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Neural responses to functional and experiential ad appeals: Explaining ad effectiveness

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ABSTRACT

Despite the large body of research that has investigated the effect of ad appeals of television advertisements on consumers' internal responses and behavior, our understanding of how different ad appeals are processed remains limited. Complementing existing literature with novel insights from neuroimaging techniques can be valuable, providing more immediate insights into implicit mental processes. The present study explores the neural responses to functional and experiential executional elements in television advertisements by using functional magnetic resonance imaging (fMRI). Comparing a unique set of different commercials for the same brand enabled examination of the influence of differences in ad appeal on brain responses and subsequent advertisement effectiveness. Findings show that functional and experiential executional elements engage different brain areas, associated with lower- and higher-level cognitive processes, and that the extent to which these particular brain areas are activated is associated with higher ad effectiveness.

1. Introduction

More than sixty years after the emergence of television advertising, the debate of what constitutes a successful commercial is still ongoing (Heath & Stipp, 2011). A large body of prior research has enriched our understanding of the effect of different ad appeals in television advertisements on cognitions, emotions, and behavior. The literature indicates that internal processes in response to ad appeals are important indicators of ad effectiveness. For instance, consumers' feelings in response to ads have been shown to have a positive influence on brand attitudes (e.g., Edell & Burke, 1987). Research on internal responses to ads has been conducted primarily using self-report metrics, which have provided useful insights, but do have several limitations. For instance, research has shown that people are limited in reflecting on their internal states (e.g., Nisbett & Wilson, 1977). Hence, the more complex cognitive or emotional responses to dynamic marketing stimuli might be difficult to capture with self-report alone, and could thus have been overlooked. Given the significant role of internal processes in driving ad efficacy (e.g., Pham, Geuens, & De Pelsmacker, 2013) a more accurate measurement of these processes is imperative, providing a richer

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understanding of consumers' responses to different advertisement executions. Through this increased understanding, the creative development of ads can be further optimized.

More implicit and innovative methods to measure internal responses, such as neuroimaging (i.e., functional magnetic resonance imaging (fMRI)), can be of value here, providing online insight into ongoing mental processes unbiased by self-report (Yoon et al., 2012). In the current study, we explore how novel insights from neuroimaging techniques can advance our understanding of how different ad appeals of a set of television commercials for the same brand are processed by consumers and how these processes are, in turn, related to advertisement effectiveness in an independent sample of consumers.

2. Conceptual framework and study rationale

2.1. Functional and experiential approaches in advertising

Broadly speaking, an advertising appeal—the central idea of a message that highlights specific attributes of the product—can be described in terms of its functional and experiential elements (e.g., Zarantonello, Jedidi, & Schmitt, 2013). In the literature, related distinctions have been defined and referred to using varying terminology, such as informational and transformational (Rossiter & Percy, 1987), utilitarian and value-expressive (Johar & Sirgy, 1991) and somewhat broader concepts as hard-sell and soft-sell (Okazaki, Mueller, & Taylor, 2010). Although many of these distinctions relate to a more general rational/emotional framework of advertising message strategy (Albers-Miller & Stafford, 1999), in the current study we will specifically focus on the distinction between functional and experiential ad appeals. Ads with a predominant functional appeal typically convey a message that focuses on factual information to explain why the consumer should like and buy a product. That is, the functional elements of an advertising message relate to a rational or utilitarian focus on product features, by including references to the product attributes, its use and performance, as well as the benefits and value that come with these features (Abernethy & Franke, 1996). In contrast, one of the key ideas of an experiential advertising appeal is that value does not only reside in the advertised good and its utilitarian and functional benefits, but that value also lies in the emotional and experiential elements associated with the good, and in the (indirect) experience of it (e.g., through advertisements; Holbrook & Hirschman, 1982; Schmitt & Zarantonello, 2013). Accordingly, a typical experiential appeal associates the product with desirable images or symbols and depicts what kind of experience results from using the brand. The experiential elements of an ad particularly evoke sensations, feelings, emotions, imaginations and behavioral responses (Brakus, Schmitt, & Zarantonello, 2009).

The issue of when a particular type of appeal should be employed has been extensively studied in the marketing and advertising literature. Researchers have posited that the effectiveness of the appeal largely depends on the advertised good itself. That is, several studies suggest that the appeal should match the product type, as, for instance, ads with a utilitarian focus are found to be more effective for utilitarian products (e.g., Johar & Sirgy, 1991). In some cases, however, advertisers may adopt an appeal that is rather incongruent with the product type. It has been shown that employing a more creative appeal with metaphorical instead of literal information for utilitarian products enhanced perceptions of sophistication and excitement, although at the cost of reduced perceptions of sincerity (Ang & Lim, 2006). Furthermore, advertisers may use incongruent (e.g., irrelevant or unexpected) messages to grab consumers' attention. Research on print ads shows that consumers' memory for information in the ad appeared to benefit most from incongruence created with unexpected but relevant information (Heckler & Childers, 1992).

Many ad appeals—also the ones of interest in the current study—contain, to some extent, both functional and experiential elements. Some research suggests that mixing emotional elements with rational information is rather ineffective. For instance, research on donation behavior shows that a narrative description of an identifiable victim led to higher donations than when the description was combined with statistical information about the cause (Small, Loewenstein, & Slovic, 2007). Moreover, eye-tracking studies of individuals viewing television commercials found that people were more likely to discontinue viewing when ads were both entertaining (i.e., warm, amusing, and playful) and informative (Woltman Elpers, Wedel, & Pieters, 2003). However, other studies have suggested that emotional content would be beneficial to any ad, independent of product category or level of involvement (e.g., Pham et al., 2013).

2.2. Processing functional and experiential ad appeals

As research on the persuasiveness of ad appeals has yielded inconclusive insights, it is crucial to understand how functional and experiential ad appeals are processed by consumers. Traditionally, the two approaches are believed to be effective through different routes to persuasion: targeting affect with experiential executional elements, and targeting cognitions with functional executional elements. Research suggests that positive brand attitude formation for information-based ads is predominantly driven by deliberate evaluations and beliefs (Yoo & MacInnis, 2005). Functional information may reduce uncertainty about the advertised product or brand (Abernethy & Franke, 1996). In contrast, positive brand attitudes for emotion-evoking ads may be predominantly driven by feelings (Yoo & MacInnis, 2005). Research has revealed that ad-evoked feelings of warmth exert a positive influence on ad liking and purchase intent (Aaker, Stayman, & Hagerty, 1986). How ad-evoked feelings affect positive brand attitudes has been widely studied in the literature, resulting in a range of different possible explanations. For instance, ad-evoked feelings may be associatively incorporated in brand evaluations through evaluative conditioning (e.g., De Houwer, Thomas, & Baeyens, 2001; Jones, Olson, & Fazio, 2010), or may affect brand evaluations indirectly through a more inferential process of affect-as-information (e.g., Schwarz & Clore, 1983).

More recent research has related differences in the processing of experiential and functional features to processing fluency (i.e., the subjective ease with which people process information; e.g., Alter & Oppenheimer, 2009). Processing-fluency theory distinguishes between fluent processing, which occurs spontaneously, and less-fluent processing, which is more deliberate and effortful. Brakus, Schmitt, and Zhang (2014) show that consumers can process experiential attributes (sensory and affective) both fluently and non-fluently. As the authors note, fluent processing of an experiential attribute is likely to occur when a consumer spontaneously receives an impression of the stimulus and responds without elaborating. Non-fluent processing of experiential attributes will occur when consumers do cognitively elaborate on such attributes. Their findings suggest that consumers will only process experiential attributes fluently when these experiential attributes are expected in the specific context, and that fluent processing is positively related to product liking. In contrast, their findings also suggest that consumers process functional attributes always deliberately, and need time to extract value from them.

2.3. The value of neuroimaging in measuring emotional and cognitive processes

Conventional measures that have been used to acquire insights into consumers' internal responses to different ad appeals and their specific elements are generally based on self-report measures, such as attitude to the ad and ad-evoked feelings (e.g., MacKenzie, Lutz, & Belch, 1986; Pham et al., 2013). These self-report measures are often based on an information processing framework that assumes that people are capable of introspecting successfully on their cognitions and feelings, and that these in turn relate to their choice. Relying on such measures might be risky in contexts in which the consumer is unaware of, or unable to report on, the actual ongoing cognitive and emotional processes. Importantly, research has shown that attempts to report on one's mental processes might actually change these processes (Dijksterhuis, 2004; Nisbett & Wilson, 1977; Wilson & Schooler, 1991). Moreover, most conventional methods do not allow for online measurement of internal states at the time of exposure to a marketing stimulus. Consequently, the time interval between exposure and evaluation might further increase susceptibility to biased reflections or self-justification processes. Hence, given the important role of internal processes in driving ad efficacy, more implicit methods that can increase the understanding of these immediate internal responses to advertisement materials are valuable and should be further explored.

Neuroimaging methods, such as fMRI, can serve as a valuable complement to conventional methods, providing insights into implicit processes that are typically difficult to access using other approaches. Using fMRI, the brain's response to marketing stimuli can be assessed in the form of a blood oxygenation level-dependent (BOLD) measurement, which is taken as a proxy for neural activation. Neuroimaging has been successfully applied to demonstrate dissociations between psychological processes and has revealed novel insights into how people process information. For instance, Sanfey, Rilling, Aronson, Nystrom, and Cohen (2003) have demonstrated the value of fMRI in investigating the relative contributions of cognitive and emotional processes to decision-making, revealing activity in brain regions related to both emotion and cognition in response to unfair offers in an ultimatum game and thereby providing novel insights into the role for emotions in economic decision-making. Although neuroimaging has challenges of its own (Plassmann, Venkatraman, Huettel, & Yoon, 2015), complementing conventional methods with neuroscience technology could set the stage for higher levels of sophistication in our understanding of how ad appeals are processed by consumers.

2.4. Rationale for current study

In this paper, we aim to build upon the extensive body of research on ad appeals by using innovative neuroimaging methods to advance our understanding of the different cognitive and emotional processes associated with advertising executional elements. Comparing a unique set of different television commercials for the same brand enabled us to investigate the influence of differences in advertisement appeal, in terms of its functional and experiential executional elements, on brain responses and subsequent advertisement effectiveness. In our experimental design, we combine data from three independent samples: (1) an fMRI neural focus group, to measure immediate neural responses to the television commercials; (2) a large sample of consumers in the population, to assess ad effectiveness for each commercial; and (3) a sample of advertising experts who assessed each commercial's appeal. Advertising effectiveness was measured here by the consumer's online information search behavior in direct response to a television commercial (i.e., click through rate to the product website). Hence, our main objectives were to explore the neural processes evoked by functional and experiential executional elements in advertisements and to demonstrate how these processes relate to ad effectiveness in an independent group of consumers.

3. Methods

3.1. Participants

3.1.1. FMRI group

Twenty-five participants were recruited for the fMRI experiment. We selected a heterogeneous audience for our commercials of interest: our group of participants varied in gender (12 male), age (range: 23–48 years; M = 36.52) and in educational background (highest qualification: high school = 4%; lower vocational education = 36%; higher vocational education = 44%; university (graduate level) = 16%). One male participant was excluded from the analyses, because he did not feel comfortable in the scanner and could not complete the experiment.

3.1.2. Population group

The population sample consisted of 1239 participants and was comparable to the fMRI sample with respect to gender (624 male), age (range: 25–55 years; M = 41.77) and educational background (highest qualification: elementary school or less = 6%; high school = 23%; lower vocational education = 32%; higher vocational education or university (undergraduate level) = 25%; university (graduate level) = 14%). Participants were randomly selected from a consumer panel hosted by a market research company.

3.1.3. Expert panel

We recruited 9 independent professionals with substantial knowledge and working experience (all >7 years) in advertising, marketing or communication as expert judges to evaluate the execution of each commercial on its functional and experiential dimensions.

3.2. Materials

Our stimuli consisted of a set of 11 television commercials for the same brand and product (i.e., a well-known muscle and joint gel), which were developed in the context of a competition between small and medium sized advertising agencies. The selected commercials were of comparable professional quality and equal length (all 20 s).

Although research has shown that the brain encodes low-level features of visual stimuli independently from higher-level features such as object properties and affective content (Chikazoe, Lee, Kriegeskorte, & Anderson, 2014), we checked for any variation in low-level visual features between commercials that could potentially covary with variables of interest in this study (i.e., the expert-rated executional elements and the ad effectiveness measure). Using the Image Processing Toolbox in Matlab 2012b, we extracted low-level visual features separately for each commercial to test for uniformity across commercials with respect to luminance (i.e., average pixel intensity per frame), luminance contrast (i.e., the standard deviation of pixel intensity per frame) and the amount of movement and cuts (i.e., the pixel-by-pixel correlation relative to the previous frame; the cross-frame correlation). All measures were computed on a frame-by-frame basis and then averaged over the commercial. One-sample Kolmogorov-Smirnov tests indicated uniformity across the commercials for luminance and luminance contrast (for both $p > 0.05$). Although cross-frame correlations were not uniformly distributed across commercials ($p < 0.05$), they did not correlate significantly with the expert-rated executional elements or the ad effectiveness measure. These results indicate that any findings related to our variables of interest cannot be attributed to differences in low-level visual features.

Furthermore, the commercials contained a highly similar voice-over text, but differed markedly in terms of specific execution style. We differentiated between the executional elements of the commercials using the expert judgments scale from Zarantonello et al. (2013), which consists of 9 formative items that pertain to the functional and experiential dimensions of an ad, respectively. The expert judges evaluated 5 functional elements of the commercials by indicating on a four-point scale to what degree the commercial focuses on product attributes ("To what degree does the ad focus on product attributes (i.e., the formulation or ingredients of the product and its features)?"), product applications (i.e., how the product has to be applied or used), product performance (i.e., what the product can do and its efficacy), functional benefits (i.e., the advantages for the consumer), and functional value (i.e., value for money or convenience of the product), respectively (1 = not at all present to 4 = strongly present). Finally, the experts indicated how functional the commercial was overall (i.e., a functional ad is an ad that includes the above and related characteristics; 1 = not at all functional to 4 = strongly functional). The experiential elements were assessed with 4 items that capture the degree to which the commercial uses or appeals to sensory elements ("To what degree does the ad use or appeal to sensory elements (i.e., colors and exciting visuals, music, touch, smell)?"), feelings and emotions (i.e., all kinds of feelings and emotions, either positive or negative), imagination and mental stimulations (i.e., thinking in a different, original and innovative way, approaching things from a new angle), and behaviors and actions (i.e., physical activities, specific actions, bodily experiences), respectively (1 = not at all present to 4 = strongly present). The experts also indicated how experiential the commercials were overall (i.e., an experiential ad is an ad that includes the above and related characteristics; 1 = not at all experiential to 4 = strongly experiential).

The 5 items on the functional dimension (i.e., "*Product Attributes*", "*Product Application*", "*Product Performance*", "*Functional Benefits*" and "*Functional Value*") and the 4 items on the experiential dimension (i.e., "*Sensory Elements*", "*Feelings and Emotions*", "*Imagination and Mental Stimulation*" and "*Behaviors and Actions*") constituted the executional elements of interest for this study. We decided not to use the 2 'overall' items in our analyses, since we were particularly interested in the (potentially different) processes in response to the specific functional or experiential executional elements that were effective in the current set of commercials. The 5 items on the functional dimension correlated generally highly (median: $r = 0.63$, range: $r = 0.33$ to $r = 0.83$). The 4 items on the experiential dimension, however, were more heterogeneous (median: $r = 0.31$, range: $r = 0.12$ to $r = 0.59$).

An inter-rater reliability analysis using the intraclass correlation statistic was performed on the 9 items, separately for each commercial, to determine consistency among raters. The median intraclass correlation was 0.83 (range: 0.63–0.95). To be more specific, the majority of the commercials (i.e., 9 out of 11 commercials) yielded intraclass correlations close to, or higher than 0.80, indicating excellent inter-rater reliability according to the guidelines of Cicchetti (1994). Two commercials were potentially more ambiguous to the raters, since their intraclass correlations were relatively lower as compared to the other 9 commercials (i.e., 0.63 and 0.66, which is still considered 'good' according to the guidelines of Cicchetti (1994)).

3.3. Procedures

3.3.1. FMRI study

Participants in our fMRI study passively (i.e., without any specific task) viewed all commercials four times (each commercial was shown twice within one run, two runs in total) in random order while their brain activity was recorded. The commercials were projected onto a screen at the back of the fMRI scanner, and participants viewed them through a mirror attached to the head coil. Participants wore headphones to be able to hear the auditory voice-over of each commercial. In-between the two runs, participants viewed a series of commercials for a branded food product that are not of interest for the current experiment. The experiment started with a 10 s fixation screen, to allow for longitudinal relaxation time equilibrium of the BOLD response. The presentation of each commercial was alternated with the same 10 s fixation screen. Each run lasted 12 min and total scanning time, including the anatomical scan, was approximately 55 min.

3.3.2. Population study

Participants in the population group were randomly assigned to passively view one of the eleven commercials in an online survey. After viewing the commercial, we provided participants with a choice to click through to the product website for more information and potential purchase of the product, or to finish the survey. Upon request by the company, the product was offered at a discount to stimulate overall purchase behavior on the product website. Participants were informed about the specific discount before they made the decision to click through or not. Although offering a discount could have added a price-sensitivity factor to participants' click-through behavior, this would be equally likely for all commercials and thus for all executional styles.

3.3.3. Expert judgments

The expert judges viewed all commercials in random order, and after viewing each commercial they filled out the expert judgments scale to evaluate its specific execution style. They were allowed to view each commercial several times to enable adequate assessment of its characteristics.

3.4. FMRI data acquisition parameters

We used a 1.5 T Siemens MRI scanner with a Siemens circular polarized head array coil to measure changes in BOLD response. Volumes were acquired with an interleaved slice acquisition and a T2*-weighted echo-planar imaging (EPI) pulse sequence (repetition time (TR): 3000 ms; echo time (TE): 40 ms; flip angle: 90°; matrix size: 80 × 80; resolution: 3 × 3 × 3.3 mm; field of view (FOV): 240 mm). In addition, we acquired T1-weighted high-resolution anatomical images using a MP-RAGE sequence (TR: 2040 ms; TE: 3.93 ms; flip angle: 15°; matrix size: 256 × 256; resolution: 1 × 1 × 1 mm; FOV: 256 mm).

3.5. FMRI data preprocessing

We preprocessed and analyzed the neuroimaging data using standard software (SPM8, Wellcome Department of Cognitive Neurology, London, UK). To correct for head motion, the functional images were realigned to the mean image within each run and motion parameters were added to the first-level general linear models as regressors of no interest. Functional images were coregistered to the anatomical image, spatially normalized to the Montreal Neurological Institute (MNI) template and spatially smoothed with a Gaussian kernel (9 × 9 × 10 mm full width at half maximum).

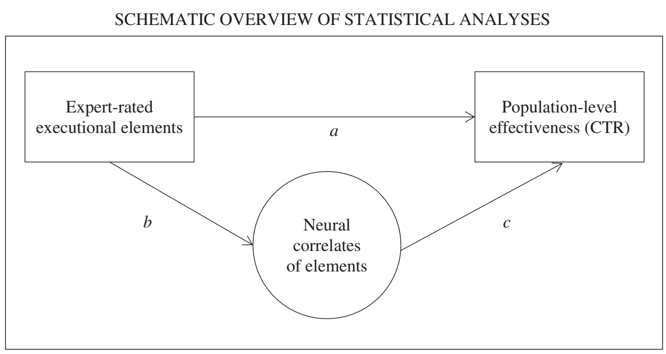

Fig. 1. Schematic overview of statistical analyses.

3.6. Statistical analyses

To investigate the neural processes evoked by functional and experiential executional elements and how these processes relate to ad effectiveness, we conducted a series of statistical analyses (see Fig. 1 for a schematic overview).[1] First, we assessed which of the expert-rated executional elements were significantly related to population-level ad effectiveness (see Fig. 1, relationship *a*). Our population-level data provided two potential measures of ad effectiveness: the decision to click-through to the product website and actual purchase of the advertised product. As our commercials advertise a utilitarian product type (i.e., a muscle gel), the decision to purchase is likely to be determined to a large extent by an actual 'need' for this product (i.e., muscle pain). As this specific 'need' was neither required nor assessed within our sample, we did not expect the number of purchases to be particularly high. Correspondingly, the data showed that the total percentage of participants across all eleven commercial-conditions that purchased the product was only 1%. Taking the characteristics of our product type into account, we used click-through rate (CTR; i.e., the percentage of participants in the population group who clicked through to the product website) as our core measure of ad effectiveness. Click-through behavior reflects participants' interest in the product as evoked by the advertisement, which could be a precursor of future purchase. The percentage of participants in our population group clicking through to the product website after viewing one of the commercials ranged from 6.20% to 16.35% (M = 9.67%). As a second step, we examined the brain regions engaged by the functional and experiential executional elements (see Fig. 1, relationship *b*). Third, we analyzed whether activity in these brain regions while participants were viewing the commercials was predictive of CTR (see Fig. 1, relationship *c*).

More specifically, to assess the relationship between the nine executional elements and population-level CTR (i.e., relationship *a* in Fig. 1), we ran a stepwise linear regression model with the expert-rated executional elements (standardized per expert) as predictors in the model and CTR as the dependent variable. Those executional elements that were most predictive of ad effectiveness constituted the elements of interest in the following analyses.

The fMRI data analysis proceeded in several steps. To investigate the neural correlates of the executional elements identified in the previous step (i.e., relationship *b* in Fig. 1) we first estimated a first-level general linear model (GLM) for each participant separately. For each run, neural responses to the commercials were modeled with a boxcar regressor based on the twenty-two onset times of all commercials, each with a duration of 20 s, convolved with a canonical hemodynamic response function (HRF). This means that we averaged the neural response per commercial, per individual. We then defined a parametric modulator to this main regressor which consisted of the mean-centered expert-rated executional elements for each commercial. The linear expansion of the parametric modulator predicted that as the rating values increased, there would be a related increase in brain activity. Six motion parameters (capturing the movement of subjects in the scanner) were added to the models as regressors of no interest. In order to remove non task-related low frequency signal changes, we included three additional nuisance regressors which capture the time-course of activity in areas that should not show any task-related activity (i.e.; in white matter, cerebrospinal fluid and the area outside the brain). Next, we created contrast images summarizing differences in brain activity as evoked by the commercials that correlate with each of the expert-rated executional elements. The beta maps resulting from fitting each of these parametric regressors were tested at the group level as one-sample *t*-tests.

To assess whether the neural activity within the regions related to the executional elements of interest was predictive of ad effectiveness (i.e., relationship *c* in Fig. 1), we constructed regions-of-interest (ROIs) within those identified brain regions (6 mm radius spheres around the most significant voxels), and extracted parameter estimates from the selected voxels using MarsBaR (Brett, Anton, Valabregue, & Poline, 2002). We included these parameter estimates as fixed effects in a multi-level linear regression model with random intercepts for participant and run, and with CTR as response variable.

4. Results

4.1. Identifying the most effective executional elements

The results of the stepwise linear regression model, assessing the relationship between the expert-rated executional elements and population-level CTR (i.e., relationship *a* in Fig. 1), show that a model including both the functional element "*Functional Benefits*" as well as the experiential element "*Imagination and Mental Stimulation*" has the best fit with the observed data ($R^2 = 0.169$, $F(1,96) = 5.204$, $p < 0.05$). See Table 1 for the model coefficients. None of the remaining elements added significantly to this model ($p > 0.11$). Moreover, the interaction between "*Functional Benefits*" and "*Imagination and Mental Stimulation*" also did not improve the model significantly ($p = 0.13$), although the positive regression weight ($b = 0.164$) might suggest an amplification effect.

As these results indicate, the executional elements "*Functional Benefits*" and "*Imagination and Mental Stimulation*" are independently related to ad effectiveness, which thus suggests that those commercials that do not only demonstrate the functional benefits of the product (i.e., the advantages for the consumer), but also appeal to imagination and mental stimulation (i.e., thinking in a different, original and innovative way, approaching things from a new angle) are most effective here in motivating online search behavior. See Fig. 2 for a graphical representation of each of the eleven ads on "*Functional Benefits*" and "*Imagination and Mental Stimulation*", and its resulting CTR.

[1] Although we assume a mediation model, a formal multi-level mediation analysis could not be performed on these datasets, as both the independent and the dependent variable were measured on the commercial-level, and thus do not vary across participants in the fMRI sample.

Table 1
Executional elements predicting click-through rate.

Dependent	*Step*	*Predictor(s)*	*Coefficients*		*Change Statistics*		
			β	*t*	*R Square Change*	*Total R Square*	*F(df1,df2)*
CTR	1	Functional Benefits	0.352***	3.707			
					0.124	0.124	13.739(1,97)***
	2	Functional Benefits	0.299**	3.117			
		Imagination and Mental Stimulation	0.219*	2.281			
					0.045	0.169	5.204(1,96)*

Notes: ***$p < 0.000$; **$p < 0.01$; *$p < 0.05$. Forward stepwise linear regression with probability to enter the model ≤0.05. Expert-ratings were standardized for each expert.

4.2. Neural responses to functional and experiential elements

To provide insight into the neural responses to experiential and functional elements (i.e., relationship *b* in Fig. 1), we explored the neural substrates associated with the two most effective executional elements as identified by our previous analyses. The results reveal that the more prominently the functional element "*Functional Benefits*" is present in the commercials, the higher the activity in, predominantly, the temporal cortex, including the inferior temporal gyrus (ITG), the middle temporal gyrus (MTG) and the parahippocampal gyrus (PHG), and to a lesser extent the dorsolateral prefrontal cortex (DLPFC; the middle frontal gyrus (MFG)). For a complete overview of these results, see Table 2a and Fig. 3a. Additionally, the stronger the commercials appeal to the experiential element "*Imagination and Mental Stimulation*" the higher the activity in, predominantly, the DLPFC (i.e., precentral gyrus extending into the inferior frontal gyrus (IFG) and the MFG), and to a lesser extent the temporal cortex (i.e., ITG and MTG). See Table 3a and Fig. 3b for a more detailed overview of these results.

As the previous results reveal that similar brain regions are engaged by the functional and the experiential executional elements (i.e., both elements engage the temporal cortex and the DLPFC), we additionally examined to what extent these executional elements are processed independently from each other. To this end, we corrected the signal increase related to "*Functional Benefits*" for activations related to "*Imagination and Mental Stimulation*" and vice versa. First, we ran a general linear model including two parametric modulators: the first one modelling "*Imagination and Mental Stimulation*" and the second one modelling "*Functional Benefits*". The parametric modulators were serially orthogonalized, meaning that any variance associated with the functional element was removed when reporting activity related to the experiential element. Thus, the neural correlates of "*Functional Benefits*" resulting from fitting this model reflect unique neural responses that are independent from those related to the experiential element. Interestingly, the results show that activation in the temporal cortex (e.g., MTG, ITG and PHG) was uniquely related to the

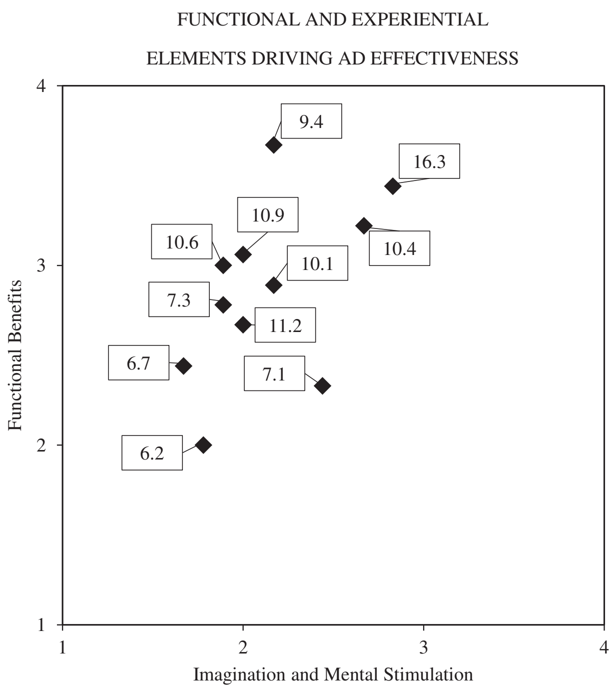

Fig. 2. Functional and experiential elements driving ad effectiveness. Notes: Scatterplot of mean expert ratings on items "*Functional Benefits*" and "*Imagination and Mental Stimulation*" for the eleven commercials. Data labels represent the percentage of people in the population group clicking through to the product website in response to the commercial.

Table 2
Neural correlates of Functional Benefits.

Region	*Hemisphere*	*MNI Coordinates*			*Cluster Size*	Z
		x	y	z	k voxels	
a) Functional Benefits						
Inferior Occipital Gyrus extending into Middle Temporal Gyrus and Inferior Temporal Gyrus	L	−45	−79	−7	782	5.53*
DLPFC: Middle Frontal Gyrus	R	39	2	39	191	4.77*
Cerebellum	L	−12	−70	−24	70	4.72*
Middle Temporal Gyrus	R	57	−46	3	527	4.62*
Parahippocampal Gyrus	L	−30	−1	−24	25	4.62
b) Functional Benefits corrected for Imagination and Mental Stimulation						
Inferior Occipital Gyrus extending into the Middle Temporal Gyrus and Inferior Temporal Gyrus	L	−45	−70	−13	830	5.60*
Middle Temporal Gyrus	R	45	−58	6	395	5.17*
Middle Occipital Gyrus	L	−12	−94	−1	102	4.35
Fusiform Gyrus	R	42	−46	−20	38	4.14*
Cingulate Gyrus	R	18	11	29	12	3.51
Parahippocampal Gyrus	L	−30	−1	−24	10	3.51
Cuneus	R	24	−82	16	12	3.36

Notes: Regions listed exceed threshold of $p < 0.001$ uncorrected, with at least 10 contiguous voxels. Regions denoted with an asterisk exceeded threshold of $p < 0.05$ FWE corrected on the cluster-level. *Z*-values for each peak are given. Abbreviations: R = Right, L = Left, DLPFC = dorsolateral prefrontal cortex. $N = 24$.

functional element, whereas activity in the DLPFC was not (see Table 2b for an overview of the results). Similarly, to investigate to what extent the experiential element was processed independently from the functional element, we ran another general linear model with two parametric modulators, the first one modelling "*Functional Benefits*" and the second one modelling "*Imagination and Mental Stimulation*". The results indicate that activity in the right DLPFC, but not in the temporal cortex, was uniquely related to the experiential element (see Table 3b for an overview of the results).

4.3. Neural predictors of click-through rate

Next, we examined how activity in the previously identified brain regions relates to our ad effectiveness measure (i.e., relationship *c* in Fig. 1). We constructed two ROIs within those brain regions that we found to be both uniquely and most significantly related to the respective functional or experiential element. One ROI was constructed within the brain region that was most

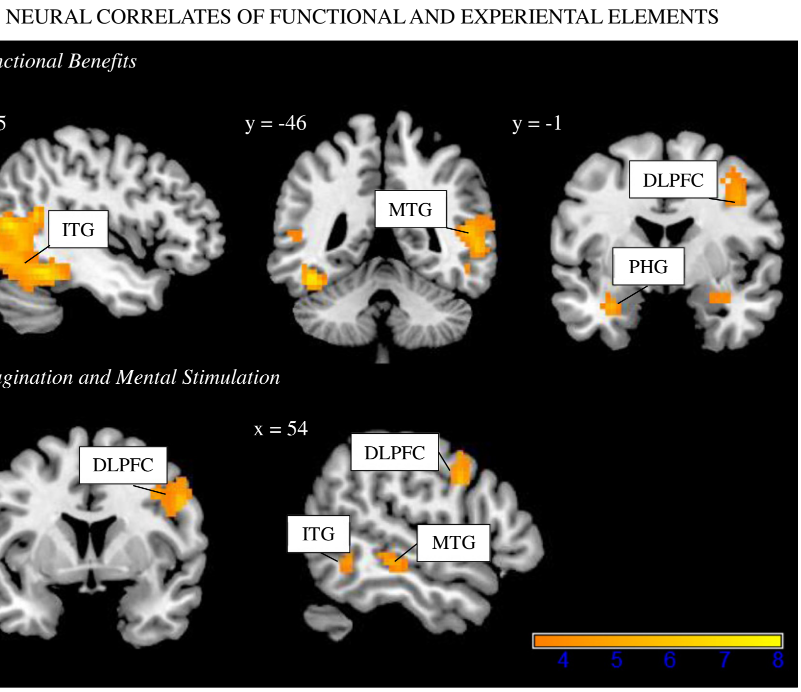

Fig. 3. Neural correlates of functional and experiential elements. Notes: a) neural correlates of "*Functional Benefits*"; b) neural correlates of "*Imagination and Mental Stimulation*". Displayed brain activity exceeds threshold of $p < 0.001$ uncorrected, with at least 10 contiguous voxels. Color bar represents *t*-statistics. See Tables 2 and 3 for more details not shown here.

Table 3
Neural correlates of Imagination and Mental Stimulation.

Region	Hemisphere	MNI Coordinates			Cluster Size	Z
		x	y	z	k voxels	
a) Imagination and Mental Stimulation						
DLPFC: Precentral Gyrus extending into Inferior Frontal Gyrus and Middle Frontal Gyrus	R	54	5	32	109	4.47*
Cerebellum	L	−15	−76	−37	62	4.45*
Middle Temporal Gyrus	R	57	−28	−7	27	4.08
Inferior Temporal Gyrus	R	54	−49	−7	12	3.69
Middle Temporal Gyrus	L	−48	−55	−4	11	3.56
b) Imagination and Mental Stimulation corrected for Functional Benefits						
DLPFC: Inferior Frontal Gyrus	R	51	5	32	16	3.92
Medial Prefrontal Gyrus	L	−6	47	26	13	3.38

Notes: Regions listed exceed threshold of $p < 0.001$ uncorrected, with at least 10 contiguous voxels. Regions denoted with asterisk exceeded threshold of $p < 0.05$ FWE corrected on the cluster-level. Z-values for each peak are given. Abbreviations: R = Right, L = Left, DLPFC = dorsolateral prefrontal cortex. $N = 24$.

strongly engaged by the element "*Functional Benefits*" (i.e., the left ITG; we took a sphere of 6 mm radius around the peak voxel (slightly shifted dorsally to make sure it fell entirely within the brain): x = −45, y = −68, z = −11), and one within the brain region that was most strongly engaged by *"Imagination and Mental Stimulation"* (i.e., the right DLPFC; a sphere of 6 mm radius around the peak voxel: x = 51, y = 5, z = 32).

The results of the multi-level linear regression model, assessing the relationship between the activity within these two ROIs and population-level CTR, reveal that neural activity within the DLPFC ROI is a significant predictor of CTR (b = 0.014, p = 0.014), and that neural activity within the ITG ROI is a directionally significant predictor of CTR (b = 0.008, p = 0.086). These ROIs significantly predict CTR as compared to an intercept-only model (χ^2 (2) = 10.745, $p < 0.005$). Hence, the extent to which the brain regions associated with the most effective functional and experiential elements were activated while viewing the commercials, predicted the successfulness of the commercials in stimulating click-through behavior. See Table 4 for an overview of the fixed predictor effects.

To explore whether brain regions other than those activated by the two most effective functional and executional elements might also be related to higher CTR, we ran another general linear model on the fMRI data and included the mean-centered CTR values for each commercial as a parametric modulator in the model, and plotted the resulting neural correlates of CTR at different thresholds of significance. As illustrated in Fig. 4, the ITG and DLPFC are the only two regions that are positively correlated with CTR, even at very liberal significance levels (i.e., from $p < 0.01$, uncorrected). These results suggest that activity in this particular combination of brain regions—those regions engaged by the functional element (i.e., ITG) and the experiential element (i.e. DLPFC)—is related to higher ad effectiveness in an independent sample.

5. Discussion

The main objective of this study was to explore the neural processes evoked by different executional elements in advertisements using fMRI methodology, and to demonstrate how these processes relate to out-of-sample advertising effectiveness. The unique set of eleven commercials for the same brand enabled us to investigate the influence of differences in ad appeal on neural responses and subsequent ad effectiveness, while keeping other factors (i.e., brand, product type, ad duration) constant.

Our findings reveal that ads demonstrating the functional benefits of the product (i.e., a focus on the advantages for the consumer), and appealing to imagination (i.e., thinking in a different, original and innovative way, approaching things from a new angle) were most effective here in stimulating click-through behavior. Ads successfully employing these specific functional and experiential executional elements more strongly engaged a particular combination of brain regions, including regions in the temporal cortex and the DLPFC. More specifically, the functional element ("*Functional Benefits*") was associated mostly with responses in the temporal cortex, while the experiential element ("*Imagination and Mental Stimulation*") particularly evoked neural responses in the DLPFC. Furthermore, we found the neural activity within these particular brain regions in response to viewing the television commercials to be significantly predictive of ad effectiveness in an independent sample of consumers, adding to previous findings in the decision neuroscience literature showing that neural responses in a limited number of subjects can be used to predict preferences of the population at large (e.g., Berns & Moore, 2012; Boksem & Smidts, 2015; Falk, Berkman, & Lieberman, 2012; Venkatraman et al., 2015).

Table 4
Neural predictors of ad effectiveness.

Dependent	Predictors	Fixed Effects			
		b	SE	t	p
CTR	ITG ROI	0.008	0.004	1.794	0.086
	DLPFC ROI	0.014	0.005	2.694	0.014

Notes: Results of the multi-level linear regression model with random intercepts for run and participant.

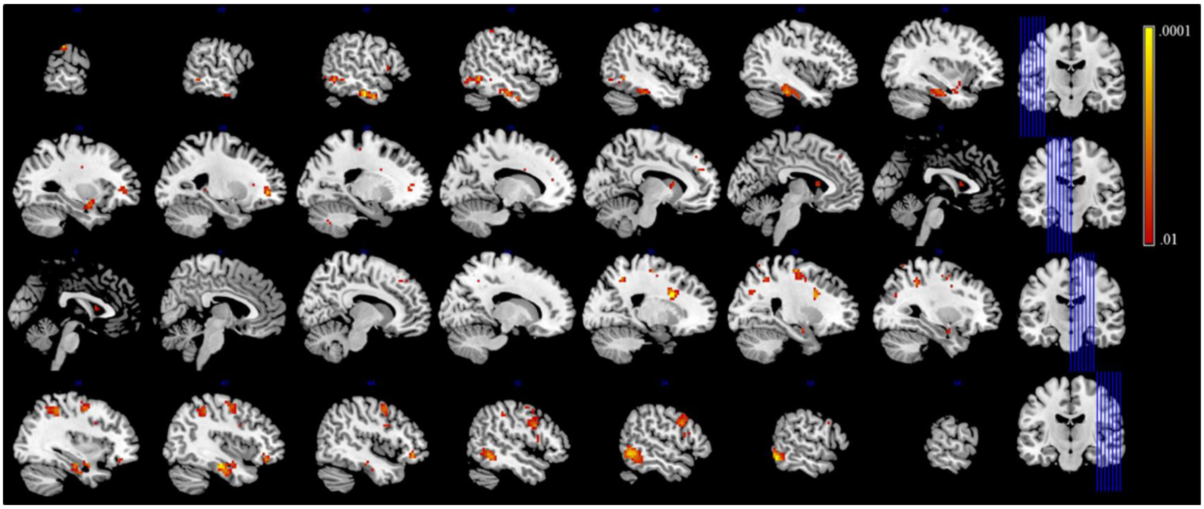

Fig. 4. Neural correlates of click-through rate. Notes: Neural activation map for the parametric modulation of population-level CTR with the BOLD response. Each image represents a slice of the brain (location of the slices is indicated in blue on the rightmost images). Resulting t-values for each voxel were transformed to −log10 *p*-values to improve visualization and interpretability. Color bar represents the corresponding *p*-values. The upper and lower rows reveal activations in the temporal cortices; de lower row also reveals activations in the right DLPFC.

Previous neuroimaging studies have demonstrated that the temporal cortex is involved in lower-level cognitive processes, such as object identification, recognition and interpretation (e.g., Bar et al., 2001). The temporal cortex thus plays an important role in rapidly identifying '*what*' things are, and constitutes an important hub in the so-called ventral stream, or the '*what pathway*', of visual processing (Goodale & Milner, 1992). More specifically, the left MTG has been found to be engaged when people identify objects that serve a specific purpose (e.g., tools; Johnson-Frey, 2004; Martin, Wiggs, Ungerleider, & Haxby, 1996) and actions associated with the use of these objects (Damasio et al., 2001). In particular, the ventral and lateral temporal cortices are activated when people are asked to answer questions on how to use tools and other objects, suggesting that these areas store information about specific object attributes and which actions may be performed when using these objects (Chao, Haxby, & Martin, 1999). Here, we found this area of the brain to be specifically associated with the degree to which references to functional benefits were present in the ads, suggesting that processes related to identifying the potential use of a product may be engaged when this functional element is present in the ad.

In summary, given that we find regions in the temporal cortex to specifically respond to those commercials that convey information on the functional benefits of the advertised product, while activation in the ITG was also found to predict CTR, our results suggest that effective processing of information on the product itself and on how the product should be used may lead to increased success of the commercial at the population-level.

Our findings also demonstrate an important role for experiential elements in driving ad effectiveness in our set of commercials. We show that neural responses in the right DLPFC were particularly evoked by experiential elements in commercials that appeal to imagination and take a more original, innovative perspective, while increased activation of this region was also predictive of CTR. Previous research has shown that the DLPFC is associated with higher-level cognitive processes such as sustained attention and working memory, processes which are critical for enabling creative thought (for a review see Dietrich (2004)), such as insight problem solving ('aha!') or creating fluid analogies (e.g., Geake & Hansen, 2005). Ellamil, Dobson, Beeman, and Christoff (2012) show the role of the DLPFC in creative evaluation as well, as participants showed higher DLPFC (including MFG and IFG) activations when evaluating creative ideas, and suggest that this executive brain region enables an analytic mode of information processing that facilitates evaluation of the utility of novel ideas.

Taken together, these findings may suggest that this specific experiential ad element appealing to imagination and mental stimulation effectively stimulates higher-level cognitive thought processes, subserved by the DLPFC, which in turn are related to higher population-level ad effectiveness.

In summary, we aimed to provide insights into implicit mental processes in response to advertisements that are typically difficult to access using other approaches. In a first attempt to explore the neural responses to different ad appeals, we dissociate brain regions responding to specific functional and experiential executional elements in ads, and show that activation of these brain regions was associated to higher ad effectiveness. This study contributes to the discussions in the existing literature on the processing of ad appeals by providing insights that generate novel hypotheses. Our fMRI findings do not seem to support a simple cognitive / emotional framework that has been assumed in previous literature (e.g., Albers-Miller & Stafford, 1999), in which functional executional elements target cognitions and experiential elements target affect, but instead suggest a distinction along the lines of lower- and higher-level cognitive processing. Our findings suggest that a functional appeal engages rapid processes related to the recognition, identification and detection of relevant information from incoming visual input depicting benefits of the advertised product. However, in contrast to the results of Brakus et al. (2014), we did not find evidence for any deliberative reasoning processes indicating more cognitive elaboration in response to this functional information. It could be that passively viewing television commercials does not necessarily involve reasoning processes per se, or that functional information is more anticipated when the advertised good is utilitarian and thereby does not call for further cognitive, effortful elaboration. These hypotheses should be further explored in future research.

Our findings do reveal higher-level cognitive processes to be engaged by the experiential appeal to imagination, which might support earlier research showing that more original ways to convey a message may draw more attention to the advertised brand (Pieters, Warlop, & Wedel, 2002). As the commercials advertised a utilitarian product, an experiential appeal to imagination could be more surprising here, and thereby draw more attention or generate cognitive elaboration. Moreover, our finding that higher-level processes are engaged by this specific experiential element seems to support the findings of Brakus et al. (2014), suggesting that experiential elements can be processed less fluently. While they find less fluent processing to be negatively related to liking, we find the potentially more effortful processing of this experiential executional element to be related to higher ad efficacy.

6. Managerial relevance

Practitioners' interest in consumer neuroscience research has recently been increasing, and the number of specialized neuromarketing research companies involved in ad testing is growing (Plassmann, Ramsøy, & Milosavljevic, 2012; Smidts et al., 2014). Higher levels of activity in the brain regions involved in reward processing are typically perceived as indicators of ad efficacy, building upon previous research in decision neuroscience demonstrating that these reward-related regions of the brain (notably the ventral striatum and the (ventral) medial prefrontal cortex) are predictive of future choice (e.g., Falk et al., 2012; Knutson, Rick, Wimmer, Prelec, & Loewenstein, 2007; Levy, Lazzaro, Rutledge, & Glimcher, 2011; Venkatraman et al., 2015). However, as this study illustrates, no single brain region is responsible for consumer choices, and responses to marketing efforts are likely to depend on an array of neurobiological processes. In particular, this will be the case for complex dynamic stimuli such as television commercials. A focused interest in these specific regions (e.g., by using only a priori defined ROIs) might therefore be limiting, as other informative (and predictive) brain activations could be overlooked. Our findings suggest that neural activity outside the reward-related areas can be predictive of advertising efficacy, and can be meaningful in understanding *why* a commercial is effective when related to specific advertising executional elements.

7. Limitations and future research

In general, caution is required for the interpretation of neuroimaging findings if reverse inference is applied (Plassmann et al., 2015; Poldrack, 2006). Reverse inference can be defined as a form of reasoning by which the engagement of a cognitive process is inferred from the activation of a particular brain region. The deductive validity of such inferences can be limited, as a given brain region may be involved in multiple cognitive processes. Given the explorative nature of the current study, our interpretation of the findings should be treated as 'hypothesis-generating' rather than conclusive. Hence, strictly speaking, future theory-driven research is necessary to confirm whether our interpretations of the underlying mental processes hold when tested with an experimental design that directly manipulates these predicted underlying processes.

In the present study, we used eleven commercials for the same, utilitarian, low-involvement product. For this particular set of commercials, we found the demonstration of its functional benefits, as well as an appeal to imagination to be effective in activating brain regions predictive of click-through behavior. However, it could be that in a set of commercials for another product, different functional or experiential elements could drive effectiveness. Future research should investigate whether similar or different brain regions are engaged for those functional or experiential executional elements that are relevant in ads for a different product. Moreover, it would be interesting to explore whether employing an ad appeal focusing on functional benefits and imagination would result in similar neural responses when a more hedonic or high-involvement product is advertised. It should also be noted that, in contrast to the items on the functional dimension, the items on the experiential dimension did not correlate highly. Due to this heterogeneity within the experiential dimension, findings related to "*Imagination and Mental Stimulation*" should not be generalized to any 'experiential appeal', as other experiential executional elements may be processed differently.

Finally, we averaged the neural responses per commercial, per individual. It would be valuable to be able to assess the dynamics of the neural response, and to capture those scenes within the commercials that are particularly effective. Moment-to-moment measures would further increase the actionability of neuroimaging findings. Future research is required to investigate how such temporal dynamics could be tested using fMRI.

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