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A Case Study in Neuromarketing: Analysis of the Influence of Music on Advertising Effectiveness through Eye-Tracking, Facial Emotion and GSR

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Abstract

Music plays an important role in advertising. It exerts strong influence on the cognitive processes of attention and on the emotional processes of evaluation and, subsequently, in the attributes of the product. The goal of this work was to investigate these mechanisms using eye-tracking, facial expression and galvanic skin response (GSR). Nineteen university women were exposed to the same TV ad of a perfume in our Laboratory (<https://neurolabcenter.com/>). Nine of them were randomly assigned to the music version and ten to the silent version. During viewing, the visual areas of interest, the fixation time, the facial emotions and the GSR were recorded. Before and after viewing the subjects completed a questionnaire. Results: 1) The commercial with music caused a GSR level higher than without music. The GSR evaluates the degree of *arousal* (emotion), 2) The facial expression indicated that the variable

"enjoy" and "engagement" were significantly higher in the version with music. The positive valence (liking) presented higher values in the musical version, 3) However, the evaluation of the variable "attention", measured through facial expression, did not show differences between the groups. There were also no differences in the heat maps of areas of interest. 4) The attributes evaluation of the product, measured with the pre-post questionnaire, showed greater increases after exposure to the musical version, but only in specific product's attributes, such as "power" but not on other attributes, such as "status". These results are interpreted within the framework of the recent theories of advertising and music (Oakes, 2007).

Keywords: case study, neuromarketing, analysis, influence, music, advertising, effectiveness, eye-tracking, facial emotion, GSR

Introduction

The music and the sound stimulus have allowed to give emotion to the stories in the movies and on the radio, accompany us in moments and give us back sensations only when we listen to the melody again. Its evocative power based on its ability to create emotions and associations (Douglas, 1986) has been used in film for its dramatic ability and in advertising, today it is difficult to imagine a television advertising without sound. Advertisers strive to use its communicative potential with music that the audience can remember, through a catchy letter or a melody, that bring emotion to the message and identity to the brand, facilitating the creation of associations that will later make it remembered. Music provides added values (Gurrea, 1999) since it awakens or suggests feeling, it empowers them, accompanies them or brings new meanings (Martínez, 2004). Music is undoubtedly an important component in advertising communication, being in some cases the main creative component of the ad (Kellaris, Cox and Cox, 1993), which will not only serve as the basis for maintaining attention and joining scenes, but also it will influence the attributes of the brand (Hung, 2000).

Music determines in our organism direct or reflex reactions, which are transient functional reactions that characterize an emotion at the moment in which musical excitement acts, and indirect reactions, which is when the musical excitement acts on the psychic representation of musical emotions. (Arteaga, 2009). The musical excitations, like any other sensory excitement, determine a direct increase in the physiological activities of the organism and will affect the attention, engagement and memory of the brand (Vermeulen & Beukeboom, 2016). A more intense experience corresponds to a greater emotional involvement, which in turn makes future considerations more reliable in the purchasing decision (Satel & Lilienfeld, 2013). In this sense, music plays an important role in advertising since it exerts a strong

influence on the cognitive processes of attention and on the emotional processes of evaluation and, subsequently, on the attributes of the products.

In relation to the role of music in advertising, Gerald Gorn (1982) demonstrated a certain relationship between the choice of an object and the type of music associated as well as the unconscious nature of this process. The type of music to be used is important, several studies show that using a music congruent with the advertisement causes greater preference for the product and the probability of purchase (North, MacKenzie, Law & Hargreaves, 2004; Alpert, Alpert y Maltz, 2005). In relation to its effect on the perception of the brand, Anand and Sternthal (1990) analyzed attitudinal responses to an advertisement for soft drinks with music and without music proving that the use of a voice-over along with music caused greater affective and cognitive effects positive towards the brand and the repetition of the ad while the one without music was perceived as more boring and irritating. The emotional and rhythmic characteristics of the music also influences by causing different emotional states that will affect the perceived perception of the brand, for example, provoking a state of positive humor with the use of cheerful music (Mitchell, 1988; Bozman, Muelind y Pettit-O'Malley, 1994). When music is used in audiovisual advertisements, that is, when accompanying a video, it has proven to be more effective than verbal cues by a greater recall of visual imagery such as action (Stewart, 1998). In their research on the effect of music on visual memory, Gorn, Goldberg, Chattopadhyay and Litvack (1991) found that the use of music, versus the same stimulus but without music, was more effective in producing higher levels of recall.

While the voice in the ad describes the properties of the product, the music evokes an emotional response. Research shows the difficulty of delimiting the emotional and cognitive responses in advertising since cognitive messages must have a message of emotional background and, on the other hand, emotional stimulus, for example through music, can trigger involuntary cognitive processes that influence purchasing intention (Oakes, 2007; Gopinath and Nyer, 1999).

Neuromarketing

Neuromarketing applies knowledge of neuroscience, scientific study of the nervous system, for a greater understanding of the unconscious processes that intervene in consumer purchasing processes. Analyzing the psycho-physiological reactions of individuals when they are exposed to marketing stimulus it is being used to study the affective and cognitive consumer's responses based on objective and scientifically measurable results. In this way it is intended to better understand the consumer and get to meet their needs more effectively. The majority of decisions are made in the intuitive or unconscious side, the emotional responses caused by the announcements are greater than those that can cause in the logical plane thanks to a higher level of engagement and excitement (Satel and Lilienfeld, 2013).

Neuromarketing registers different indicators whose analysis allows to measure criteria such as emotional engagement, retention, purchase intention, novelty, knowledge and attention. The most widespread are those non-invasive techniques related to readings of brain activity such as electroencephalogram (EGG), positron emission tomography (PET), magnetic resonance imaging (fMRI) or magnetoencephalography (MEG) that allows to register brain activity during the stimulus. These studies help to correlate emotional states, brain activity tests and behavioral studies such as preferences for stimuli (Herz and Schooler, 2002, Sowndhararajan and Kim, 2016). But in addition to these tools, neuromarketing allows the integration of other psychophysiological variables (Cuesta, Martinez-Martinez and Cuesta, 2018). The facial expression of the emotions or *Facial Expression* technique register emotional states of the individuals, by means of observable gestures like a smile or micro-muscular changes like contractions associated to certain reactions, it is an indicator of the positive or negative emotional responses of the individuals. Through the use of *eye-tracking* can be recorded automated behaviors such as pupil visual tracking and dilation of the pupil, informs about the route of the gaze, the heatmaps, areas of interest and the time of attention spent by individuals at a point providing information about the attention, interest and engagement caused. The visual selection and the route of the look are effective to measure the effectiveness of the brand, knowing where the individual looks at the stimulus gives us information on how information is ordered (Plassmann, Ramsøy & Milosavljevic, 2012). The dermoelectric response, or *Galvanic Skin Response* (GSR), records the electrodermal activity or skin conductance sensitive to increased activity or emotional arousal. The heart rate and the variability of the heart rate are related to emotional and cognitive aspects. The emotional response can be of positive or negative valence, the triangulation of the different indicators will allow us to finally evaluate the degree of emotion and whether it is positive or negative.

Therefore, neuromarketing offers scientific research techniques that can provide important information about the effects of music used in advertising on an affective and cognitive level in individuals allowing a better understanding of the audience and of the mechanisms inherent in the perception of the brand.

Method

Objectives and Research Questions

The objective of this study was to investigate the effects of the use of music in advertisements on 1) the cognitive processes of attention, 2) the emotional processes of evaluation and 3) its effect on the attributes of the products using the techniques of eye tracking, facial expression and GSR. Research questions:

RQ1: How does music in advertisements affect the emotional responses of individuals?

RQ2: How does it affect cognitive responses?

RQ3: Does it affect the way the ad is viewed?

RQ4: How does it influence the perception of the brand?

Procedures and Sample

A sample of 19 university students with an average of 25 years and an age range between 19 and 27 years were used. A factorial design of independent measures was carried out where the independent variable is music, with two levels: 1) an ad with music and 2) the same ad without music; that it would allow to analyze the effect of the use of music in advertisements on the perceptions of individuals about a product and / or brand, its attributes and valuations. The television ad for One Million perfume by Paco Rabanne (21sec.) was used, presenting it to a group of subjects with sound and to another group without sound. The subjects were randomly assigned to the experimental treatment groups.

Five dependent variables were used: (1) "product perception", (2) "brand assessment" as well as the psychophysiological variables measured during the exposure to the ad: (3) GSR, (4) eye-tracking, and (5) facial expressions.

The research was carried out in the Neuromarketing Laboratory "NeuroLabCenter" (www.neurolabcenter.com) in the School of Communication of the Complutense University of Madrid. After completing the pre-test, the participants were randomly exposed to one of the experimental treatment groups (announcement with sound vs. announcement without sound) while their psychophysiological responses (GSR, eye-tracking and Facial Expression) were collected by the different sensors. After viewing the participants completed the post-test.

Measurement instruments

To measure the evaluations and perception's attributes of the brand, a questionnaire of 7 questions was used. The questionnaire was completed at the beginning of the session and, subsequently, after the presentation of the subjects to the experimental treatment. The questionnaire was based on an adaptation of the same used in previous research (Cuesta, Niño and Martínez-Martínez, 2018).

The psychophysiological variables: GSR, eye-tracking, pupilometry and facial recognition of emotion were measured using a Shimmer for GSR registration, a Tobii EYE Tracking, a high definition camera together with AFFECTIVA software and the iMotions software for the processing of the different indicators. The technique used has been widely described by us in previous research (Cuesta, Martínez and Cuesta, 2018).

Analysis and results

Effects of music on attention and emotion

The data obtained from the galvanic skin response (GSR) showed that the announcement with music caused a greater reaction (78% of viewing time) than the

ad without music (50% of viewing time). Regarding the type of reactions provoked, we found that in the ad with music they were more positive (7.5%) than in the case of the ad without music (5%), the latter also recorded some negative reactions (1.2%).

The results of the facial expression showed that the advertisement with music provoked a higher level of engagement (10%) compared to the announcement without music (7%), however, the attention values were similar in the advertisement with music (57%) and without music (56%).

The GSR showed two peaks of attention and emotion coinciding in both ads. In the first peak, the subjects concentrated their gaze on similar areas, however after that peak the attention and emotions generated decayed more pronounced in the ad without music. (Figure 1)

The same happened in the second peak of attention at the end of the announcement when the two golden perfume bottles appeared (female format and male format) and the name of the brand on a white background. Both groups set their sights on the packaging without looking at the brand, the attention and emotion were maintained for longer in the ad with music and declined to a greater extent in the ad without music. (Figure 2).

The image that provoked higher levels of attention, engagement and positive emotions in both groups was the face of man, we can observe that these levels were higher in the case of the ad with music. (Figure 3 and Figure 4)

As previously suggested, another peak attention was the final image of the ads where appeared the products and the name of the brand. This scene also generated positive reactions in both ads, although the levels were higher in the music ad.

Heatmaps and areas of interest

According to the data obtained through the Eye Tracking in relation to the points of attention of the individuals during the viewing, that allow us to distinguish the different areas where the individuals fix their gaze, we can observe that there were no significant differences in the hot zones or areas of interest between the two groups. In both conditions the character that receives the most attention is the man (Figure 5).

Perception of the brand

We did not find significant differences ($p < 0.05$) neither between groups nor in the data obtained before and after the stimulus. In relation to the type of emotion that the participants associated with the brand, 95% named concepts such as success, sensuality, sexual attraction, passion, motivation and power. No differences were found between groups nor in the opinions offered before and after the stimulus.

When the participants were asked to associate certain attributes to the Paco Rabanne brand, practically all the evaluations increased in both groups showing thus main effects of the experimental factor. However, an interesting interaction effect also appeared showing that changes were greater in the announcement with music (Table 1). The Student's T test showed significant differences in the scores before and after the stimulus only in the ad group with music for the attribute "power" ($p = .002$; Table 3).

After the stimulus, there was also some increase in both groups over their belief on the item "a perfume influenced the mood", but with no significant differences between groups ($p < 0.05$). Regarding the image of the product, data shows an increase in all the evaluations after both stimuli (Table 2) but no significant differences were found neither of main effects nor of interaction (Table 3)

Conclusions and Discussion

Discussion

Music is one of the most important characteristics of advertising for the generation of persistent effects that has a potential to mobilize emotions in the viewer that accompanied the perception of messages enriching its contents. It also causes an increase in emotional activity that facilitates both the subsequent memory and the increase in attention.

However, previous research in this field has shown unclear results, which can be very complex, with different creativities, types of music, creative styles, etc. All this requires accumulating a large amount of experimental experience that allows accumulating enough data to create a comprehensive theoretical body of this complex phenomenon.

Previous investigations have proposed that music it's perceived as a peripheral type signal that it is used to provoke an emotional state (Stout and Leckenby, 1988). According to the dual process theory, that is, the theory of central and peripheral processing, it has been interpreted that music acts as a signal to generate a positive attitude towards the message and then transmit it to the brand and the product. In this way, music would have a greater effect on an audience that is not very involved (low commitment audience), (Park & Young, 1986, MacInnis & Park, 1991, Petty & Cacioppo, 1986).

However, specific effects of music that can directly produce on the brand and the product have also been proposed: through the feelings of the spectators and the provoked emotions that will be directly linked to the stimuli through associative conditioning (Clynes and Nettheim, 1982, Alpert and Alpert, 1990).

In line with previous works Zimny and Weidenfeller (1961) our research seems to confirm this last proposal. Zimny and Weidenfeller demonstrated through GSR and

heart rate how music generates emotion in the subjects (psychophysiological activation) which was transferred directly to the brand and product.

In a similar sense, our research provides the physiological data that show the greatest emotional activity in certain perceptual segments generated by music. This emotion has resulted in different perceptions of the product and the brand shown in the surveys made to the subjects. Researchers are now learning that emotions guide and influence consumer behavior far more than seen in traditional, cognitive research. (Rossiter & Percy, 1991)

Consistent with the studies of Zimny and Weidenfeller, the transmission of values attributed to the brand and the product has been very consistent with the type of music used and the emotions that they mobilize in the subjects: the highly critical and markedly asymmetric music has generated an emotion of "power" or "speed" that has been transmitted as an attribute to the product. However, other values, such as status, not linked to the association generated by music, have not appeared as a gain due to music.

Conclusions

The study on the effects of music on advertising has been studied previously. However, in our knowledge, there are no research that use questionnaires together with neuromarketing techniques that help to understand in greater depth these effects.

In this research, the analysis of psychophysiological responses showed that the use of music in the ad has a greater effect on emotional processes such as excitement and emotion. It also caused greater enjoyment and engagement. On the other hand, the use of music did not show an effect on cognitive processes such as attention, the way of looking at the advertisement, or in the areas of interest during both stimuli. However, it did have a persuasive effect on specific attributes of the brand such as "power". These data reveal that the music in the advertisements affects the emotional processes of the consumers and also the perception of the brand without influencing the cognitive responses of the subjects, which would provide clarity on the debate between the link of emotional responses and cognitive in advertising (Oakes, 2007; Gopinath and Nyer, 1999).

On the other hand, the increase in the attribute "power" can be caused by the type of music used in the ad coherent with the type of image (black and white) with dry changes that link cuts of general and short planes.

These data provide important information about the effects of music on the perception of the brand through stimulating emotional processes studied in other research (Bozman, Muelind and Malley, 1994), as well as the importance of using music coherent with the announcement (Anand and Sternthal, 1990).

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Tables

Table 1. Group statistics attributes associated with the brand Paco Rabanne

	Type of stimulus	N	Average	Standard deviation	Error mean standard
PRETEST Association BRAND WITH SUCCESS	MUSIC	9	6,56	3,167	1,056
	NO MUSIC	10	7,80	1,135	,359
POST- Association BRAND WITH SUCCESS	MUSIC	9	6,67	3,082	1,027
	NO MUSIC	10	8,30	,823	,260
PRETEST Association BRAND WITH GLAMOR	MUSIC	9	7,00	3,041	1,014
	NO MUSIC	10	8,40	,843	,267
POST-TEST Association BRAND WITH GLAMOR	MUSIC	9	7,56	3,046	1,015
	NO MUSIC	10	8,50	1,080	,342
PRETEST Association BRAND with ELEGANCE	MUSIC	9	7,33	3,082	1,027
	NO MUSIC	10	8,40	1,174	,371
POST-TEST Association BRAND with ELEGANCE	MUSIC	9	8,11	1,691	,564
	NO MUSIC	10	8,60	1,075	,340
PRETEST Association BRAND with POWER	MUSIC	9	6,44	1,810	,603
	NO MUSIC	10	7,20	2,741	,867
POST-TEST Association BRAND with POWER	MUSIC	9	8,22	1,202	,401
	NO MUSIC	10	7,90	1,197	,379

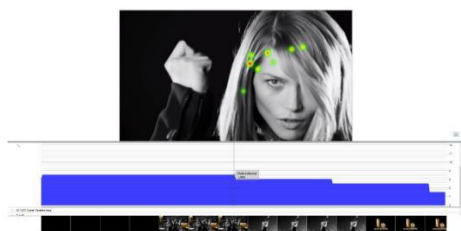
PRETEST Association BRAND WITH LUXURY	MUSIC	9	7,67	3,464	1,155
	NO MUSIC	10	8,00	2,357	,745
POST-TEST Association BRAND WITH LUXURY	MUSIC	9	8,22	1,481	,494
	NO MUSIC	10	8,40	,966	,306

Table 2. Group statistics Attributes associated with the presentation of the brand

	Type of stimulus	N	Average	Standard deviation	Error mean standard
PRETEST Presentation SIMPLE	MUSIC	9	1,67	2,345	,782
	NO MUSIC	10	2,90	2,846	,900
POST-TEST Presentation SIMPLE	MUSIC	9	3,67	3,082	1,027
	NO MUSIC	10	4,80	2,300	,727
PRETEST Presentation MODERN	MUSIC	9	6,89	1,364	,455
	NO MUSIC	10	7,50	1,434	,453
POST-TEST Presentation MODERN	MUSIC	9	7,11	1,616	,539
	NO MUSIC	10	7,50	1,716	,543
PRETEST Presentación YOUNG	MUSIC	9	5,56	2,455	,818
	NO MUSIC	10	7,20	1,751	,554
POST-TEST Presentation YOUNG	MUSIC	9	7,22	1,787	,596
	NO MUSIC	10	8,30	1,829	,578
PRETEST Presentation ATTRACTIVE	MUSIC	9	7,56	1,236	,412
	NO MUSIC	10	8,80	,789	,249
POST-TEST Presentation ATTRACTIVE	MUSIC	9	8,22	1,563	,521
	NO MUSIC	10	8,90	,568	,180
PRETEST Presentation SENSUAL	MUSIC	9	7,44	3,046	1,015
	NO MUSIC	10	8,20	1,814	,573
POST-TEST Presentation SENSUAL	MUSIC	9	8,11	1,167	,389
	NO MUSIC	10	8,80	1,229	,389

Table 3. Group statistics Attributes associated with the announcement					
	Type of stimulus	N	Average	Standard deviation	Error mean standard
PRETEST Presentation SIMPLE	MUSIC	9	1,67	2,345	,782
	NO MUSIC	10	2,90	2,846	,900
POST-TEST Presentation SIMPLE	MUSIC	9	3,67	3,082	1,027
	NO MUSIC	10	4,80	2,300	,727
PRETEST Presentation MODERN	MUSIC	9	6,89	1,364	,455
	NO MUSIC	10	7,50	1,434	,453
POST-TEST Presentation MODERN	MUSIC	9	7,11	1,616	,539
	NO MUSIC	10	7,50	1,716	,543
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	NO MUSIC	10	8,90	,568	,180
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	NO MUSIC	10	8,20	1,814	,573
POST-TEST Presentation SENSUAL	MUSIC	9	8,11	1,167	,389
	NO MUSIC	10	8,80	1,229	,389

Figure 1. Comparison GSR peaks ad with music and without music

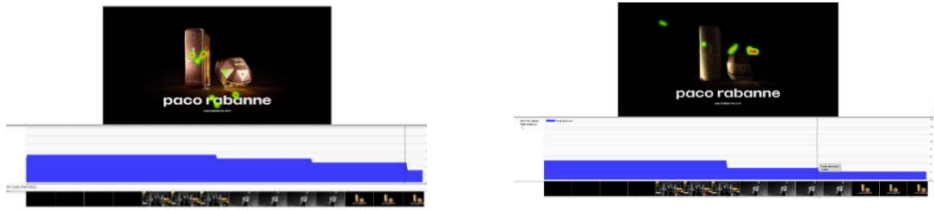


GSR peak ad with music



GSR peak ad without music

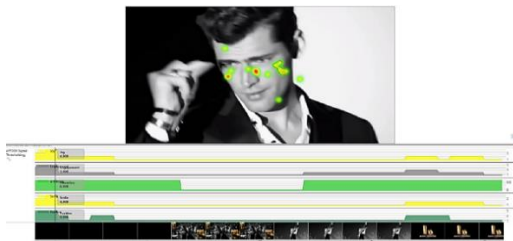
Figure2. Comparison GSR peaks announcement with music and without music



GSR peak ad with music

GSR peak ad without music

Figure 3. Facial recognition with music



Facial expressions music ad

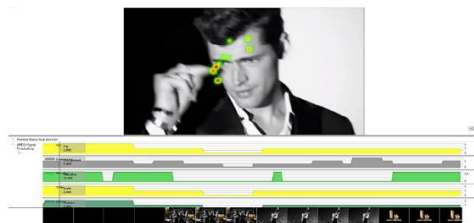


Figure 4. Facial recognition without music

Figure 5. Comparison heatmaps ad with music and without music



Heatmap ad with sound



Heatmap ad without sound