

# The Synesthesia effects of Online Advertising Stimulus Design on Word-of-Mouth and Purchase Intention: From the Perspective of Consumer Olfactory and Gustatory

*Full Papers*

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## Abstract

Multisensory marketing has been seen as an approach improving advertising effect in the social science, neuroscience, and marketing literature. For examining visual/audio synesthesia, the effect of smelling and tasting an online product, this study first developed design elements of digital video advertising: rational/emotional appeals and fast/slow tempo. Moreover, it strives to investigate empirically the effects of various online advertisement contexts on consumer emotion, attitude, and behavioral intention. We used event-related potentials (ERPs) in a scenario-based laboratory experiments. Data collected from 166 customers provide strong support for the research model. Through EEG and SEM analyses, in rational advertisings, consumers' olfactory was triggered and both arousal and pleasure of the emotions affected the attitudes; in emotional advertisings, not only olfactory but gustatory were triggered and only pleasure affected the attitudes. By understanding online advertising design and synesthesia, insights from the findings can benefit designers and marketers in implementing more effective marketing strategies.

## Keywords

Online advertising effectiveness, synesthesia, EEG, pleasure, arousal, attitude toward advertising, purchase intention, word-of-mouth.

## Introduction

With the development of social media, digital media has been filled with all kinds of advertising, exposing consumers to a large quantity of commercials. According to the announcement of IAB (Interactive Advertising Bureau) (2015), online advertising revenues in America for the first half of 2015 amounted to \$2.75 billion, an increase of 19% compared to \$2.31 billion in the first half of 2014. In addition, according to the statistics of Strategy Analytic (2015), traditional advertising takes up 70% of the total expenditure. It is expected that it will decline to 64% in 2018. This is an indication that digital or online advertising will transcend traditional advertising to become the mainstream form of advertisement in the future.

However, how online advertising validly impress consumers is worth noting. Since consumers cannot practically touch a product, the method for presenting online advertising is particularly important. Multisensory marketing has been regarded as a way to enhance advertising effects (Fenko et al., 2014). Synesthesia is known as sensory complexes, when a type of sensory stimulation is received, it will induce another sensations (Cytowic, 2002 ; Mattingley et al., 2001). For instance, when we taste a certain food (gustatory), we associate it with the appearance of the food (visual) (Cytowic, 1993). When we hear a certain sound (auditory), we associate it with the smell of a specific food (olfactory) (Beeli et al., 2005). However, previous studies on online advertising merely involve visual and auditory stimulus (Parsons, 2002), and the unique gustatory senses (Elder & Krishna, 2010) remain scarce. Therefore, we argue that

even in a visual and auditory control of network environment, different combinations of senses can be applied to stimulate consumers' other sensory perceptions.

In recent years, many researchers from the marketing field have incorporated EEG in cognitive neuroscience and neuroeconomics to discuss the sensory (Gulas & Bloch, 1995; Li, 2008). EEG (electroencephalography) can be defined as the measurement of placing electrodes on the scalp to measure brain activity and response by scanning the electrical signals (Liberios et al., 2014). According to the olfactory imagery (or odor imagery) study, it is confirmed that the neural network during actual smell perception and olfactory imagery has overlapping parts. Additionally, EEG (electroencephalography) analysis is the most direct way to observe sensory stimulation (Zald & Pardo, 2000; Simmons et al., 2005; de Souza et al., 2013; Krishna, 2014). Therefore, video advertising in four different advertisement contexts is used to measure the olfactory and gustatory sense by using EEG.

Previous research indicates that consumers' behavioral result after watching a commercial is related to emotions (Hall, 2002) and concretely manifested in consumer decision-making (Comiati & Negrea, 2009). From the perspective of consumers, we discuss the positive and negative emotions of consumers toward online advertising, and measure attitude toward advertising in order to examine the effect of consumers' behavior intention and word-of-mouth. Through marketing approach, how to effectively enhance the advertising product is explored, and served as a reference for advertising designers.

## **Literature background and hypotheses**

### ***P-A-D and attitude toward advertising***

Pleasure-arousal-dominance (P-A-D) is regarded as the most fundamental description of emotions (Havlena & Holbrook, 1986). Pleasure refers to the positive and negative emotional state of an individual under a certain situation. Arousal refers to the relatedness between an individual's physiological and psychological function under a certain stimulus. Dominance refers to an individual's tendency to control others and environment under a certain situation (Russell & Mehrabian, 1977). However, Russell (1979) pointed out that pleasure and arousal are both able to fully explain emotional response. Meanwhile, Russell & Pratt (1980) mentioned that dominance involves individual's cognitive judgment, rather than emotional level. Moreover, researches also indicated that D (dominance) has been verified to be the weakest part of P-A-D scale (Mehrabian 1980; Ridgway et al., 1990). Thus, this study only discuss customer emotions from two emotional dimensions: P (pleasure) and A (arousal).

Pleasure is an affective evaluation during actual consumption (Mattila & Wirtz, 2006). Attitude toward advertising refers to the consumer's positive feeling after being exposed to an advertising stimulus (Shimp, 1981). Consumer produces different emotional intensity when they receive advertising stimulus, the more positive and emotional advertisement is, the stronger emotional intensity they produce, and then the higher customer's positive emotion toward advertising (Moore & Harris, 1996). Advertising with entertainment indicates a higher hedonic function, which has been proven to be positively related to attitude toward advertising and the greater degree of pleasure on the part of consumers (Alwitt & Prabhakar, 1992; Mittal, 1994). Thus, we propose the following hypothesis:

H1a: Emotional pleasure is positively related to attitude toward advertising.

Arousal reflects an emotional dimension of how excited or calm a person feels (Xie & Lee, 2008). Consumers have greater arousal toward a product tend to enhance the emotional intensity of the product, and the more positive attitude toward the brand (Grigorovici & Constantin, 2004). Previous study indicated that in a virtual environment, strongly arousal often reflect a higher brand attitude (Nelson et al., 2006). Therefore, we hypothesize that arousal has a positive impact on attitude toward advertising.

H1b: Emotional arousal is positively related to attitude toward advertising.

### ***Attitude toward advertising and WOM***

Word-of-mouth (WOM) is defined as a products, services, or any communication media that deliver messages among individuals (Brown et al., 2005). Prior studies showed that attitude can positively affects word-of-mouth after consumers purchase a certain product (Knauer, 1992). After using a specific product,

customer develops a certain degree of product satisfaction (Kotler, 2000). Thus, the higher the product satisfaction, the higher the customer value (Petrick, 2004); the higher the customer value, the more likely it is to spread word-of-mouth transmission (Babin et al., 2005). Therefore, the more positive consumers are toward a product, the more willing they are to give positive evaluation (Park & Lee, 2009). Thus, we proposed:

H2: Attitude toward advertising is positively related to word-of-mouth.

**Attitude toward advertising and purchase intention**

Purchase intention refers to consumers’ actual willingness to purchase a certain product, the vital predictor for actual purchase behavior (Grewal et al., 1998). According to the Theory of Reasoned Action in 1975, an individual’s attitude tend to affects behavioral intention (Fishbein & Ajzen, 1975). Exciting advertisements attract consumer’s attention, it brings pleasant memories in consumers mind and help them learn about the product quality, thereby enhancing consumers’ fondness and positive buying attitude towards the advertising product (Usman et al., 2010). The more positive customers’ attitude is towards a product, the better their desire and purchase intention will be induced. Therefore, attitude toward advertising indeed directly affects purchase intention of the brand (Mitchell & Olson, 1981). Thus, the following hypothesizes is proposed:

H3: Attitude toward advertising is positively related to purchase intention.

**Research methodology**

**Research methodology**

This research uses stimulation of olfactory/gustatory sense as external variables. The purpose is to understand the sensory trigger by different online advertising designs, and then investigates the positive effect of advertisement contexts on consumer emotions, attitude, and behavior intention. According to P-A scales, emotions are divided into two dimensions: pleasure and arousal, to explore the impact between emotions and attitude toward advertising. Moreover, by combining Theory of Reasoned Action, word-of-mouth and purchase intention these two antecedents of behavioral intention are discussed. Through attitude positively influence behavioral intention, in order to further understand consumers’ willingness of word-of-mouth and purchase intention on advertising product.

**Online advertising stimulus design**

In this research, we used advertising appeals, an important element that can attract target audience, and music for design four types of advertisement contexts (see Table 1). As for advertising appeals defined by Belch & Belch (2003), the rational/informational appeals and emotional appeals are served as the main basis. Rational advertising emphasizes on the content authenticity, which are presented in informational text. Emotional advertising outlines product characteristics through non-informational dynamic images. As for music, we adopted the background music fast and slow tempo as the basis which is defined by Duncan (1996): fast tempo is higher than 90 beats per minute, the slow tempo is between 60-65 beats per minute. Additionally, we uniformly used classical music to avoid compromising results due to the varied music preferences of the participants. According to the music cognition research by Schellenberg et al. (2007), the fast/slow tempo music are divided into the following two types: fast tempo for the Mozart’s Sonata for 2 Pianos in D major, K.448, slow tempo for the Albinoni’s Adagio in G Minor.

	Rational appeal	Emotional appeal
Fast-tempo	R-F, fast-tempo and text	E-F, fast-tempo and dynamic images
Slow-tempo	R-S, slow-tempo and text	E-S, slow-tempo and dynamic images

**Table 1: Online advertising context classification**

Note: Rational appeal/fast-tempo (R-F), Rational appeal/slow-tempo (R-S), Emotional appeal/fast-tempo (E-F), Emotional appeal/slow-tempo (E-S)

## Participants

One hundred and sixty-six college students (63 males and 103 females, with ages ranging from 20 to 25 years) were found to be without medical implants, mental disorders. The whole experiment carried out for two months. From the perspective of marketing, young adults are a major potential customer group in the marketing, thus they have relative value in Business Research (Campbell, 1999; Moschis, 1987). Therefore, the participants in this experiment were mainly university students.

## Experimental design and procedure

This research adopted the ERP approach and a 2 (rational appeal vs. emotional appeal)  $\times$  2 (fast-tempo vs. slow-tempo) measure design. The experiment comprised six main steps and were conducted in a sound-proof room. First, we briefed participants on the introduction of the experiment and show a picture of simulated website with an advertising in it, and asked them to imagine that they were watching an online advertising when browsing on e-commerce website. The purpose of this procedure is to ensure the participants' basic competence consistency. Secondly, we put the EEG headset on participants' head and ensured the accuracy of EEG signals. Third, we began to start the EEG recording. Participants were asked to gaze at the cross (“+”) for five seconds, in order to reduce any disturbance before EEG recording and ensure the integrity of the data collection. In the fourth step, participants were randomly distributed into different types of advertisement contexts: R-F, R-S, E-F, and E-S. After watching the video advertising, questionnaire was collected from the participants. In order to encourage participants to answer all the questions carefully, after we confirmed the integrity and validity of EEG data and questionnaire, the participants were awarded about 5 US dollars (see Figure 1, Figure 2, Figure 3).

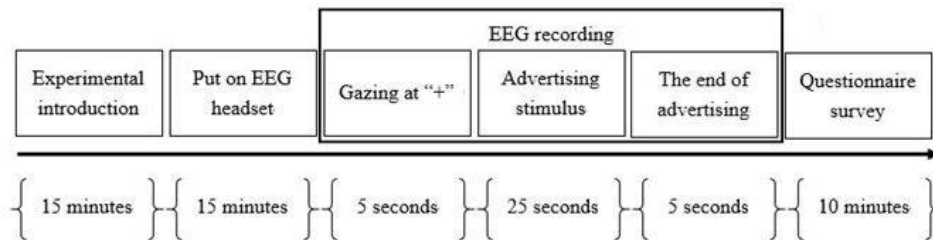


Figure 1 : Experimental process



Figure 2: Rational advertising



Figure 3: Emotional advertising

## Materials

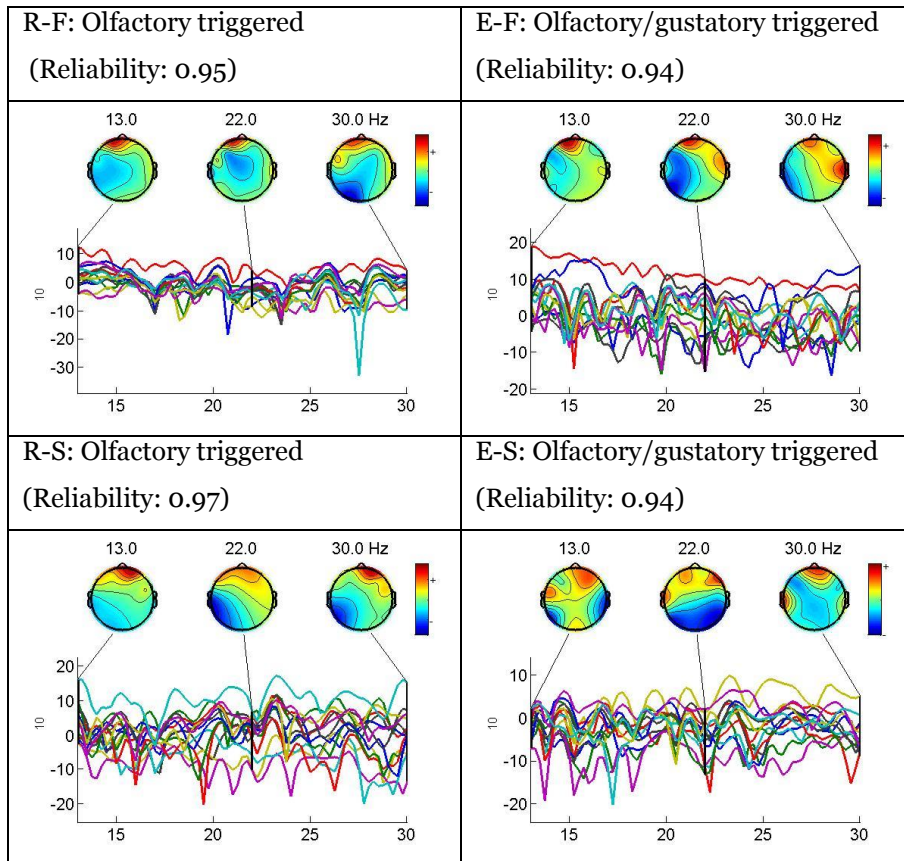
In the research of advertising, EEG is the most common tool for measuring electrical activity of the consumers' brain (Walker, 1980). EEG is a non-invasive brain imaging technique with high temporal precision, it can fully record the activation of cerebral cortex under information stimulus. Furthermore, EEG signals can accurately reflect the cortical activities of gyri and sulci (Mizoguchi et al., 2002). Therefore, we adopted EEG as measurement tool to ensure the integrity and correctness of the data collection. E-prime software was adopted for experimental design. E-prime has a graphical interface and include the ability to use digital films (MPEG, WMV, AVI) as stimuli during experiments. In addition, E-prime can also connected to external devices for record stimuli, with the more accurate time-stamping of responses (precision of 1/1000 second) (Roberts, 2012). Through the RS232 connection, EEG data and E-

prime time-stamping are transmitted to the Emotiv TestBench for recording. Thus, this research possess rigorously and accurately experimental design and data collection.

**Electroencephalogram recording and analysis**

The cortical area of olfactory cognition is based on the Olfactory Imagery study by Djordjevic et al. (2005). We observed the electrical activity of prefrontal cortex which contains the olfactory cortical areas of orbitofrontal cortex, and extracted the frequency bands of  $\beta$ -wave (13-30Hz), which is dominates the “consciousness level” (Zhang et al., 2006). The corresponding EEG electrodes in prefrontal region are include: AF3, AF4, F3, F4, F7, and F8. The cortical area of gustatory cognition is according to the study of Mizoguchi et al. (2002) on gustatory evoked potentials (GEPs). The temporal cortex, which contains the superior temporal sulcus, is observed as the basis for gustatory cortical areas. We also extracted  $\beta$ -wave (13-30Hz) because it is particularly evident when individual is awake. The corresponding EEG temporal lobe electrodes are include FC5, FC6, T7, and T8.

In order to measure the olfactory/gustatory response objectively in four advertisement contexts, we used electroencephalogram to classify every types of advertisement contexts. The three EEG researchers graded the assignments separately based on the topography of each EEG. One measurement was classified as four types from 0 to 3: no sensory, olfactory triggered, gustatory triggered, and olfactory/gustatory triggered. Since the scores on the objective measurement are assigned based on the researchers’ subjective interpretations, reliability of the scales becomes an issue. The reliability is calculated through the interjudge agreement developed by Holsti (1969). The result shows that R-F and R-S were olfactory triggered and E-F, E-S were olfactory and gustatory triggered. The reliability of R-F, R-S, E-F, and E-S are 0.95, 0.97, 0.94, and 0.94 respectively. The result of high reliability indicates the grade is reliable (see Table 2).



**Table 2 : Four types of online advertisement context- EEG beta wave**

Note: Rational appeal/fast-tempo (R-F), Rational appeal/slow-tempo (R-S), Emotional appeal/fast-tempo (E-F), Emotional appeal/slow-tempo (E-S)

## Questionnaire design

All of the measures was applied a seven-point Likert scale, with ranged from strongly disagree (score of '1') to strongly agree (score of '7'). Among them, the measures in this study were all adopted from existing measures. To preserve the richness of each construct, all of the constructs were measured with a multiple-item scale. Moreover, measurement items were adapted from the literature. The measurements constructs of synesthesia were developed according to Rogowska (2011); constructs of pleasure-arousal were developed according to Olney et al., (1991); constructs of attitude toward advertising were developed according to Sheininet al. (2011), Miller et al. (2011), Yanget al. (2013); constructs of word-of-mouth were developed according to Cho & Rutherford (2011); constructs of purchase intention were developed according to Doddset al. (1991).

## Pretest

Before the experiment, five experts from information management and technological management related fields (three PhDs and two experts in the industry) were requested to first perform the pretest. Thirty participants were invited to undergo the pilot test. The experimental process is in line with the formal experiment. Results of reliability shows that the Cronbach's  $\alpha$  of constructs all exceed 0.7 (Nunnally, 1978). In questionnaire validity, the indicator loading all exceeded 0.5 (Fornell & Larcker, 1981).

## Results

### Data analysis

The data analysis utilized a two-step approach, as recommended by Anderson & Gerbing (1988). The first step analyses the measurement model, while the second tests the structural relationships among the latent constructs. The aim of the two-step approach is to establish the reliability and validity of the measures before assessing the structural relationships of the model. SmartPLS 2.0.M3 was used because partial least squares (PLS) places minimal restrictions on the measurement scales, sample size and residual distribution (Chin, 1998).

### Measurement model

Reliability was measured based on the component reliability. Nunnaly (1978) suggested that the acceptable level of component reliability should above 0.7, and all of the values in this paper are above 0.7. According to the research of Fornell & Larcker (1981), the scales of the convergent validity was assessed by two criteria: (1) all indicator loading should be significant and exceed 0.7; (2) each construct of the average variance extracted (AVE) should be significant and exceed 0.5. Results in this paper shows that all of the AVEs ranges from 0.633 to 0.895. Thus, this paper possessed good convergent validity (see Table 3).

Discriminant validity was examined using the following three tests: (1) the square root of each AVEs should exceed the correlation shared between the construct and other construct (Fornell & Larcker, 1981); (2) the cross-factor loadings indicate good discriminant validity when the loading of each measurement item on its assigned latent variable is higher than its loading on any other constructs (Chin, 1998); (3) the correlations among all constructs should less than 0.852 threshold (Kline, 1998). The result shows that all values were conform to these three criteria and possessed good discriminant validity.

Constructs	Items	R-F			E-F		
		CR	Cronbachs Alpha	AVE	CR	Cronbachs Alpha	AVE
ARO	3	0.837	0.729	0.633	0.873	0.801	0.696
ATT	5	0.913	0.881	0.676	0.902	0.864	0.648
PI	3	0.962	0.941	0.895	0.908	0.847	0.768
PLE	4	0.892	0.838	0.674	0.852	0.773	0.590
WOM	3	0.889	0.815	0.728	0.874	0.783	0.700

Constructs	Items	R-S			E-S		
		CR	Cronbachs Alpha	AVE	CR	Cronbachs Alpha	AVE
ARO	3	0.855	0.760	0.663	0.850	0.780	0.657
ATT	5	0.909	0.874	0.666	0.904	0.866	0.656
PI	3	0.952	0.924	0.868	0.951	0.923	0.867
PLE	4	0.923	0.890	0.749	0.921	0.885	0.744
WOM	3	0.897	0.827	0.744	0.923	0.874	0.800

**Table 3: Descriptive statistics for the constructs**

Note: Rational appeal/fast-tempo (R-F), Rational appeal/slow-tempo (R-S), Emotional appeal/fast-tempo (E-F), Emotional appeal/slow-tempo (E-S), Arousal (ARO), Attitude toward advertising (ATT), Purchase intention (PI), Pleasure (PLE), Word-of-mouth (WOM)

### **Structural model**

In this research, SmartPLS was used for statistical analysis tools. We examined the structural paths and the R<sup>2</sup> values to assess the explanatory power of our structural model. The significance of all paths was assessed with 500 bootstrap run by bootstrap resampling method. Research model of four online advertising contexts: rational appeal/fast-tempo (R-F), rational appeal/slow-tempo (R-S), emotional appeal/fast-tempo (E-F), emotional appeal/slow-tempo (E-S), were analyzed respectively.

In rational appeal/fast-tempo (R-F), the R<sup>2</sup> value of attitude toward advertising, WOM, purchase intention are 0.631, 0.386, 0.414. The result of path coefficient shows that pleasure ( $\beta=0.666$ , P-value<0.001) and arousal ( $\beta=0.212$ , P-value<0.05) have a significantly positive effect on attitude toward advertising. Attitude toward advertising has a significantly positive effect on WOM ( $\beta=0.621$ , P-value<0.001) and purchase intention ( $\beta=0.643$ , P-value<0.001).

In rational appeal/slow-tempo (R-S), the R<sup>2</sup> value of attitude toward advertising, WOM, purchase intention are 0.398, 0.564, 0.266. The result of path coefficient shows that pleasure ( $\beta=0.372$ , P-value<0.01) and arousal ( $\beta=0.411$ , P-value<0.01) have a significantly positive effect on attitude toward advertising. Attitude toward advertising has a significantly positive effect on WOM ( $\beta=0.751$ , P-value<0.001) and purchase intention ( $\beta=0.516$ , P-value<0.001).

In emotional appeal/fast-tempo (E-F), the R<sup>2</sup> value of attitude toward advertising, WOM, purchase intention are 0.463, 0.433, 0.499. The result of path coefficient shows that pleasure ( $\beta=0.574$ , P-value<0.001) has a significantly positive effect on attitude toward advertising. Arousal has no significant effect on attitude toward advertising. Attitude toward advertising has a significantly positive effect on WOM ( $\beta=0.658$ , P-value<0.001) and purchase intention ( $\beta=0.706$ , P-value<0.001).

In emotional appeal/slow-tempo (E-S), the R<sup>2</sup> value of attitude toward advertising, WOM, purchase intention are 0.529, 0.551, 0.364. The result of path coefficient shows that pleasure ( $\beta=0.713$ , P-value<0.001) has a significantly positive effect on attitude toward advertising. Arousal has no significant effect on attitude toward advertising. Attitude toward advertising has a significantly positive effect both on WOM ( $\beta=0.742$ , P-value<0.001) and purchase intention ( $\beta=0.604$ , P-value<0.001).

### **Conclusion**

(1) This research uses synesthesia as a means to achieve advertising design.

By the used of scenario-based laboratory experiments, we collected both neuroimaging and questionnaire data within and after the participants watched the advertising. Through neurocognitive mechanisms of synesthesia towards the advertising stimulus, EEG results show that rational advertisings, both of fast/slow tempo background music, triggered the olfactory sense. Moreover, emotional advertisings with both of fast/slow tempo background music can triggered not only olfactory sense but gustatory sense. The classification results can serve as a reference for advertisers when engaging in advertising design.

(2) This research establishes an integration of consumer emotion, attitude toward advertising, and behavioral intention.

Research results show that positive emotions indeed lead to consumers' positive attitude toward products, as manifested in their purchases decision. The more the consumers' emotional pleasure, the more fondness they had for the advertisement, and thus enhance the consumer's positive attitude toward advertising. The more positive attitude toward advertising can cause consumers' desire and motivation to buy, further, increasing the willingness of word-of-mouth to the advertising product.

(3) Different advertisement contexts design have different effects on consumers' emotions.

In the result of SEM, we found that in the type of emotional appeal emotional pleasure has significant effect on attitude. Arousal is the intensity of consumer's emotional stimulation (psychological) to the reaction (physiological) (i.e., inspired, attracted attention). The emotional appeals is related to consumer's emotional experience (Aaker & Williams, 1998). By presenting emotional psychological level, emotional advertising enables consumers to make a corresponding emotional feedback and lead consumers to more interested in products. Therefore, because of this psychological type of advertising appeals, emotional advertising may reduce the arousal, which should generated through psychological to physiological.

Olfactory and gustatory sense are correlated with consumer's emotional response. Advertising in rational appeals can triggered individual's olfactory stimulus. Further, the olfactory enables to enhance the effect on both pleasure and arousal to attitude toward advertising. In emotional appeals, advertising can aroused not only individual's olfactory but gustatory. However, the olfactory and gustatory only strong the effect between pleasure and attitude toward advertising. Advertising designers could develop advertising strategy by understanding consumer types and product category. Designers could develop rational advertising by target on product with scents, such as coffee or perfume, and high-involvement consumers who needs more product information. In addition, designer could also target on food and low-involvement consumers to design emotional advertising. Because low-involvement consumer is a kind of emotion-oriented person (Vakratsas & Ambler, 1999). Therefore, they would be more satisfied with pleasure situation and emotional appeals. The results of this paper can provide advertising designer with a direction of advertising design. Further, we can also proposed designers and marketers to develop and strategize advertising strategy and marketing strategy.

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