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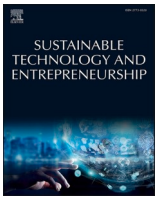

Full Length Article

Analysis of the residual effect using neuromarketing technology in audiovisual content entrepreneurship

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ABSTRACT

Considering the informational overwhelm of the last few years and given the rise in new entrepreneurship of communication means, the optimization of commercial communication's marketing has become one of the primary objectives of marketing strategy. The quantitative computation of the number of impacts has been rendered insufficient for evaluating and planning a communication campaign. Strategic planning relies on increasingly more precise models for determining the desired formula. These models do not typically take the physiological parameter essential to decision-making into account: emotion. The technologies applied to the new methodologies that neuromarketing brings rely on great support from theorists and professionals, even though hardly any studies that center on strategic planning media exist. In this study, we present an analysis of the residual effect and the distortion of erroneous attribution stemming from neuromarketing's own technologies with the objective of analyzing the influence of adjacent content items on the subject's decision-making process. Cross-technologies were used: EEG and GSR, with the goal of analyzing the subject's emotional activation and motivation. The results demonstrate an emotional dragging effect and the appearance of bias of attribution with very significant values in every case, showing notable differences regarding the nature and polarity of emotions.

Introduction

Planning presupposes a key element in the attainment of marketing plan objectives and in the study of communication's efficacy.

Attending to the basic criteria in the process of elaborating a strategic media plan displayed by Doctor Papí (2009), the search for advertising efficacy in the media plan is revealed in different stages. The first stage focuses on maximizing coverage and the number of displays – an arduous task, especially when considering that both are opposing concepts. The second stage consists of the search for the optimal value of frequencies from which the response curve and contact distribution are obtained. Finally, the last stage references the prevailing models, like the FPV model, which permits the evaluation of different contributions. The optimal equation connotes great difficulty upon coordinating distinct variables with the goal of obtaining the most effective advertising impact. The researchers try to analyze the most relevant aspects of choosing media and spaces. Notwithstanding, in the academic realm and in accord with Papí (2009), studies related to these assessments are scarce at every stage. Faced with such a panorama, it is fitting to indicate the importance that neuromarketing has acquired as a discipline in recent years with respect to research in the fields of Marketing and Communication. So much so, in fact, that more and more academics agree on the need to rally more support in favor of constituting its own subfield within marketing (Lim, 2018). Currently, its great value and utility as a tool essential to the emotional analysis of comprehending consumers' decision-making behaviors is indisputable (Gill & Singh, 2020; Galindo-Martín et al., 2023).

However, through a bibliographical review of four of the databases of specialized journals with the highest level of impact (Elsevier, Springer, Scopus, Web of Science), the present study verifies that scientific texts based on neuromarketing methodologies applied to the study of strategic media planning are indeed scarce. For this reason, through the implementation of Neuromarketing methods, this study intends to offer a new perspective from which to approach strategic media planning, including the study of the subject's emotion and behavior, with the goal of determining the optimal impact value by which to attain greater advertising efficacy.

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Theoretical framework

The incipient development of Neuromarketing over the last decade, not to mention the multiple applications within development strategies and campaign evaluation, has transformed this marketing subdiscipline into one of the areas of greatest interest among professionals and academics. Furthermore, it has also contributed to the improvements that implementing neuroscience's own technologies in its development of neuromarketing methodologies and its posterior application in analyzing consumer decision-making. Neuromarketing is defined within the study of neuroscience as the field whose objective is to analyze the buyer's conduct through the procedures and instinctive reactions in the brain Gill and Singh (2020). This research methodology has been implemented by large brands such as PepsiCo, Coca Cola, Hyundai, Intel, Microsoft, E-Bay, Sky Television Network, Johnson & Johnson, HBO, IBM, Proctor & Gamble, Unilever, and ESPN, among others (Dorison et al., 2020), with the intention of optimizing their investments in strategic marketing, basing their studies on the mediation of the psychophysiological parameters that activate in audiences, fruit of the perception of their campaigns, products, or brands. The principal objective is to obtain a strong indicator with which to predict what decision a consumer will make.

The theoretical framework used in cognitive neuroscience, above all with relation to the weight granted to emotions in decision-making, by authors like Antonio Damasio, Daniel Kahneman, Joseph Ledoux, Vernon Smith, or Plassmann, has positioned these processes as excellent predictive indicators for consumer decision-making. Researchers now recognize that emotions are, for better or worse, potent and omnipresent influences on behavior (Dorison et al., 2020). This turn in theories of consumer decision-making has converted neuromarketing into an ideal research paradigm for studying the consumer. Emotions are biological responses produced in the face of exposure to a competent emotional stimulus that are capable of provoking overexcitement in the sympathetic nervous system. This activation encompasses a group of complex automatic, chemical, and neuronal responses that form a distinctive pattern (Núñez- Cansado et al., 2021). As a result of these responses, a temporary change in the bodýs state and cerebral structures occurs which forces an evaluation of the stimulus, be it conscious or unconscious, giving place to an emotional state (Damasio, 2018). In this way, the process of an emotional state is the result of physiological and cognitive arousal coherent with the new state. This adaptation presupposes emotional processing for the subject that takes place on an unconscious level, and which begins with the activation of the dorsomedial prefrontal cortex, the anterior cingulate cortex, and the orbitofrontal cortex, principally implicating automatic changes in cognitive and behavioral processes (Ni et al., 2021).

Traditionally, the two energetic phases in this process have been differentiated: activation and arousal. The former relates to the change produced at the baseline after exposure to the stimulus, while the latter is conceptualized as the general energetic state (Vaez Mousavi et al., 2007). The physiological activation produced when facing an emotionally competent stimulus is not a momentary state but instead describes a dynamic process of a very variable duration that can oscillate between a few seconds and last up to several hours or days (Caniëls & Motylska-Kuźma, 2023). Not all emotions have the same temporal course; some have proven to be more persistent than others. For example, sadness presents a longer-lasting course than shame or disgust (Brans, 2007) while emotions associated with boredom have shown to be very brief (Gallagher, 2012). The duration of the arousal response can be persistent, even when the eliciting stimulus has disappeared (Qui et al., 2020). In other words, the response to a new stimulus can be a direct consequence of the activation provoked by a previous stimulus: The positive relation between the duration of the emotion-eliciting event and emotion duration does not imply that emotions always or even typically end at event offset; it rather means that the emotion is unlikely to end as long as the elicitor remains present. (Verduyn et al., 2015a,b p. 331)

There are many variables that can influence this activation process. For example, the cognitive processes carried out to allow for the evaluation of changes present strong influences according to the intensity of emotions, given that high intensity emotions require a long recovery period (Verduyn et al., 2015a,b). Affective chronometry, a concept defined by Davidson (2015), is one of the great challenges in researching emotions. Despite this, there are not many studies that have been conducted in relation to this theme, and they diverge according to the methodology of the experimental conditions: either laboratory or natural. The object of affective chronometry is to discover the temporary dynamic of the emotional responses. As such, for example, Fredrickson and Levenson (1998) studied the duration of emotions attending to neurophysiological components like heart rate. In the same vein, Pieper's (2005) team explored chronometry through cardiovascular recuperation. Verduyn (2012) referenced the cognitive component, while Bylsma (2011) studied how long expressive behavior lasted. Although all of these studies differed in the emotional temporality of the different components present in the process, all of them affirmed that activation goes beyond the presence of the eliciting stimulus. This degree of persistent activation, known as residual activation, is described as the degree of activation that extends from one context to another (Cummins, 2017). This residual activation functions as an additive to the stimulation of a subsequent event to intensify the emotional response to the adjacent event, propitiating a transference of activation. In Zillmann's Excitation Transfer Theory (1971), a temporary activation in the autonomic nervous system is defined without taking the polarity or the evaluation of change into account, which, according to author, was performed afterward. Some of the researchers have demonstrated the residual effect and its effect on the final valuation, through direct measurements of autonomic arousal (GSR) and/or self-reports of emotional intensity (Cummins et al., 2012; Jeong et al., 2013).

The change in the evaluation due to emotional drag is possible thanks to the effect defined as the paradigm of erroneous attribution (Cummins, 2012), through which the recipient incorrectly attributes the emotional state triggered by the previous stimulus to the adjacent one. This fact is produced because of the slowness in excitatory deactivation, with relation to the cognitive evaluation in the response the subject embodies. The transference not only contributes to an objective activation increase in response, but it also affects the evaluations or judgments of the contiguous stimulus. In this way, for example, the emotionally charged images included on websites have the capacity to evoke emotions in the recipient beyond the mere exposure to the page itself (Riaz et al., 2018). Despite the fact that Excitation Transfer Theory was formulated to explain emotional reactivity in social interactions with respect to aggressive behavior and fear response (Zillman, 1971; Mattes & Cantor, 1982), it has basically been applied to the study of audiovisual stimuli, as in the studies carried out with relation to the reception of sporting events focusing on the effects over the competition on the athletes (Bryant & Raney, 2000) and the spectators' euphoria (Peterson & Raney, 2008; Cummins et al., 2012; Giles, 2003). This is also the case with stimuli with solely auditory components (Hansen & Hansen, 1990) and stimuli related to each other semantically (Cummins, 2012). In this sense, it is pertinent to mention Perse (2000), a study which obtained evident results that guarantee the superior efficacy of advertising located at the extremes or at the climax of programming in relation to the rest of the ads. Regardless of the favorable results obtained in a numerous study, Zillmann's theory seems to have fallen into oblivion in recent years. It is for this reason that the bibliography might appear a bit obsolete to the reader's eye, despite the theory's validity and its myriad applications in diverse fields.

In a large part of the scientific literature, the tool used to validate the residual effect has been GSR, but no other technology has yet been applied to analyze the evaluation of stimuli in their approach or withdrawal, what is without a doubt a key element in the paradigm of erroneous attribution, opting to evaluate motivation through

declarative methods like self-reporting with Likert scales. The postulation that arises from this study would encompass both facets of the theory, cognitive evaluation as much as psychophysiological activation, attempting to delve into the consequences of this residual effect on strategic media planning with relation to achieving optimal impact. Despite their validity, declarative methods do not offer as much precision as methodologies that analyze physiological parameters (Bellman, 2007). Galvanic skin response (GSR) is presented as one of the most effect methodologies, in terms of results as well as economically and ecologically. Galvanic skin response allows the registration of electrodermal activity sensitive to the increase in physiological activation associated with emotional excitation (Juárez-Varón et al., 2023). Mediation is based on the fact that skin resistance changes according to the level of activation of the sympathetic cholinergic neurons situated in the eccrine sweat glands. Bodily sweating is controlled by the Autonomic Nervous System, and when it is overstimulated, the glands' response increases, thus provoking more transpiration and with it an increase in skin conductance (Durán Acevedo, 2021). This methodology is one of the most frequently used in studying emotion (Li et al., 2021), because it produces effective results for measuring psychophysiological activation.

Another of the most relevant methodologies in research centering on emotion is the Electroencephalogram (EEG). Almost every author agrees that reframing the importance of studying physiological parameters with more than one technology, and to this purpose, the GSR and the EEG (Tiwari et al., 2016) tend to appear together, both methods being the most representative in neuromarketing research (Li et al., 2021). The EEG has the capacity to register neuronal activities in the brain, quantifying the change in electrical flows that are produced in synapses. In basic terms, it is used as a valid methodology for effective information on emotional states (Sammler et al., 2007). Moreover, in recent years, it has also been used to detect the degree of approach toward and withdrawal from a stimulus by way of measuring frontal asymmetry.

Frontal Alpha Asymmetry (FAA) delivers information related to the differential degree in cerebral activation between the frontal right and frontal left hemispheres. This gives us a very relevant index with relation to the subject's decision-making in terms of motivation: approach/withdrawal. In this way, a higher activation in the frontal left hemisphere acts as a strong predictor of approach behavior on the part of the subject toward the stimulus. An increased activation in the frontal right hemisphere would identify a withdrawal behavior (Stasi et al., 2018); Avinash et al., 2018; Hakim et al., 2021). This parameter permits the prediction of the consumer's decision-making with relatively high precision (Golnar-Nik et al., 2019). When combined, both methodologies can produce relevant statistical insights into physiological activation and cognitive evaluation that will permit churning out relevant data in relation to emotional chronometry and residual effect, equally considering the key aspects of evaluation and activation.

Objectives

This study seeks to discover the repercussions derived from the residual effect in decision-making in relation to cognitive evaluation, in terms of approach/withdrawal and the consequent applications to strategic media planning.

Hypothesis

H_1: When presented audiovisual content with high emotional charge, a residual effect is produced consistent with prolonged physiological activation beyond the physical presence of the eliciting stimulus, functioning as an additional way to intensify the emotional response to the adjacent event.

H_2: The residual effect can modify the cognitive evaluation (in terms of approach/withdrawal) of the adjacent audiovisual content, producing an erroneous attribution that can affect decision-making.

Methodology

A quasi-experimental intersubject design was used in the comparison of groups with univariable and multifactorial strategies, the dependent variables of which are physiological activation (GSR) and cognitive evaluation in terms of withdrawal/approach (FAA). The independent variable was designed based on the emotional charge of the audiovisual content (low and high emotional thresholds).

Employing a sampling of convenience, 40 participants were selected from the general population of the University of Valladolid (age range 19–23 years) distributed evenly between the two experimental conditions (O1 20/ X1 20).

Data collection was performed with neuromarketing technology following two different techniques: EEG (Electroencephalography) electrodes (Table 1) and GSR (Galvanic Skin Response) electrodermal activity electrodes (Table 2), through a mobile unit with equipment at the monitorization point. The integration and synchronization of the biosensors is carried out using Imotions 7.2 software, endorsed by over 350 research articles.

Data collection was carried out with minimal error variance considering the following aspects: the instruments utilized are valid, sensitive, and reliable (Hakim et al., 2021; Golnar-Nik et al., 2019; Khushaba et al., 2013; Black et al., 2021; Guerrero-Rodríguez et al., 2020; Hamelin et al., 2020; Patlar Akbulut et al., 2020). The experimenter was the same in both groups.

Research design

1. Unit Analysis Selection

According to the Excitation Transfer Theory (Zillmann, 1996), in order to produce an attribution error, it is necessary for the adjacent stimulus to be intrinsically less stimulating than the one that precedes it. A pilot study tending to this requirement was carried out with the objective of selecting advertising spots that fulfill the following criteria:

1. Spot with a high emotional elicitation threshold (HET)
2. Spot with a low or neutral emotional elicitation threshold (N)

A sample of 250 University of Valladolid students was randomly selected for convenience (ages 19–23 years). They were exposed to a total of sixty spots (in four different sessions), and they were given the task of evaluating the spots using a Likert scale, focusing on emotional elicitation. The resulting unit analysis was a total of six television spots with well differentiated content. Three of them had a high emotional threshold (HET) clearly identified in the message, while the other three spots were neutral (N).

2. Experimental Conditions

A sample of 40 participants from the University of Valladolid, ranging in age from 19 to 23, were exposed to two different experimental conditions, evenly distributing the 20 participants in each

Table 1
Technical characteristics of EEG biometry. Source: https://shimmersensing.com/.

Para meter	Value
Brand	Emotiv Epoc +
Model	Epoc. 1.1
Sample frequency	128, 256 Hz
Channels	AF3, F7, F3, FC5, T7, P7, O1, O2, P8, T8, FC6, F4, F8, AF42
Resolution	4 bits 1LSB = 0,51 μV (16 bits of ADC with 2 bits of noise canceling)
Software	EmotivPRO

Table 2
Technical characteristics of GSR biometry. Source: https://emotiv.com.

Parameter	Value
Brand	Shimmer
Model	Shimmer3 GSR+ Unit
Sample frequency	15,9 Hz
Measurement range	10 kOhm - 4,7 MOhm
Deviation	+- 10 %
Software	ConsensysBASIC from Shimmer

condition.

Condition 1 – Control Group. (O_1) Viewed Content: three spots with neutral emotional content (N/N/N). Sequence: Video 1 – Generic Medication (30.141 msec); Video 2 – "La Tienda en Casa" (LTC) Pest Reject (The At-Home Store) (30.095 msec); Video 3 – "Inmobiliaria Truncal" (Truncal Real Estate) (44.303 msec).

Condition 2 – Experimental Group 1. (X_1) Viewed Content: six spots in alternating order between content with high emotional threshold and neutral emotional charge (HET/N/HET/N/HET/N) Sequence: Spot 1 – Haynes Baked Beans (42.888 msec, Emotion: Joy)/ Spot 2 – "Inmobiliaria Truncal" (44.303 msec)/ Spot 3 – "Fundación de Ayuda contra la Drogadicción" (FAD Foundation for Help Against Drug Addiction) (30.936 msec, Emotion: Disgust)/ Spot 4 – "La Tienda en Casa" Pest Reject (30.095 msec)/ Spot 5 – PETA.ORG (89. 558 msec, Emotion: Compassion)/ Spot 6 – Generic Medication (30.141 msec).

(Video links in Appendix).

Given that inferential techniques cannot be developed because the software does not provide disaggregated data, a Variation Rate (Yang Díaz-Chieng & Vitón-Castillo, 2020) defined as a variation (increase or decrease) in the psychophysiological parameters in the distinct experimental conditions was used, where a change of 15% was established as meaningful.

$$VR\%FAA/X_1 = ((X_1 - 0_1)/0_1) * 100$$

$$VR\%GSR/X_1 = ((X_1 - 0_1)/0_1) * 100$$

VR% FAA / X_1: Variation Rate of Frontal Asymmetry Indices in Experimental Condition X_1
VR% GSR / X_1: Variation Rate of Physiological Activation Indices in Experimental Condition X_1
X_1: Experimental Condition 1 Results
0_1: Control Group Results

Analysis of results

The audiovisual content viewed by the Control Group (O_1) shows a level of physiological activation inferior to the content with high emotional thresholds presented to the Experimental Condition 1 (X_1) (Table 3). As such, the basic condition is fulfilled to allow for the analysis of residual effect, keeping in mind that, in order for the effect to be produced along with the distortion of erroneous attribution, the emotional threshold must be lower than that of the adjacent content (Cummins, 2014). Elevated activation is presented in the "La Tienda en Casa" spot with significant differences with respect to the other two contents of lesser elicitation, the index of which is always inferior to that of the spots with high elicitation.

With respect to the FAA indices (Table 2), the "La Tienda en Casa" spot also demonstrated more elevated levels of acceptance than the rest of the low elicitation spots, even though these indices were hardly significant in terms of acceptance and approach. Even if they do not indicate a clear intention to approach, none of the indices shows rejection. The interpretation of both indices in the low elicitation or neutral spots reveals a low interest in the audiovisual content, as expected, and coinciding with the results of the first phase of selection of the units of analysis using the Likert scale.

The results of the Control Condition O_1 show low levels of approach, just like what happened with the physiological activation. This group's indices are superior to the results obtained by the FAD and PETA spots (high emotional elicitation thresholds), thus verifying the effectiveness of FAA measurement, since the elicited emotions in both cases (disgust and sadness/compassion respectively) generate little acceptance by the subject, in contraposition to the indices shown in the elicitation of joy (Beans spot).

In Experimental Condition X_1, the results in the three high threshold spots demonstrate high indices of physiological activation, of which the FAD spot stands out most. Given the result obtained by this spot using the FAA index, we can conclude that the subject presents a strong emotional activation with negative polarity, possibly due to the evocation of "disgust" produced by the worm-cocaine metaphor. On the other hand, the Haynes Beans spot, although it indeed shows inferior emotional activation in comparison to the FAD ad, it also shows very favorable indications of approach, possibly driven by the evocation of "joy." The first spot, that of the NGO PETA, demonstrates high levels of emotional activation and registers low FAA indices that borderline rejection. This response is due to the evocation of "sadness," which quite possibly constitutes the basic objective of this communication strategy (Table 3).

There is a trend of very significant growth in emotional activation (Graph 1) in Condition X_1 in relation to Condition O_1 in the three spots, the most pronounced curve is that produced by the "Truncal" spot, and the least variation is seen in the "La Tienda en Casa" ad. In each of the three cases, a significant increase is produced after viewing the high emotional threshold content.

In relation to the growth seen in the motivation variable (approach/withdrawal) (Graph 2), the "Truncal" and Generic Medications spots present values of significant increase in Condition X_1. The "La Tienda en Casa" spot shows contrary behavior, a strong decrease in phase X_1.

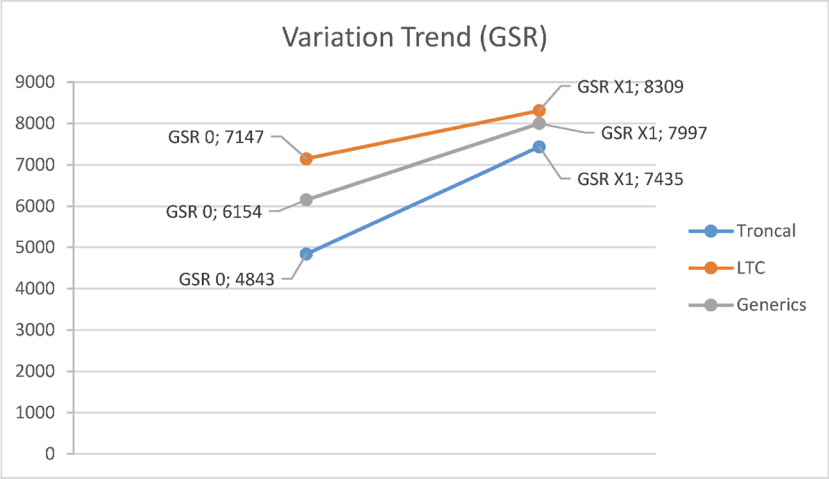
Evaluating the variation rate (Table 4) shows very significant results in relation to both variables: activation and motivation. With respect to emotional activation in Experimental Condition X_1, all the spots of low emotional threshold present a significant increase. The "Truncal" ad increased 53.5 %, "La Tienda en Casa" went up 16.2 %, and the Generic Medications ad increased 29.9 %, each up from its respective starting value. These results assume increases for all the spots with differing degrees of significance but always within the accepted criterion. Therefore, an increase in participant stimulation occurs when exposed to high emotional threshold ads. The "La Tienda en Casa" (LTC) spot is that which displays the least variation, right at the limit of the minimal criterion for significance. Regarding the "Truncal" spot, high indices in variation rate suggest a very significant result. Finally, the Generic Medications ad also marked a notable increase in emotional activation between the Control Group O_1 and Experimental Condition Group X_1.

The FAA indices in Experimental Condition X_1 show notable growth in what is referred to in terms of approach, significantly overtaking the criteria for variation rate, except for the LTC spot, which presented a 60 % decrease. The most notable growth was a 41 % increase produced by the "Truncal" ad, while the greatest reduction occurred when exposed to the LTC content (Table 4).

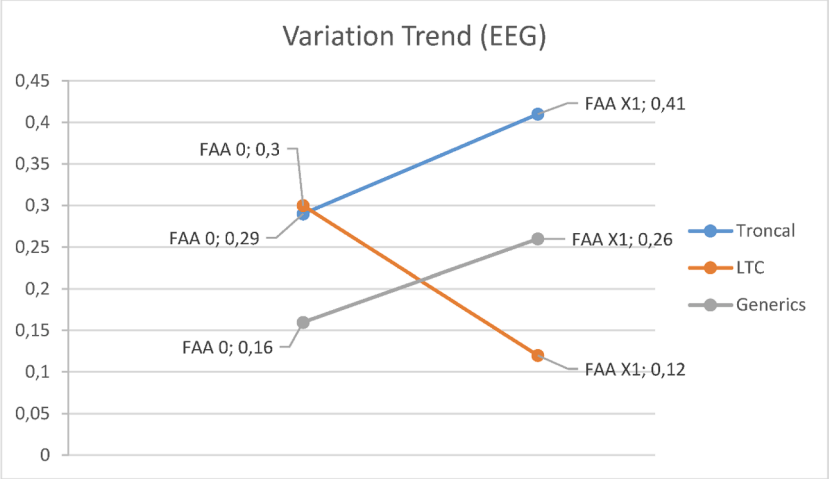
Table 3
GSR and FAA indices.

		Beans	Troncal	FAD	LTC	PETA	Generics
GSR	0_1		4843		7147		6154
	X_1	8143	7435	8728	8309	7534	7997
FAA	0_1		0,29		0,30		0,16
	X_1	0,41	0,41	0,20	0,12	0,11	0,26

Note: Normalized data. Source: Original work of the authors of this study. FAA: average values in measurement range of 0-+1. GSR: Peaks/min.



Graph 1. Variation trend in GSR. Source: prepared by the authors.



Graph 2. Variation trend in EEG. Source: prepared by the authors.

Table 4
Variation rate. Source: prepared by the authors.

	Truncal (Joy)	LTC (Disgust)	Generics (Sadness)
GSR	53.52	16.26	29.95
FAA	41.38	−60	31.25

Discussion

The three spots selected for their low emotional threshold have offered very inferior emotional activation results in comparison with the spots selected with high emotional thresholds, an indispensable requirement to be able to evaluate the residual effect. The "La Tienda en Casa" spot displayed the highest patterns of emotional activation close to those of the high emotional threshold spots, but always with inferior results (Table 3). In the three low emotional threshold spots, a significant increase in emotional activation can be observed in Condition X_1, given that all the variables remained stable. We would conclude, albeit in exploratory form, that a residual effect is produced in these spots due to the drag of emotional activation from the adjacent content. We consider that the emotional drag originated by the activation produced from the elicitation of the adjacent content has contributed to the growth in activation in the experimental condition, because a significant change exists between conditions that is always related to an increased in activation that oscillates between 52 % and 16 %. The subjects present different indices when exposed to the same content relative to the activation shown previously in the control group.

The residual effect is proportional to the initial activation, because the LTC spot with results similar to those of the high emotional threshold content, although always lower, shows a variation with respect to its initial activation value and much inferior to the rest of the ads. To the contrary, the spot that displayed the least emotional activation in Condition O_2 ("Truncal") presents the most elevated variation near 53 %. In this way, we consider that level of initial activation directly influences the result on the residual effect. Slight difference between initial activation and adjacent activation produces a minor variation rate on the residual effect. As such, the residual effect could be seen as conditioned by the rate difference in the emotional activation the content inspires. This supposes that, although in exploratory form, H_1 is verified:

Exposure to audiovisual content with high emotional charge produces a residual effect consistent with the prolongation in physiological activation beyond that of the physical presence of the eliciting stimulus, functioning as an additional way of intensifying the emotional response to the adjacent event. As such, the emotional response to a spot can be amplified by placing it contiguous to other content with a high emotional threshold.

The variation rates in the FAA indices show an increase of up to 41 % in the case of the "Truncal" ad and 31 % in the case of the Generic

Medications ad. In both cases, the residual effect has influenced the subject's evaluation, presenting more favorable indices. In similar fashion, the subjects display approach behaviors superior to those obtained in the control group that can be key at the moment of decision-making, which in turn could constitute a false attribution originating from the adjacent emotional activation. As Cummins (2014) argued, the residual activation has functioned as a posterior amplifier of the emotional response to the adjacent event, thereby influencing the cognitive evaluation of the content. The variation rates are superior in evoking joy, which might initially suggest that residual effect and erroneous attribution bias are not produced in equal magnitude and polarity based on the different emotions evoked. As other authors have analyzed, notable differences exist with regard to the chronometry of emotions – a fact which can be important upon contemplating the residual effect, not only in relation to its intensity, currently a central theme in scientific literature, but also with respect to its polarity and its nature.

The data presents a highly significant fact that can open new paths for investigation. The variation rate in the FAA variable for the "La Tienda en Casa" spot is negative to a very significant percentage, presenting a decrease of 60 %, a relevant piece of information if keeping in mind that the subjects showed a positive evaluation of it with acceptable approach indicators for the control group. The residual effect thus generates a radical change in evaluation, situating the subjects at extreme opposites with a very high rejection rate toward this spot's content, a phenomenon that is not produced in the control group. The difference between the typologies of emotional activation, as related to the nature of the emotion evoked, can be key at the moment of analyzing this result. As has been proven, a greater negative emotional intensity is associated with a longer duration of activation in the regions located along the cortical midline associated with autoreferential processing (Fossati et al., 2003).

It is very revealing that when exposure to adjacent content in which the principal emotion is activated is "disgust," the variation produced is so significant, generating a change in the subject's evaluation after which the exposure shows a negative judgment with indices far superior to that of the favorable evaluation from the control group. The effect of erroneous attribution is much more accentuated regarding this emotion, but it is still coherent with the effect of rejection that the elicited emotion provokes. This implies that it does not fulfill an additive function, because its corresponding variation rate does not increase when focusing on the positive polarity quality, but instead it tends toward an opposite polarity to that of the initial. It would be convenient for future research to analyze the quality of the drag effect in relation to creating an additive effect focusing on the nature of the emotions, which might possibly even include modifying the polarity tending to the nature of the emotion, as happened in this case. Paying attention to these results, we would be able to conclude in an equally exploratory manner that the second hypothesis is also proven:

H_2: The residual effect can alter the cognitive evaluation (in terms of approach/withdrawal) of the adjacent audiovisual content, producing erroneous attribution that can affect decision-making.

Conclusion

The psychophysiological parameter of emotion has been transformed in recent years into a key indicator for analyzing consumer decision-making. The advance in neuromarketing research methodologies has made access to vitally important data from marketing design strategies possible. However, this parameter is not considered in the formulas used in strategic media planning, which are generally centered on more quantitative aspects like the number of impacts, transmission schedule, channel, etc. The purchase of advertising blocks is currently done without an analysis of the effects that can cause an emotional drag factor and subsequent erroneous attribution bias. Analyzing the context of emotional activation can be a useful tool to achieve maximized coverage and to contribute to the optimization models in media strategy. This study emphasizes the necessity to consider changes in the *modus operandi* of strategic planning professionals, such as the influence of adjacent content that increases physiological activation. This influence is a fact which has contributed to notable changes in the subjects' cognitive evaluation regarding content with low emotional charge.

In relation to positive emotions, a response has been produced that has functioned additively, improving the acceptance of content. This is a response contrary to the case of negative emotions, which have produced a very significant effect in terms of rejection on the subjects' part. Consequently, this leads us to conclude that both the subject's evaluation as much as the decision itself are strongly influenced by emotional transference from adjacent content. On the other hand, it would be prudent to reflect on the designs of marketing studies that are grounded in copy testing. It is possible that evaluating a piece in isolation from the environment in which it would be disseminated would not obtain the same results, given that it would be devoid of the drag effect and erroneous attribution bias incurring in a lack of external validity. We consider it essential to become familiar with and to study the effect of environment on consumer decision-making to gather more precise data about the effect of communication campaigns on the target market.

The typology of emotions and the variability in physiological activation should be key components when analyzing the effectiveness of a commercial audiovisual content, always considering the context and the residual effect. To date, research on affective chronometry is scarce, which opens a new panorama in research that can contribute to a clear improvement in strategic media planning. The classification of commercials according to their capacity for emotional transmission and contagion could be a key tool in buying space.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.stae.2023.100069.

Appendix 1

Video Links to Spots Used in Control and Experimental Groups

Truncal Real Estate: "Inmobiliaria Truncal" (2021, October 20) Spot "Inmobiliaria Truncal" (Video) https://www.youtube.com/watch?v=rwnssT-yXeA

Generic Medications: Medicamentos Genéricos (2021, October 12) Spot Medicamentos Genéricos (Video) https://www.youtube.com/watch?v=gdcg3BdI_Xs

The At-Home Store: "La Tienda en Casa". (2021, October 20) Pest Reject. (Video) https://www.youtube.com/watch?v=DaGbtnaBfmM

Haynes Beans: Dovorzy L. (2021, October 16) Beans not for astronauts (Video) https://www.youtube.com/watch?v=hKDiPp2aCQk

Foundation for Help Against Drug Addiction: FAD. (2021, October 11) Spot FAD. (VIDEO)
https://www.youtube.com/watch?v=Ebq-aMPJat0

People for the Ethical Treatment of Animals: PETA (2021, October 9) A Teddy Bear The Trauma of animal test in New Video. (Video) https://www.youtube.com/watch?v=T_Wz9flO7kU

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