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Literature Review Corner

Social Consumer Neuroscience: Neurophysiological Measures of Advertising Effectiveness in a Social Context

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The application of neurophysiological methods to study the effects of advertising on consumer purchase behavior has seen an enormous growth in recent years. However, little is known about the role social settings have on shaping the human brain during the processing of advertising stimuli. To address this issue, we first review previous key findings of neuroscience research on advertising effectiveness. Next, we discuss traditional advertising research into the effects social context has on the way consumers experience advertising messages and explain why marketers, who aim to predict advertising effectiveness, should place participants in social settings, in addition to the traditional ways of studying consumer brain responses to advertising in social isolation. This article contributes to the literature by offering advertising researchers a series of research agendas on the key indicators of advertising effectiveness (attention, emotion, memory, and preference). It aims to improve understanding of the impact social context has on consumers' neurophysiological responses to advertising messages.

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Marketers' spending on advertising reached $569.65 billion worldwide in 2015 (eMarketer.com 2015). Such enormous spending should be informed by a significant effort in measuring the effectiveness of the advertising. Traditional methods for predicting the success of advertising are based on self-reports and largely depend on the willingness and ability of consumers to describe their levels of attention, emotions, preferences, or future buying behavior in relation to the marketing campaign to which they have been exposed. The application of self-reports for measuring consumer behavior, such as questionnaires and/or face-to-face or telephone interviews, can lead to invalid results due to the limitations and biases that are inherent to conscious and unconscious processes (Fisher 1993). For example, unconscious processes occur below the awareness threshold: Human consciousness starts to work approximately 300 to 400 milliseconds (ms) after a stimulus has been presented and can therefore not be reliably reported verbally, yet it is still processed by the human brain (Johansson et al. 2006). However, these unconscious processes may have a considerable impact on consumer behavior (Zaltman 2000). People sometimes have subtle feelings of knowing what they have experienced in relation to advertising exposure, although they may be unable to retrieve explicit information from their memory and express it in words. Likewise, consumers' emotional experiences related to advertising are complex and often include automatic processes, which are difficult to capture in self-reports (Davidson 2004; Zajonc 1980). Consumers are not always capable of accurately predicting their future buying behavior due to novelty, context, and specificity of the product—factors that seem to change unpredictably (Loewenstein and Schkade 1999). Alternative scales have tried to improve the ability to predict consumer behavior using self-reported preferences and intentions by considering biases in reporting and measurement (e.g., Mittal and Kamakura 2001).

In search of better measures and higher predictability, academic and commercial research has been employing neurophysiological methods to study the dimensions of advertising effectiveness more frequently. Consumer neuroscience, the use of neurophysiological and biological methods of research, offers access to consumers' mental processes and is therefore often used to complement traditional self-reported measures (Ariely and Berns 2010). Consumer neuroscience promises to reveal processes heretofore hidden in the consumers' "black box" and thus offset many weaknesses associated with traditional methods (Plassmann et al. 2007; Telpaz, Webb, and Levy 2015). Its methods include electroencephalography (EEG) and functional magnetic resonance imaging (fMRI); biometrics such as skin conductance, heart rate, respiration, eye tracking, and facial expressions; and psychometrics, such as reaction times. They offer safe, noninvasive access to consumers' brain responses to such stimuli as print ads, television ads, and movie trailers for products and services and even political speeches (Falk et al. 2015; Pozharliev et al. 2015).

In the light of recent growth in the use of neurophysiological methods in advertising research, the authors of this article are asking one important question: Is there room for improvement in the way consumer neuroscience is used to predict advertising success? Can consumer neuroscience research on advertising effectiveness benefit from including social context in studying consumers' neurophysiological responses to advertising stimuli? To answer this question, we first review previous key findings of consumer neuroscience research on advertising effectiveness. Second, we briefly discuss the results and implications of traditional advertising research in a social context. Third, we elaborate on the link between the social and neurophysiological processes and their effect on neural systems recruited during ad exposure. Finally, we provide a coherent research agenda that is consistent with the previously discussed relationships and briefly suggest some methods from the field of consumer neuroscience that can be used in social settings. We hope that our observations and propositions will help researchers advance the problem of the application of consumer neuroscience in social contexts.

CONSUMER NEUROSCIENCE IN ADVERTISING CONTEXTS

In the past decade, marketers have become more open to the use of neurophysiological methods to measure advertising effectiveness (Venkatraman et al. 2014; Wedel and Pieters 2008). This section introduces the two most commonly used methods in consumer neuroscience and discusses their main advantages and disadvantages.

EEG measures variations in electrical activity over the cortical brain regions, as a function of external or internal variables. These variations are recorded at various frequencies—theta (4 to 7 Hz), alpha (8 to 12 Hz), beta (15 to 30 Hz), and gamma (> 32 Hz)—that have been related to different physiological phenomena. For instance, an increase in the alpha frequency band (8 to 12 Hz) over specific brain cortical regions has been inversely related to underlying brain activity (Jensen and Mazaheri 2010). Generally speaking, the human brain is divided into four main areas: frontal, temporal, parietal, and occipital. The frontal area is frequently associated with experiencing reward, planning, social skills, motivation, short-term memory, and emotional regulation processes (Langleben et al. 2009; Morris et al. 2009). Specifically, the smaller alpha activity in the left frontal area, compared to right frontal area, is related to approach motivation (Davidson 2004). The occipital brain area, located in the rearmost portion of the skull, is the visual processing center of the human brain. In particular, the smaller occipital alpha activity is used as an index of higher attention (Klimesch 2012). In addition, fMRI is commonly used in advertising research. This noninvasive method localizes and measures changes in blood oxygenation during cognitive tasks. Brain activity following specific cognitive tasks requires more oxygen in the involved brain areas. Oxygen is delivered by an automatic increase of blood flow into the specific area, which is measured with high-field MRI scanners (Huettel, Song, and McCarthy 2004). Each method has strengths and weaknesses, giving it different advantages in studies of the specific content of ad messages (Venkatraman et al. 2014). For instance, EEG offers high temporal resolution (on a millisecond time scale), significantly greater than that of fMRI (on a time scale of seconds), and is therefore more effective in investigating ongoing consumer responses to different parts or scenes of TV ads, on a second-by-second scale (Dmochowski et al. 2012). On the other hand, fMRI offers extremely high spatial resolution (2 to 3 mm), significantly greater than that of EEG (1 to 2 cm), and may therefore be more suitable when the exact localization of the brain response is key to predicting ad success (Falk, Berkman, and Lieberman 2012). However, due to low temporal resolution, fMRI often provides only aggregate measures for an entire stimulus and misses subtle temporal variations that might occur at multiple times during the viewing of ads. Neurophysiological data obtained from EEG, fMRI, and other consumer neuroscience methods are often used in advertising research as direct correlates of a number of key indicators of advertising effectiveness.

Advertising research suggests the use of four key constructs as indicators of ad message effectiveness: attention, emotion, memory, and preference (Pieters, Rosbergen and Wedel 1999; Shapiro and Krishnan 2001; Venkatraman et al. 2014). Consumer preference is frequently used as a direct correlate of subsequent purchase behavior (Cobb-Walgren, Ruble, and Donthu 1995). The following sections review some of the neuroscience literature on advertising effectiveness for each of the key constructs.

Attention

Neurophysiological methods, such as eye tracking and EEG, offer more direct measures of attention when compared

to self-reports and provide marketers with a reliable tool to successfully distinguish between bottom-up and top-down attention in relation to marketing-relevant stimuli (Boerman, van Reijmersdal, and Neijens 2015; Pieters and Wedel 2007). An eye-tracking study found, for example, that for magazine advertisements the position that attracts the most attention is the bottom of the right-hand page, next to an article or illustration with limited colors (Smit, Boerman, and van Meurs 2015). In EEG research on advertising, occipital alpha activity has been related to attention processes, such as visual gating during the viewing of TV commercials (Rothschild et al. 1986). Past studies using fMRI found a negative correlation between the amount of attention for noncommercial broadcast ads, reflected by occipital activity and accuracy of recognition, suggesting that the "attention-grabbing" visual content of the ad could block learning and retention of information in a commercial (Langleben et al. 2009). In another fMRI study, the amount of attention for a static photo was positively associated with the perceived attractiveness of the product package and therefore with preference toward the advertised brand (Stoll, Baecke, and Kenning 2008).

Emotion

Previous advertising research has used a variety of self-reported approaches in analyzing consumers' emotional engagement in relation to advertising, such as TV commercials, print ads, and web ads (Sundar and Kalyanaraman 2004). Earlier neuroscience studies allude to the importance of frontal alpha activity in affective processes (Davidson 2004). The model presented by Davidson (2004) argues that less left frontal alpha activity, compared to right frontal alpha activity, reflects the processing of positive stimuli. For instance, in two EEG studies, Vecchiato et al. (2010, 2011) investigated viewers' emotional engagement with commercials incorporated in normal television program content. Both studies reported greater right frontal alpha activity for more pleasant and liked commercials and greater left frontal activity for unpleasant ones. Another fMRI study also confirmed the importance of the frontal regions in emotional processing (Morris et al. 2009). Morris et al. (2009) examined brain responses to television commercials through a three-dimensional construct of emotion (pleasure, arousal, and dominance). Using advertisement Self-Assessment Manikin responses as a model for the fMRI data, they showed an association between activation in the frontal brain areas and the pleasure response to the commercial.

Memory

In an eye-tracking study on advertising, Wedel and Pieters (2000) investigated the role of eye fixations with memory for brands. Their findings indicate that systematic fixations on the brand and pictorial features of the printed ad support brand memory, while text fixations have no effect on subsequent memory. Rossiter et al. (2001) were the first researchers to use EEG to investigate brain locations of visual memory encoding in relation to dynamic visual stimuli. Their results suggest that the short- to long-term memory transfer of information from television commercials takes place in the left hemisphere. They concluded that the left frontal activation reflected by reduced alpha activity is a reliable predictor of which ad scenes will be better encoded in long-term memory and will subsequently be recognized more easily. These same frontal patterns of alpha activity, in relation to memory encoding during the watching of TV commercials that elicit high subjective interest, were also found in other EEG studies (Smith and Gevins 2004). The association between frontal activity and memory in relation to advertisement content was also reported in fMRI studies (Langleben et al. 2009). Bakalash and Riemer (2013) found greater amygdala activity for memorable versus unmemorable ads.

Preference and Purchase Behavior

Previous EEG studies that suggest the strength of long-term memory encoding for brand information is reflected by greater left prefrontal activity may be used as an indicator for advertising effectiveness and therefore for its ability to favorably affect consumer preferences and purchase behavior (Silberstein and Nield 2008). In an fMRI study on consumer decision making, Knutson et al. (2007) reported a correlation between nucleus accumbens (NAcc) activity, a brain structure closely located and related to the amygdala, and a preference for a specific product. NAcc has frequently been reported to be involved in the cognitive processing of motivation, reward, reinforcement learning, and addiction (Knutson et al. 2007). In an important fMRI study, Falk, Berkman, and Lieberman (2012) examined whether neural responses of individuals to TV ads can predict general population purchase behavior above and beyond self-reported measures. Their results suggest that, on the large population level, measured by a change in purchase behavior, effectiveness is better predicted by neural activity in the medial part of the prefrontal cortex (MPFC) of people in a small group, compared to self-reported judgments. MPFC activity accounted for 33% of the variance in the effectiveness of ad campaigns. Recently, Falk et al. (2015) replicated their findings on the role of MPFC as a reliable predictor of TV campaign effectiveness, reflected by a change in individual purchase behavior.

In a combined EEG and fMRI study, Dmochowski et al. (2014) attempted to find the neural correlates of individual preferences during TV ad viewing. Their results indicate that individual preferences for television ads are predicted by the level of intersubject synchronization among viewers (Dmochowski et al. 2014). Intersubject synchronization is a decomposition method, similar to independent component analysis, that extracts linear combinations of brain activity data that are maximally correlated in time (Hasson et al. 2004). This neural synchronization predicted the general

population preferences of people who did not take part in the lab experiment, measured by social media activity (e.g., tweet rates and Nielsen ratings), more accurately than those of the individuals from whom the neural responses were collected. Dmochowski et al. (2014) suggest that one reason for this unusual finding might be due to the social-influence processes that are likely to take place in large groups in a real-life environment (Chan, Berger, and Van Boven 2012). The EEG and fMRI data were recorded from participants placed in complete isolation so that no social influence or interaction process could occur. Here, in contrast, the general population behavioral responses were collected outside lab settings, and in that way social-influence processes could have largely altered individual preferences for TV ads via social facilitation, social interaction, or word of mouth. Indeed, someone's behavior is highly susceptible to social processes, such as social conformity, assimilation, compliance, and persuasion (Algesheimer, Dholakia, and Herrmann 2005; Cialdini and Goldstein 2004). The human memory, for instance, is largely susceptible to social influence (Edelson et al. 2011).

TRADITIONAL ADVERTISING RESEARCH IN A SOCIAL CONTEXT

In the past, marketing research on consumer behavior focused on studying advertising effectiveness in relation to its textual content, audiovisual features, and the media context in which the ad appeared (De Pelsmacker, Geuens, and Anckaert 2002; Malthouse, Calder, and Tamhane 2007). Most of these studies do not consider the social dimension of advertising and minimize the role that the social interactions of the audience might have on such physiological processes as attention allocation, emotional engagement, and memory (Kamins et al. 1989). Only recently have marketing researchers tried to overcome this theoretical gap by examining the effects that social context has on the physiological processes during advertising viewing (e.g., Jayasinghe and Ritson 2013; Puntoni and Tavassoli 2007; Puntoni, de Hooge, and Verbeke 2015; Raghunathan and Corfman 2006). For instance, Jayasinghe and Ritson (2013) investigated the influence of everyday domestic social environments and interpersonal family interactions on the way consumers process TV ads. They concluded that the context in which the message is consumed has a significant impact on consumer engagement practices. Importantly, past marketing research reports a strong influence of social processes on all four key indicators.

Attention

First, social context was found to affect viewers' attention allocation to TV commercials. Moorman et al. (2012) found that watching a sports event on TV in the company of other people enhances the amount of attention paid to the commercials shown during that show. The authors suggest that watching sports events in social contexts enhances commercial exposure because individuals are less inclined to switch channels during commercial breaks. Other studies provide evidence for the negative effect of coexposure on attention allocation. Bellman et al. (2012) found that the mere presence of others distracts every coviewer's attention from the TV screen, leading to reduced effectiveness of commercials, measured by delayed ad recall.

Emotion

Some studies have found that experiencing ad messages in social contexts enhances emotional engagement. Csikszentmihalyi and Kubey (1981), for instance, report that coviewing is a more emotionally engaging experience than solitary viewing. However, social context was also found to have a negative impact on consumers' emotional experience with ad messages. Fisher and Dubé (2005) found that males reported a less pleasant emotional experience when the ad was viewed with another male.

Memory

Further support for the impact of social processes on ad viewing was found in an article reporting on the effects of social context on advertising memory (Puntoni and Tavassoli 2007). Puntoni and Tavassoli (2007) showed that with print ads the recall of words that appeal to social desirability occurs faster when the participants are in the mere presence of one other person, compared to being alone. Furthermore, Bellman et al. (2012) found that the mere presence of others leads to reduced effectiveness of commercials, measured by delayed ad recall.

Preference and Purchase Behavior

Mora (2016) proposed that ad consumption in a social context leads to the activation of within-person goals, which directly influences consumer purchase behavior, as well as the activation of person–environment goals, which affects purchase behavior directly or through social interaction (Ariely and Levav 2000). Despite their limited number, all previously mentioned traditional studies on advertising effectiveness clearly indicate that social settings, such as mere presence, coviewing, social interactions, and social processes, including social facilitation, social cognition, and social reward processing, alone or in combination, affect the way consumers experience advertising messages.

SOCIAL PROCESSES INFLUENCING ADVERTISING EFFECTIVENESS AND ASSOCIATED NEURAL SYSTEMS

Marketing academics recognize that instances of consumer behavior, such as allocating attention to branded products and

making decisions, can be influenced by the presence of other people, who could be strangers, friends, family members, or salespeople (Jayasinghe and Ritson 2013; Kurt, Inman, and Argo 2011; Ariely and Levav 2000). Thus, attention allocation to a billboard or emotional engagement with a TV ad might be modulated by social processes (e.g., social facilitation, self-referential cognition, social cognition, social embarrassment, and social reward processing) that take place when people view advertising in a social context (see Figure 1).

Social Facilitation and Mere Presence

Consumers' cognitive processing of advertising can be modulated by the presence of another physical body or brain in, for example, a simple social situation when subjects are not engaged in active social interaction. Social facilitation is conceived as a tendency for individuals to behave or perform differently in the mere presence of others (Zajonc 1965). Early studies defined the mere-presence effect as a noninteractive social situation, where a second person, passively copresent, does not attempt to engage the first person in any way (Zajonc 1965). The author proposed that mere presence is a sufficient condition for producing nondirective, nonspecific arousal. In a recent EEG study, Pozharliev et al. (2015) studied the modulation of attention allocation to ad materials in relation to different social settings (e.g., alone versus mere presence). The authors found enhanced brain activation in occipital areas when participants viewed pictures of branded products together with another person compared to when they viewed them alone. This suggested that the presence of another person increases the attention allocation that consumers give to advertising-related materials, especially to those with strong emotional value. Interestingly, the mere presence of others seems to influence the unconscious cognitive processing of advertising material, as people declare no difference in being alone or in a social context (Pozharliev et al. 2015). Another EEG study suggests that the mere presence of another person in close proximity during a task-free resting state condition is sufficient to increase the level of tonic alertness, which is required for more active introspective processes such as self-referential thinking (Verbeke et al. 2014). Thus, it can be assumed that neural systems that are hypothesized to be involved in the cognitive processing of advertising materials may be influenced by social processes experienced in simple or complex social settings (see Figure 2). For instance, Pozharliev et al. (2015) showed that mere presence affects neural systems that are involved in attention allocation, such as the visual cortex. Therefore, it is possible that the mere presence of others may also influence activity in brain areas engaged in emotion, memory, and preference, including the amygdala, hippocampus, ventral striatum (VS), and frontal regions. These assumptions are further elaborated in the section dedicated to research agendas.

Self-Referential Cognition

Thinking about others requires that one first thinks about oneself (i.e., self-referential cognition; Ames et al. 2008). For

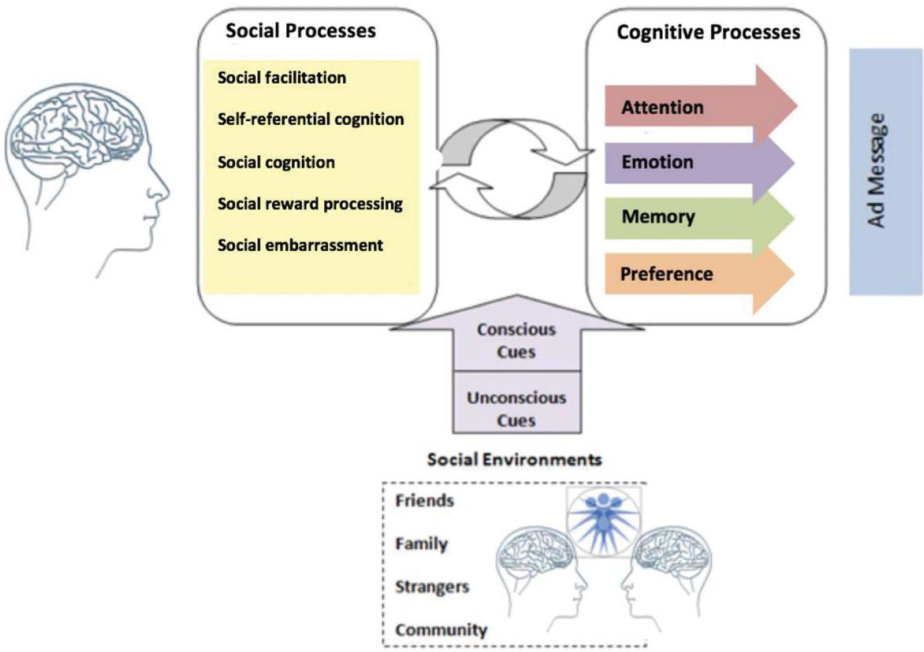

FIG. 1. Social processes affecting the way consumers experience advertising messages in real-world situations where the active human brain interacts with the social environment.

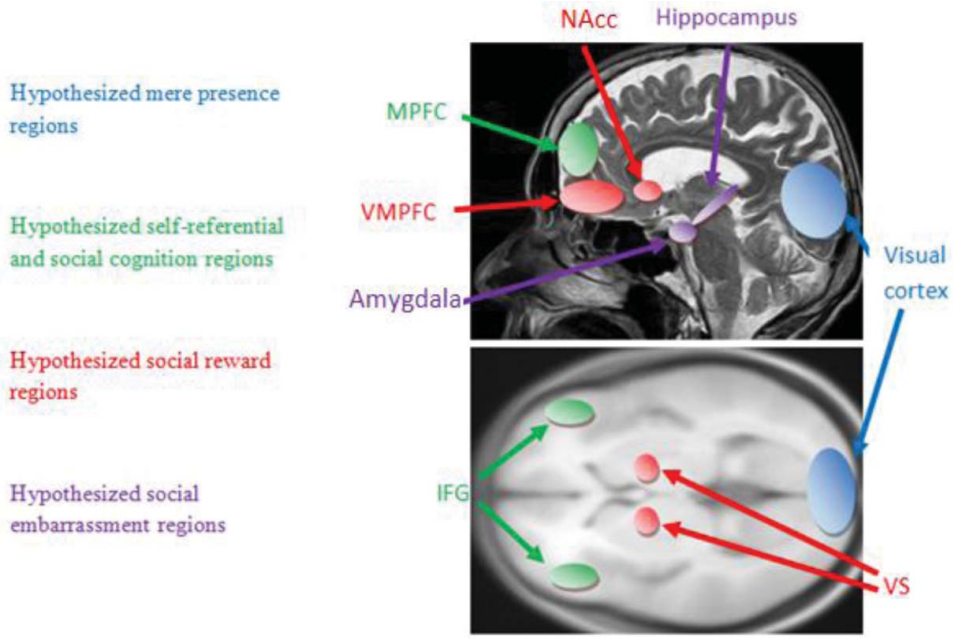

FIG. 2. Hypothesized neural systems involved in cognitive processes related to advertising effectiveness that may be influenced by social processes. *Attention*: VMPFC = ventral medial prefrontal cortex, visual cortex. *Emotion*: PFC = prefrontal cortex, amygdala; IFG = inferior frontal gyri. *Memory*: MPFC = medial prefrontal cortex, amygdala, hippocampus. *Preference*: VS = ventral striatum; VMPFC; NAcc = nucleus accumbens.

instance, when a woman walks down the street with friends or family and passes a billboard showing an attractive female model in lingerie, she may think about how others perceive this ad or what others think about her if she pays too much attention to it. Receiving feedback from the group may elicit reflected self-appraisal and social comparison, which requires more thinking about one's own reaction in relation to the behavior of other group members. Comparing her personal reward of experiencing the ad to possible social feedback from friends or family will likely determine the way the woman cognitively processes the information in the ad (Fliessbach et al. 2007). Self-referential cognition recruits frontal brain areas that are also involved in attention, emotion, memory, and preference, including the PFC and MPFC. Thinking about oneself during ad processing in a social context might thus influence the neural systems that neuroscientists use to measure advertising effectiveness (see Figure 2). Interestingly, self-referential cognition employs brain regions that are also involved in thinking about others, specifically the MPFC (Mitchell, Banaji, and MacRae 2005; Northoff et al. 2006).

Social Cognition

Being in a social context makes us think about the mental states and motivations of the other people that are physically present. For instance, imagine a woman sitting in a beauty parlor. While she waits for her appointment, she is watching various programs on a big TV screen (e.g., fashion show, talk show, or cooking show) with several commercial breaks. Then an ad for a new cosmetic product (or perfume or clothing brand) that the woman likes appears on the screen. Again, the dynamic social context may prompt her to think about how others perceive this ad or what others would think of her if she paid too much attention to it. In addition, seeing how other members of the audience experience the ad (e.g., facial expression, gesture, body posture, and gaze direction) may prompt her to think about what motivates their behavior. These socially evoked processes may influence the way she processes the ad. Earlier neuroimaging studies have shown that thinking about others' intentions, motivations, feelings, and thoughts activates a network of brain regions including the MPFC, inferior frontal gyri, and amygdala (Lieberman 2013; Mitchell, Banaji, and MacRae 2005). Note that the MPFC is involved in memory, while the amygdala and the inferior frontal gyri play important roles in emotional regulation (see Figure 2). Both self-referential thinking and social cognition are essential for complex socially elicited processes, such as processing social reward and embarrassment.

Social Reward Processing

Past neuroscience studies suggest that the presence of other people can imply a positive experience resulting from social reward (Lieberman and Eisenberger 2008). Moreover, social pleasure, as opposed to the pleasure experienced when satisfying physiological needs (e.g., eating a sandwich or drinking coffee), is not a conscious experience (Lieberman 2013). In addition, some studies have shown that our brain longs for

positive feedback from others (Davey et al. 2010). In this way, the social feedback that consumers receive before, during, and after viewing an ad can change the way they process it (Fliessbach et al. 2007). For instance, imagine a man in a sports bar watching commercials during a network-televised game. He receives positive social feedback from other customers in the bar, such as cues that others support his team, understand his excitement, or agree with his reactions to the referee's decisions (Morelli, Torre, and Eisenberger 2014). This may influence the way he emotionally processes the commercials, especially compared to the opposite situation, where he feels unappreciated or disliked by the bystanders. Likewise, seeing others who have already given positive social feedback watching a certain ad with interest and excitement may encourage him to pay more attention, memorize more information, or become more emotionally involved (Campbell-Meiklejohn et. al. 2010). Perhaps the good experience others have while viewing the ad may transfer to him, often without his conscious awareness. Previous neuroimaging studies have shown that social rewards activate a network of brain areas composed of the lower part of the MPFC, called the ventral medial prefrontal cortex (VMPFC) and VS (Davey et al. 2010; Izuma, Saito, and Sadato 2008; Lieberman 2013). The VS includes the previously discussed NAcc and functions as a part of the reward system (Fliessbach et al. 2007). The VS is associated with the various parts of the limbic system's "emotional brain," including the amygdala and hippocampus (Izuma, Saito, and Sadato 2008). Most important, these same brain areas are also involved in such cognitive processes as attention, emotion, memory, and purchase behavior (see Figure 2). In dynamic social settings, the interaction between neural systems that are engaged in cognitive and social processes is likely to be more complex and less linear. For instance, the VS and VMPFC are known to respond to a variety of rewarding stimuli, including primary (e.g., product), secondary (e.g., money), and social rewards (Bartra, McGuire, and Kable 2013). They propose that activation of these brain regions may be modulated by the social context in which the advertisement is experienced (Zaki, Schirmer, and Mitchell 2011). Thus, modulation of brain activity in areas including the VMPFC and VS might be expected as a result of social reward processes that are likely to occur when ad messages are experienced in social settings (see Figure 2).

Social Embarrassment

Embarrassment is a strong social phenomenon that is extremely important for marketers, because advertising viewing is often experienced in a social context (Puntoni, de Hooge, and Verbeke 2015). Embarrassment is a publicly elicited, self-conscious emotion that manifests itself when social events endanger one's social identity (Miller 1996). On some occasions embarrassment occurs as a result of one's own actions (Verbeke and Bagozzi 2003), such as when someone is buying condoms in the presence of other people, makes a mistake when interacting with a customer, or slips on a wet floor in a store (Dahl, Manchanda, and Argo 2001; Verbeke and Bagozzi 2003). Yet in other cases people feel embarrassed even when they are not personally responsible for the socially embarrassing episode (Lewis 2000). People can feel embarrassed, for instance, when stared at or when they are the focus of unwanted public attention. Both what people do and who they are can lead to feeling embarrassment. It can change both the valence and intensity of the emotional engagement with certain advertising (Puntoni, de Hooge, and Verbeke 2015). Due to the strong correlation between the key constructs of advertising effectiveness, socially provoked embarrassment is likely to influence other aspects of ad processing, such as memory and attention. For instance, viewing socially sensitive commercials (e.g., condoms, drugs, feminine hygiene products) in the presence of other people may lead to lower attention allocation or emotional engagement due to the viewers' concerns about the opinions of others or the situational appropriateness of certain behavioral expressions (e.g., smile, grimace, hand gesture, gaze direction). Consumers are likely to avoid paying attention to potentially embarrassing advertising, especially when the other people around them do not share their social identity. Several fMRI studies indicate that feeling embarrassment activates the MPFC and visual cortex (Paulus et al. 2014; Takahashi et al. 2004). Other brain regions frequently related to memory, such as the amygdala and hippocampus, are also related to processes such as social embarrassment (Paulus et al. 2014; Takahashi et al. 2004). Therefore, enhanced or reduced neural activity might be observed in areas that are used to measure advertising effectiveness as a result of social embarrassment (see Figure 2). Even more important, most brain regions associated with social processes (e.g., social cognition, self-referential cognition, social reward processing, social embarrassment), including the VMPFC, VS, and amygdala, are also involved in neural value computations when choices between material goods are made (Ruff and Fehr 2014). Ruff and Fehr (2014) speculated about the existence of a unified mechanism for motivational control of behavior, which may include brain regions associated with processing both social and nonsocial factors.

In conclusion, the authors of this article argue that all four core constructs used to measure the effectiveness of advertising campaigns are likely to be influenced, together or separately, by the social processes that occur in real-life conditions. They propose that neurophysiological methods should be used in both social context and isolation as a complementary tool to self-reported measures because including social context in studying marketing campaign effectiveness may enhance the predictive power of the study.

RESEARCH AGENDA

As previously discussed, advertising research refers to four constructs as key indicators of ad message effectiveness:

attention, emotion, memory, and preference (Pieters, Rosbergen and Wedel 1999; Shapiro and Krishnan 2001; Venkatraman et al. 2014). Future consumer neuroscience research on advertising effectiveness should study the effects of different social processes: first, all four key measures separately, and then possible interactions among them. As it is one of the most studied and better understood cognitive processes, attention allocation should be the starting point in this future research agenda.

Attention

Pozharliev et al. (2015) studied mere-presence influence on attention allocation to pictures of branded products. Future research should try to validate their results and extend the study to other neurophysiological methods. An eye-tracking study that looks at mere-presence effects on attention allocation to ad-related stimuli would be an important step in this direction. The presence of others could possibly increase attention to one ad element (e.g., brand, pictorial, and text) at the expense of other ad elements (Pieters and Wedel 2004). Other social processes, such as social embarrassment and social reward processing, could also explain shifts in attention, depending on the type of brand or picture used in the ad message (see Figure 2). An attractive female model may attract more or less attention at the expense of other ad elements (e.g., brand, text), depending on the type of social context in which the ad is being experienced. Next, future fMRI research should test the hypothesis of Langleben et al. (2009) by looking at consumer attention behavior to ad messages in different social settings. The previously reported negative correlation between the amount of attention given to an ad and the accuracy of recognition might change to a positive one, because in social settings people may feel the need to talk about what they have previously been exposed to and in so doing learn and retain more ad-related information (Davey et. al. 2010; Langleben et al. 2009). One useful research design that could be used in a similar study is the hyperscanning technique (for a review, see Hasson et al. 2012; Babiloni and Astolfi 2014). Hyperscanning has been used to study cognitive processes of major interest in advertising, such as attention allocation. In neuroscience hyperscanning is used to describe a simultaneous recording of neurophysiological activity from multiple subjects. The most frequently used hyperscanning methods include the Pearson correlation, Granger-based correlation (King-Casas et al. 2005), partial directed coherence (Babiloni et al. 2007), the estimator phase shift (Tognoli et al. 2007), and the principal locking value (Dumas et al., 2010). In addition, fMRI hyperscanning has been used successfully between two scanners, located in two different U.S. states, via broadband Internet connections, which removes limitations to the way marketers can study neural activations in relation to advertising in dynamic social settings (King-Casas et al. 2005). Hyperscanning fMRI techniques should prove useful in studying consumer attention allocation to ads usually experienced in dynamic social contexts (e.g., stadiums, cinemas, bars, family rooms) where social influence takes place as two or more individuals instigate reactions from one another while processing ad material (Hari and Kujala 2009).

Social consumer neuroscience should not be limited to the previously mentioned methods; it should also include other neurophysiological measures, such as biomarkers (e.g., hormones, genes, skin conductance), facial coding, facial electromyography (fEMG), voice pitch analysis, and personality traits. Future research should examine changes in salivary hormonal levels (e.g., cortisol, testosterone, alpha amylase) in relation to ad messages in various social contexts. Brain region activity related to attention and emotion, including the VMPFC and the amygdala, has been associated with changes in salivary testosterone levels (Stanton et al. 2009). Finally, future research agendas must include a series of studies that examine the simultaneous effects of different processes (e.g., social facilitation, social reward processing) on neurophysiological measures (e.g., salivary hormonal levels) and brain areas related to attention (e.g., visual cortex, VMPFC) during ad viewing.

Emotion

First, future EEG studies should try to qualify the frontal alpha asymmetry in emotional processing of ad stimuli in different social settings (Davidson 2004). Social processes—including self-referential cognition and social reward processing—that recruit several frontal regions may alter the emotional experience with the entire ad message or just certain parts of it, which may be reflected in changes in the frontal alpha activity (see Figure 2). Fisher and Dubé (2005) found that males reported a less pleasant emotional experience when the ad was viewed with another male. Viewing ad messages in the presence of a female friend may qualify the frontal alpha model, while viewing the same ad message in the presence of a male friend or a stranger might lead to a different distribution between left and right frontal alpha activity. Multisubject EEG has seen enormous growth in the past decade and has gradually become the most frequently used neuroscientific method for hyperscanning studies in social neuroscience (e.g., Babiloni and Astolfi 2014).

Hyperscanning EEG has also been used in studies on emotional processes of major interest in advertising. For instance, a hyperscanning setup was employed to study the synchronized flow of emotions between the brains of romantic partners communicating via facial expressions (Anders et al. 2011). Thus, hyperscanning techniques can offer a valuable tool to explore both the temporal and social dynamics of this ongoing social influence and the way it simultaneously affects the emotional engagement of two or more viewers of the ad message. The neurophysiological results of participants who experienced the ad in a dynamic social context can be compared with the results of participants who process the same advertising material in isolation. This comparison might provide marketers with a more complete picture of how TV ad campaigns affect viewers' emotional engagement in various social

settings. Second, fEMG is a tool designed to register facial muscle activity. This method has been used as a physiological measure for consumers' emotional responses to ads (Poels and Dewitte 2006). We propose research that qualifies or challenges the findings of Hazlett and Hazlett (1999). Peaks in fEMG responses, temporally related to emotion-congruent events in the ad, might differ between viewers who experience the commercial in social settings compared to viewers who view it in isolation. Finally, we propose a series of studies that examine the influence of social cognition and embarrassment on neurophysiological measures of arousal, including pupil dilation and skin conductance, and brain areas related to emotions (e.g., PFC and amygdala) during ad viewing.

Memory

Puntoni and Tavassoli (2007) showed that recall of words in print ads appealing to social desirability occurs faster when participants are in the mere presence of another person compared to when alone. Bellman et al. (2012) found that the mere presence of others leads to reduced commercial effectiveness, measured by delayed ad recall. First, we propose a series of EEG and fMRI research that validates these findings by examining the moderating effect of social facilitation and social embarrassment on brain areas (e.g., MPFC, amygdala and hippocampus) related to memory and recall performance (Bakalash and Riemer 2013). The possible influence of social embarrassment is especially relevant when consumers experience socially sensitive advertising (Chan et al. 2007). The possible influence of social reward processing is especially relevant for advertising of products signaling social status, such as luxury goods (Han, Nunes, and Drèze 2010).

Second, we suggest a study that examines whether the results of Wedel and Pieters (2000) would change if eye-tracking data on printed ads were collected from participants who are in the mere presence of another person compared to when they are in social isolation. The text fixations, for instance, could have an effect on subsequent memory but only when a text with a socially relevant content is experienced in social context. The application of social consumer neuroscience to studies on memory in advertising may lead to new findings, such as enhanced memory for specific ad-related features (e.g., appealing to social desirability). The enhanced recall performance for certain ad characteristics in social compared to solitary settings might be reflected by an increase in MPFC or hippocampus activity (Bakalash and Riemer 2013). We expect that including social context could lead to a better understanding of previously reported results and could improve the predictability power of future consumer neuroscience studies.

Preference and Purchase Behavior

Future consumer neuroscience research should look for variations in consumer preferences during and after viewing an advertising message in social contexts compared to in social isolation. The logical step is to start with a simple social situation, in which subjects are not engaged in active social interaction (e.g., mere presence), and then gradually increase the complexity of the social context. Previous research indicates that social reward processing and social embarrassment modulate activity in brain areas (e.g., VMPFC, VS, and NAcc) that correlate with the ability of an ad message to induce a change in purchase behavior (Knutson et al. 2007; Lieberman 2013). An exciting idea for social consumer neuroscience research would be to replicate Falk et al.'s (2015) study but this time in different social settings. Viewing an ad message that promotes the benefits of using a health-related product in the presence of friend or a family member may activate brain areas that are related to social reward processing more strongly, which happen to be the same brain areas that drive purchase behavior (Falk, Berkman, and Lieberman 2012; Knutson et al. 2007). Including a social context might account for a larger portion of the explained variance in brain activity in areas related to change in purchase behavior (see Figure 2). One offline technique that can be used for a similar research scenario is intersubject correlation (ISC) analysis, a decomposition method similar to independent component analysis (Hasson et al. 2004). ISC has been used extensively in studying offline brain synchronization on a group level, especially in relation to preferences and purchase behavior (Dmochowski et al. 2012; Hasson et al. 2004). Importantly, ISC can be used to examine brain synchronicity between persons during active social interaction as well as in mere-presence social settings, especially in relation to natural and dynamic advertising materials (Dmochowski et al. 2012; Dmochowski et al. 2014).

CONCLUDING REMARKS

Measuring brain responses to advertising in individuals isolated in laboratory-based settings has long been the gold standard in previous consumer neuroscience research. However, in the real world, consumers are never exposed to ad messages in circumstances that mimic laboratory settings and advertising is not always experienced in complete isolation. Recent research suggests that isolated laboratory settings may provide suboptimal conditions for measuring brain responses in individuals acting in real-world environments (Kasai et al. 2015). Kasai et al. (2015) propose implementing next-generation, real-world, multiperson neuroscience that would enable researchers to investigate brain responses to the environment through the brain dynamics that occur in natural social situations. It is important to note that consumer neuroscience studies that adopted the isolated brain approach laid the basis for understanding and predicting consumer responses to ad messages and have consistently identified brain areas related to the processing of advertising related stimuli (Rothschild et al. 1988; Vecchiato et al. 2010; Falk, Berkman, and Lieberman 2012; Falk et al. 2015). In conclusion, we believe that

marketers can benefit in terms of both understanding and predicting by including social context in their studies of consumer behavior and brain responses in relation to advertising (Pozharliev et al. 2015; Puntoni and Tavassoli 2007).

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