$, $M_{\text{high arousal}} = 3.48$, F (1, 150) = 3.023; p(1-tail) < .05, and an insignificant effect of arousal on immediate memory under low fit: F (1, 150) = .100, p = .752. In the delayed memory condition, the 2-way arousal × fit interaction was significant (F (1, 150) = 4.386, p < .05), with a marginally significant positive effect of arousal on delayed memory under high fit ($M_{\text{low arousal}}$ = 2.33, $M_{\text{high arousal}} = 3.64$, F (1, 150) = 2.29; p(1-tail) = .065), and an insignificant effect of arousal on delayed memory under low fit (F (1, 150) = .065; p = .8; Figure 3).

This pattern was demonstrated consistently across the three experimental studies, which utilized diverse operationalizations. In a few cases, however, the effects were only marginally significant. Yet a combined analysis following the adding-z's procedure of Rosenthal (1978; see also Smith and Schwarz 2012) revealed an overall significant negative effect of fit ad-arousal on immediate memory (z = .401, p < .001) and a significant positive effect on delayed memory (z = .387, p < .001). The effects of unfit arousal on immediate and delayed memory were both insignificant (z = .043, p =.369 and z = .03, p = 0.351, respectively). It is evident, therefore, that altogether, the findings are robust across the three experiments.

General discussion

Summary and contribution

Ad emotional arousal had a negative effect on immediate memory but a positive effect on delayed memory. These effects took place only when the level of emotional arousal fit with the ad claim. When the level of emotional arousal did not fit with the ad claim, arousal affected neither immediate nor delayed memory.

These results provide insights into the boundary conditions for the effect of ad emotional arousal on memory. Our results suggest that in contrast to general belief (e.g. Ambler and Burne 1999; Bakalash and Riemer 2013; Robinette, Brand, and Lenz 2001), emotionally arousing ads may not always be helpful in improving the consumer's memory. This research suggests that advertisers should use emotionally arousing messages only if they are interested in improving long-term memory of the ad, avoiding such messages if their goal is to enhance short-term memory of the ad. Furthermore, in line with research on the effect of arousing ads on consumers' dispositions (Belanche, Flavián, and Pérez-Rueda 2017), our research suggests that due to memory considerations, arousing messages should be used only when they fit with the claim, but not when they do not fit with it.

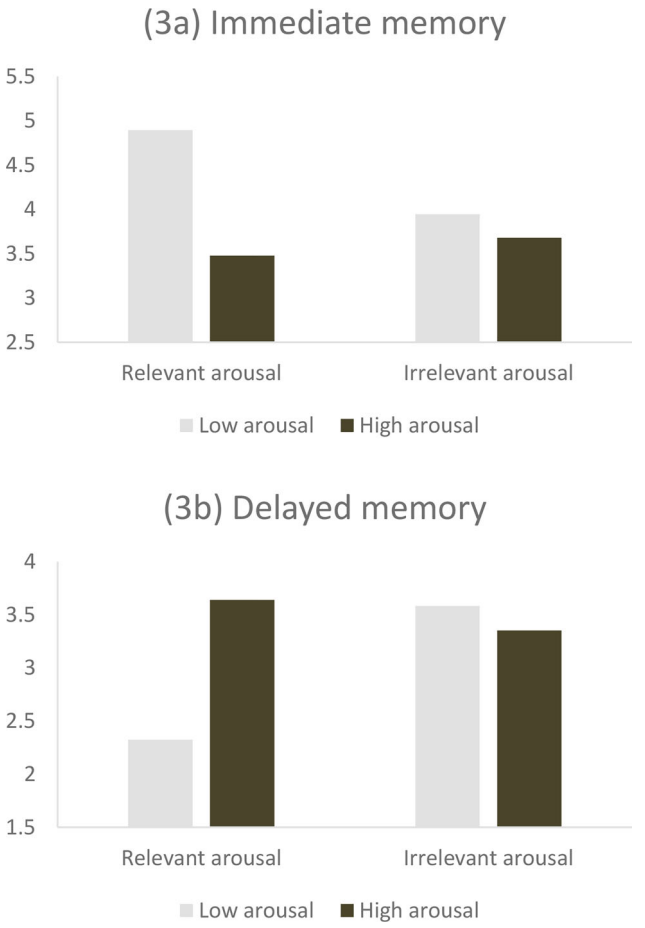


Figure 3. Results of Experiment 3: The effect of fit and nonfit arousal on (1a) immediate memory and (1b) delayed memory.
Values on the Y-axis refer average memory score across participants in each condition, based on their writing and coders; assessments (ranging from 0 to 8)

Interestingly, our findings that point to the importance of fit in advertising effectiveness are in line with one other advertising study that examined different but related factors. Sar and Anghelcev (2015) show that ads are most effective when the regulatory focus communicated in them (i.e., prevention or promotion goal) is congruent with the consumer's pre-existing mood. The prevention or promotion goals communicated in the ads in Sar and Anghelcev's study can be considered analogous to the goals activated by the ad claim in our study, and the consumer's preexisting mood in Sar and Anghelcev's study can be seen as analogous to the emotional arousal elicited by the ad in our study. According to Sar and Anghelcev prevention goals fit with sadness and promotion goals fit with happiness. In both studies, it is only when the factors are in fit that the ads are effective. Although the perspective, constructs, and variables in each study are different, it seems that both studies support the notion that amygdala activation takes place only in cases of correspondence

between factors, which leads to goal relevance, and in turn contribute to ad effectiveness.

Incidentally, across the three experiments, the results of the delayed memory tests consistently revealed a trend regarding the effect of fit on memory: under low arousal, the memory under the low fit condition is higher than the memory under the high fit condition.[7] Although this effect is beyond the scope of the current research, it is noteworthy that this finding is in line with past research. Huang, Kahana, and Sekuler (2009) concluded that task-irrelevant (unfit) information enhanced memory in the short term but did not impact delayed memory. Heckler and Childers (1992) also found that irrelevant (unfit) information could enhance recall, especially when irrelevance was unexpected. The effect of fit (vs. nonfit) isolated from arousal should be further examined in future research.

Limitations and further research directions

Several limitations of our study call for further investigation. First, while the patterns demonstrated in our results are consistent with insights from neuroscientific theorizing about emotional memory processes, the current research does not provide evidence on neural processes. In fact, evidence of such processes in the advertising context is limited. A study by Bakalash and Riemer (2013) provides fMRI evidence for social cognition (interpretation)-based process under exposure to emotionally arousing ads, and for an association between this process and memorability. However, Bakalash and Riemer's study is exploratory, and may not supply sufficiently robust evidence for the processes underlying the effects demonstrated in the current research. More research into these processes is therefore needed.

Second, as mentioned earlier, we did not distinguish between different types of memory tests, and used different memory measures as indications for memory in general. Specifically, our experiments used cued recall and recognition tests. Interestingly, these measures demonstrated consistent patterns. It would be interesting to expand the investigation to examine whether different effects would occur in other memory tests, such as free recall, and whether there are differences in the mechanisms underlying the effects on different types of memory. Moreover, this research focussed on explicit memory. Different mechanisms are involved in implicit memory, which justifies further investigation (see Shapiro and Krishnan 2001).

Third, our first experiment did not distinguish between different types of arousal (e.g., sexual vs. fear), and our second and third experiments controlled for the valence of affect while manipulating arousal. Thus, none of our experiments compared the various types of arousal or arousal of different valence. Future research should examine the moderating role of the type of arousal and of valence (see Das, Galekh, and Vonkeman 2015; Lang, Dhillon and Dong 1995), as well as the effects of mixed (informative and emotional) appeals.

Fourth, all of our experiments were conducted in a lab using student participants. A field experiment with real broadcasted ads and more diverse consumers may add to the generalizability of our findings. Future research should also examine the role of age, gender and cultural orientation in the effect.

Fifth, random assignment to experimental conditions in our studies assumed similar distributions of participants' pre-existing affective states and arousal-seeking tendencies across conditions. Future research should examine the effect of the interaction between each of these factors and ad-arousal on ad effectiveness.

Sixth, the current research focuses on the effect of the ad's executional elements, rather than of the claim and the brand benefit. Yet, arousal can also be elicited by the product and the benefits associated with it. Specifically, unlike the products used in our thirst experiment, which were shown to be clearly associated with either low or high arousal (water and energy drink, respectively), certain products can be equally associated with either low or high arousal benefits. For example, preliminary studies in our lab show that cars are such products – they can be associated both with low arousal benefits such as safety and with high arousal benefits such as an exciting driving experience. Future research should examine differences in memory for these various product benefits, as well as their underlying processes and the factors that might moderate such effects. Future research can also examine differences in the effect when the ad claim is stated explicitly versus implicitly.

Finally, this research focussed on the effect of arousal on memory. Ad emotional arousal also influences consumer's attitude, and this effect may also be contingent upon various factors (see, e.g., Warren, Carter, and McGraw 2019). More research is needed to shed more light on this as well.

Notes

1. Due to copyright considerations, ads can be available upon request.
2. The use of a single-item scale has both advantages and disadvantages. In our case, we were interested in reducing the number of questions, as each participant had to rate multiple ads. According to Bergkvist and Rossiter (2009), single-item scale measures are valid for rating concrete objects or concrete constructs.
3. There are English versions of the ads. The original ads had Hebrew captions to suit the Israeli Hebrew speaking participants.
4. The results reported here are based on an analysis of the 94 participants who viewed the four ads which were ultimately selected to the experiment (out of the 240 participants who viewed all 12 pretested ads).
5. Even though we only needed participants in the delayed memory conditions to return to the second session (for the delayed memory test), participants in both delayed and immediate memory conditions were invited to a two-session study. This was done to prevent a large difference in sample sizes between the immediate and delayed memory conditions, due to participants' selection in 1- or 2-session study based on their interests.
6. Only the target ads were for beverages, so it was clear that the memory measure was linked to the target ads and not to the filler ads.
7. This effect was directionally consistent but not always significant.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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