

FRAMING, RISK PERCEPTION AND SOCIAL HEALTH CAMPAIGNS. AN ANALYSIS FROM NEUROSCIENCE

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ABSTRACT

Social health campaigns have been widely used by health authorities to improve the attitudes and healthy behaviors of the population. With the COVID-19 pandemic, they have become an essential tool to increase compliance with health measures, mainly among the young population, a particularly reluctant group. The aim of the study is to analyze the effectiveness of different campaigns to improve the intention to change behavior of young people towards compliance with health measures.

For this purpose, an experimental study has been carried out using neurophysiological tools (electroencephalogram and galvanic skin response) as well as self-reported data from a questionnaire. The experiment analyzed three health campaigns with different narrative frames and emotions in the message. The results show different degrees of persuasive effectiveness depending on the framing, the emotions used and the intensity. The influence of the perceived risk declared by the participants on the impact of the different campaigns is also analyzed. Implications for the design of campaigns are derived, and limitations and future lines of research are addressed.

KEYWORDS: social health campaigns; framing; risk perception; neuroscience, COVID-19; persuasiveness.

INTRODUCTION

The SARS-CoV-2 virus, causing COVID-19, has generated a pandemic that has had a major impact on global society. A pandemic is one of the major risks facing societies today, and COVID-19 has highlighted that it not only influences people's health, but also affects their economic status and well-being (Siegrist *et al.*, 2021). People's behavior is central to the control of the pandemic through the population's compliance with the recommendations of the health authorities. However, the follow-up of these measures by citizens, especially adolescents and young adults, has been in general scarce (Nivette *et al.*, 2021). With the aim of increasing compliance with preventive guidelines, health authorities have launched different types of persuasive social campaigns, in many cases aimed at young people, with the purpose of modifying their risk behaviors in the face of the pandemic (Heffner *et al.*, 2021).

A social campaign is a multidimensional process aimed at communicating and promoting social change. It is based on a persuasive message that aims to change attitudes and/or behaviors to improve the well-being of individuals and society (Wymer, 2011). Different studies have shown that persuasive messages can enhance the follow-through of prevention behaviors during a global public health crisis, and have confirmed the need to assess the impact that persuasive messages have on people's attitudes and behavior (Carfora & Catellani, 2021; Heffner *et al.*, 2021).

Regarding the elements that affect the persuasiveness of social campaigns, research has shown that the persuasive effect depends, at least in part, on how the message is framed. Thus, a

positively framed message (gain-framed) shows the positive consequences associated with performing the recommended behavior, whereas a negatively framed message (loss-framed) presents the negative consequences associated with not performing the recommended behavior (Carfora & Catellani, 2021; Cesario *et al.*, 2013). Thus, individuals' cognitive and emotional involvement, as well as changes in attitudinal response and behavioral intention, may differ depending on the type of narrative used (Carfora & Catellani, 2021). Another fundamental variable in the success of advertising campaigns is the emotional reaction it provokes in individuals (Poels & Dewitte, 2019). In this sense, the use of negative emotions, such as fear, sadness, or guilt, is very frequent in social advertising with the aim of attracting attention and favoring the change of attitudes and behavior. Nevertheless, previous literature review does not provide conclusive results (Borawska *et al.*, 2020). In addition to emotional factors, certain works (Pozharliev *et al.*, 2017) identify cognitive factors such as attention, memory and consumer preferences as key indicators of advertising effectiveness.

In addition, controversial results can be explained by the methods being used in previous literature too. Thus, most studies assessing the impact of advertising campaigns rely on a mixture of qualitative and quantitative research methods based on declarative measures of individuals. However, these types of methods have different limitations as they tend to be subjective self-reports based on individuals' conscious statements (Ohme *et al.*, 2011) that may be biased by cognitive or social desirability constraints (Poels & Dewitte, 2006).

More recently, aiming to overcome the problems of traditional techniques, several studies use neurophysiological tools such as electroencephalogram (EEG), functional magnetic resonance imaging (fMRI) or galvanic skin response (GSR) to examine the cognitive and affective processes that advertising generates in consumers, in contexts such as social marketing and public service messages (Gountas *et al.*, 2019; Harris *et al.*, 2019).

Furthermore, the analysis of the individual socio-psychographic characteristics of the recipients has been studied as possible modulating variables of the persuasive impact of social marketing messages (Cesario *et al.*, 2008). One of the factors analyzed in literature has been perceived risk. For the particular case of the COVID-19 pandemic, the perception of health risk is the main predictor of the acceptance of the measures applied and their behavior (Siegrist *et al.*, 2021). Specifically, individuals with low perceived risk for COVID-19 will be more likely to fail to comply with preventive measures against COVID-19 (Badr *et al.*, 2021).

In order to deepen this field of research, the objectives of the present study are twofold: (a) to examine the persuasive impact of three social health campaigns with different message strategies and (b) to analyze the role of perceived risk in the persuasive impact of the analyzed campaigns. To address these objectives, the researchers have used galvanic skin response (GSR) and electroencephalogram (EEG) as neurophysiological tools, together with self-reported measures by respondents.

Two main contributions justify this work from both a scientific point of view and from the relevance of its practical implications for decision making. First, the present study overcomes the limitations of the traditional techniques to collect data. To this purpose, neurophysiological measurement tools together with self-report measures are used. Second, in situations of global public health crises, such as the COVID-19 pandemic, to identify which types of social campaign messages are most effective in increasing the follow-up of preventive health behaviors is essential, thus facilitating health managers to develop social campaigns capable of raising awareness of the threat under current and future pandemics (Carfora & Catellani, 2021).

LITERATURE REVIEW

Social communication campaigns

Social advertising is the promotional component of social marketing, which refers to the "adaptation of commercial marketing technologies to programs designed to influence the voluntary behavior of target audiences to improve their personal welfare and that of the society of which they are a part" (Andreasen, 1994, p. 110). The term social campaign includes organized communication-based interventions aimed at large groups of people, targeting different social domains (Snyder, 2007) that seeks to promote positive social change through mass media and social networks (Grigoryan, 2019). They address various issues that affect both attitudinal and behavioral changes, such as eating habits, healthy lifestyles, financial support to various charities, environmental care, safe driving, etc. (Borawska *et al.*, 2020).

The rapid growth of marketing applied to the social sphere in recent decades is a consequence of the progress of societies and the concern on the part of states and institutions to ensure the welfare and development of citizens. In this context, social marketing campaigns are revealed as an effective tool to influence behaviors and, thus, help in the resolution of known social problems (Park *et al.*, 2020).

Designing effective social campaigns poses a great challenge for researchers. Most studies on social advertising focus on analyzing the effectiveness of messages in promoting the desired social change (Wilson *et al.*, 2020). In this context, several authors have pointed out the need to identify the most effective communication strategy to promote awareness of well-being issues, in addition, to explore tools to objectively measure emotional reactions and cognitive factors in terms of individuals' attention and recall (Borawska *et al.*, 2020; Missaglia *et al.*, 2017).

Theoretical approaches to persuasion in social campaigns

According to the type of message, different theoretical models are used to explain the effectiveness of social marketing campaigns. On the one hand, the concept of narrative transport (transport-image model) (Green & Brock, 2000), serves as a theoretical framework to understand the use of different advertising message strategies in social campaigns and it has been proposed as one of the main mechanisms to explain the persuasive impact on individuals (Deng *et al.*, 2020). Narrative persuasion uses stories to generate a focus of attention, generating an emotional effect on the subjects, and at the same time decreasing the motivation to counterargue, generating changes in the attitudes, intentions and actions of individuals (Green & Brock, 2002).

On the other hand, message framing characteristics are relevant to identify factors that explain the persuasive effectiveness of social campaigns (Carfora & Catellani, 2021). Thus, the messages may differ in terms of the type of framing. In this sense, "a gain-framed persuasive appeal emphasizes the advantages of compliance with the recommendation or the communicator's point of view, in contrast to loss-framed appeals, which emphasize the disadvantages of noncompliance" (O'Keefe & Jensen, 2007, p. 623).

The literature shows that the orientation of messages used in social campaigns has ranged from positive framing (e.g., humorous appeals) to negative framing (e.g., fear, guilt, and shame appeals) (Wilson *et al.*, 2020). In that sense, in the health field the literature has shown contradictory results when comparing negative versus positive narrative (Teng *et al.*, 2019;

Missaglia *et al.*, 2017). Some authors highlight that messages that use fear to accentuate the negative consequences of not performing a healthy behavior (loss-framed), generate a positive persuasive effect and originate a change in behavior (Witte & Allen, 2000). Contrary, other studies (Roskos-Ewoldsen *et al.*, 2004) found a "boomerang effect" (Brehm & Brehm, 1981), favouring recipients to reject recommended behaviors when they perceive health messages as too frightening or threatening (Carfora & Catellani, 2021; Missaglia *et al.*, 2017).

The classical models of advertising literature considered cognition as the key element in the response of individuals (Lavidge & Steiner, 1961). However, years later authors such as Zajonc (1980), generated new lines of research highlighting the crucial role of emotions in determining advertising effectiveness (Poels & Dewitte, 2019), arguing that emotions have pre-eminence and independence from cognition. However, there is no consensus on the effectiveness of campaigns based on the level of intensity of the emotional reactions it generates (White *et al.*, 2003). Several studies have concluded that the higher the level of negative emotions, the greater the effectiveness of the campaign (Lennon *et al.*, 2010); other researchers have found that moderate emotional reactions obtain better results (Roskos-Ewoldsen *et al.*, 2004), while others have not found conclusive empirical evidence on this relationship (Tannenbaum *et al.*, 2015).

Other studies follow a contrary line of argument and have examined how persuasive health messages can be framed in terms of the benefits of performing a healthy behavior (gain-framed), and use humor as a persuasive strategy. Yoon & Tinkham (2013) find that humorous appeals that generate positive emotions in social campaigns show a different level of effectiveness depending on the intensity of the threat and the involvement of the topic, while other authors (Fraustino & Ma, 2015; Moyer-Gusé *et al.*, 2011) defend that humor can favor the attention of recipients and reduce counterarguments, thus improving persuasion.

Taking into consideration the theoretical framework being used in this research, we propose the following the first group of hypotheses:

H_{1a}: A loss-framed social communication health-related strategy is more persuasive than a gain-framed one.

H_{1b}: In a loss-framed social communication health-related strategy context, the level of intensity of the narrative being used is inversely related to the persuasiveness of such strategy.

Risk perception

In the study of consumer behavior, the concept of perceived risk has been investigated in the literature since the contributions of Bauer (1967), on the purchase decision (Bettman, 1973), satisfaction/brands and their management (Erdem & Swait, 1998). Mitchell (1999) define perceived risk as a complex, differentiated and dynamic concept. It is also characterized as subjective, as each individual may have different, but equally valid, perceptions and frames of reference for the same risk (Portell & Solé, 2000).

Perceived risk has been a key construct widely studied from different theoretical approaches to health behavior. For example, the Health Belief Model (Rosenstock, 1974) and the Protection Motivation Theory (Rogers, 1975) propose that the perceived risk of a health threat drives the person to adopt preventive behaviors as a way to reduce that risk. In this line, different research has found that perceived risk promotes preventive health behaviors (Oh *et al.*, 2020).

Previous analyses indicate that perceived risk has been explored as a contextual factor in research on the persuasiveness of communication campaigns on different social issues. There is some evidence of a greater persuasive impact of negatively framed messages when people present a high perceived risk, while positively framed messages were more effective in subjects with low perceived risk, for the case of intention to donate blood (Mohanty *et al.*, 2021).

In the current pandemic context, the perception of risk to COVID-19 is very relevant for the population to accept the measures of the health authorities, and to adopt the recommended behavioral changes in terms of physical distancing from others or increased hygienic behavior (Siegrist *et al.*, 2021). Different authors have found that the perception of health risk is the main predictor of acceptance of the measures applied and of their behavior in the pandemic (Badr *et al.*, 2021; Siegrist *et al.*, 2021). In short, those with low perceived risk to COVID-19 are less likely to implement protective behaviors, making them vulnerable citizens to breach protective measures.

To test the role of risk perception in defining social campaigns, we propose the following hypothesis.

H₂: Individuals' risk perception level influences the persuasiveness of the social health-related campaigns

Neuroscience and social research

Traditional methods for analyzing the effectiveness of social advertising campaigns are usually based on self-reports and rely heavily on the willingness and ability of individuals to describe their attention levels, emotions, or behavioral intentions in relation to the social campaign they have been exposed to. These methods provide more subjective assessments due to respondents' reluctance to openly reveal their preferences and responses to stimuli (Gountas *et al.*, 2019). In addition, self-report measures capture conscious emotional reactions (Micu & Plummer, 2010), but the validity of these assessments is often biased by cognitive or social desirability constraints (Poels & Dewitte, 2006).

In contrast, neuroscientific techniques help to obtain relatively more objective and quantitative information because they require neither an active or conscious response from participants (Telpaz *et al.*, 2015), nor measured by cognitive processes (Poels & Dewitte, 2006; Harris *et al.*, 2018). Therefore, neuroscience contributes different neuroscientific and physiological research techniques with the aim of detecting changes in neuronal electrical or metabolic activity (Verhulst *et al.*, 2019) and to identify cognitive and affective processes (Ciorciari *et al.*, 2019).

In short, neuroscience offers the opportunity to explore in depth decision-making processes involving attention, emotions, and memory (Bettiga *et al.*, 2017; Lim, 2018). Accordingly, neuroscience can be particularly useful for exploring issues that are often the focus of social marketing campaigns (Achrol & Kotler, 2012), as indicated that neurophysiological tools present greater predictive power compared to more traditional methods applied to pro-social marketing (Lee, 2016).

METHODOLOGY

To test the hypotheses, we opted for an empirical approach by designing an experiment. In order to obtain relatively more objective information, neuroscience tools were combined with the application of a pre and post questionnaire, as stated before. This approach will allow us to compare the effects of different communication strategies and their results in a more accurate way.

A within-subjects experiment was conducted in the neuroscience laboratory of Spanish university under ethical and confidentiality guarantees. The task consisted in the monitored visualization of a series of stimuli (images) that included different commercials broadcasted on television and the Internet. Among them, the commercials of three social campaigns in improving attitudes toward compliance with COVID-19 pandemic prevention measures were shown. In addition, they had to answer a pre- and post-viewing questionnaire. The fieldwork was carried out during March and April 2021.

Before starting the experiment, the device sensors were fixed on each participant and calibration was performed. The experiment per se lasted a total of 33 minutes: 23 minutes of viewing and 10 (5 + 5) minutes to answer the questionnaire. First, the participant had to answer the pre-questionnaire. Then, the viewing began with a series of images of adaptation to the measurement tools. Next, the stimuli were presented as well as other commercials of different popular products/brands. To guard against order effects, spots were presented in one of three random orders. Once the viewing was over, the participants were asked to finish answering the post-questionnaire about the commercials that featured in the experiment.

Stimuli design

Based on the literature reviewed, a panel of communication experts (3 professionals and 4 scholars) assessed a pool of 9 COVID-19 campaigns targeting young people broadcast on social networks in November and December 2020. They finally selected and classified three of them as the most appropriate (Table 1).

Table 1. Description of the stimuli used

CAMPAIGN	MESSAGE STRATEGY	TITLE	DESCRIPTION
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C1	Gain-framed message Humorous narration	"Become a hero too and stay at home" https://n9.cl/tbprk	Story of an elderly man explaining that he was awarded a medal in the winter of 2020 for his efforts in the fight against the coronavirus. Through humor, the protagonist explains that as a young man he was very lazy, and with the pandemic he remained the same lazy slob he always was. In short, "laziness could save lives" and with that, he became a hero.
C2	Loss-framed message Low intensity narrative	"Your grandmother has COVID, she's not going to make it through the night" https://onx.la/a643c	The story of a young man who is out partying with his friends and receives a call from his mother to tell him that his grandmother is in a very serious hospital with COVID-19. The mother asks him if he has been out partying, as the young man recently visited his grandmother. The campaign shows the young man's emotion in the foreground throughout the rest of the campaign.
C3	Loss-framed message High intensity narrative	"Don't be a jerk" https://onx.la/d4b31	Story of a young woman telling how she was an imbecile for not respecting protection measures. Images (hospital, cemetery) and phrases ("choose life") are shown that are dramatic and explicit of the consequences of her behavior.

Sample

Participants were recruited under the guise of a study about current advertising trends. All of them were undergraduate students from different social science degrees. Before the experiment began, they were informed about the different neuroscience tools that were going to be used. The final sample consisted of 45 young people aged between 19 and 24 years (Mean= 20.91, SD 1.443); 21 (46.7%) male, 24 (53.3%) female. Most of them had neither suffered COVID-19 (86.7%) nor their direct relatives (62.2%).

Explicit and neurophysiological measures

Explicit measures

Three variables were measured by a self-reported questionnaire. The measurement scales were selected and adapted from the literature:

- Risk perception: 4 items adapted from Olaimat *et al.*, 2020 and Roma *et al.*, 2020
- Emotional Response: 10 items adapted from Bagozzi *et al.*, 1999
- Intention to change behavior: 2 items adapted from Borawska *et al.*, 2020

All responses were measured using a 7-point Likert scale, ranging from “strongly disagree = 1” to “strongly agree = 7”.

Neurophysiological measures

Two different consumer neuroscience techniques were used: skin conductance and electroencephalograph provided by BitBrain Technologies. This company has already been involved in previous research such as García-Madariaga *et al.* (2019).

Galvanic skin response (GSR) measures the electrodermal response that occurs when the skin becomes a better electrical conductor due to increased activity of the sweat glands because of the exposure to a specific stimulus (Potter & Bolls, 2012). Therefore, the skin conductance amplitude provides a direct measure of subjects' arousal (Venkatraman *et al.*, 2015). The GSR device used in the present study to get the arousal was the BitBrain GSR ring, a wireless device for real-time monitoring of electrodermal and cardiac activity.

This technique measures activation as the level of physiological activation produced by a stimulus or situation (arousal). Ranged from -100 to +100, values less than 0 are associated with a relaxed or calm state and values above 0 are associated with an excited state.

The electroencephalograph (EEG) is a non-invasive instrument that provides information from areas underneath the cortex and, combined with other instruments, may provide very accurate results on a subject's response to a marketing stimulus (Du Plessis *et al.*, 2011). It helps to understand the way the brain responds to various stimuli. Cerebral activity was recorded using the BitBrain Dry-EEG wearable y mobile with 12 channels at a sampling rate of 256 Hz, while impedances > 100 dB @50Hz, > 50 GΩ. For the experiment, we used 12 electrodes, 12 x EEG (Fp1, Fp2, AF7, AF8, F3, F4, P3, P4, PO7, PO8, O1, O2), REF (A1) y DRL (Fpz).

EEG allows us to determine the following measurements (values ranged from 0 to 100):

- Engagement: Degree of involvement or connection between the participant and the stimulus or task
- Valence: Degree of attraction, positive or negative, experienced by a stimulus or situation
- Attention: Cognitive resources used for the performance of a task or the visualization of a stimulus
- Memorization: Intensity of cognitive processes related to the generation of future memories during the presence of a stimulus

RESULTS

The analysis of the participants' statements in the questionnaire after viewing the campaigns yields the following results. Campaign 1 is the one that provokes the least anger, dislike, disgust,

sadness, and fear, while it is the one that generates the highest levels of joy, surprise, fun, tenderness and pride. Campaigns 2 and 3 do not show significant differences in the variables of fear, joy, surprise, fun, tenderness, and pride. Although campaign 3 elicits higher levels of anger, dislike, disgust, and sadness, with the exception of fear, similar to Campaign 2 (Table 2).

With respect to the relationship between negative emotions and intention to change, we found that, in all cases, there were direct and significant relationships. In other words, the greater the negative emotional reaction to the campaign, the greater the intention to adopt new preventive behaviors in the face of COVID-19. Consistent with these results, the ANOVA analysis of the differences in the levels of intention to change behavior between the campaigns shows that campaign 3 is the one that provokes the greatest predisposition, and campaign 1 the least intention to change behavior. Campaign 2 is placed in an intermediate position, maintaining significant differences compared to campaigns 1 and 3.

Table 3 shows additional results from biometric data collected by neuroscientific techniques. As can be observed, campaign 1 is the one that provokes the lowest levels of activation and engagement, while the highest ones in memorization. This campaign also shows good results in terms of attention, but in this case, the levels of effectiveness of campaign 1 are statistically similar to those of campaign 3.

Campaign 2 generates the highest levels of engagement and valence, but the worst results in terms of memorization and attention. Somehow, it could be concluded that, at least in these variables, the results of campaigns 1 and 2 are quite opposite. In terms of activation, campaign 2 presents good results, but in this case, there are no statistical differences between campaigns 2 and 3.

Finally, campaign 3 stands out in activation and attention, but similarly to campaign 2 and 1, respectively. For the rest of the variables, the results allow us to conclude an intermediate effectiveness.

The data obtained through physiological techniques are consistent with those self-reported. In this sense, campaign 1 causes the least activation, while campaigns 2 and 3 show statistically significant higher levels of activation, with respect to campaign 1. These results allow us not to reject the first hypothesis H_{1a} but, contrary to our expectations, high intensity narrative seems to be the one that imply a greater change in the behavior of individuals, in a loss-framed message context. Therefore, the empirical evidence obtained implies rejecting hypothesis H_{1b} , since the relationship between the level of intensity of the message and the persuasiveness of the campaign is direct rather than inverse, as proposed initially.

Table 2. Self-reported information: main results

	ANGER	DISLIKE	DISGUST	SADNESS	FEAR	JOY	SURPRISE	FUN	TENDERNESS	PRIDE
Campaign 1	M=1.489 SD= 1.079	M=1.689 SD= 1.164	M=1.822 SD=1.230	M=2.822 SD=1.722	M=1.600 SD=1.031	M=3.978 SD=1.685	M=4.400 SD=1.814	M=4.222 SD= 1.929	M=3.600 SD=2.071	M=3.222 SD=2.109
Campaign 2	M=3.533 SD=2.117	M=3.756 SD=1.932	M=2.778 SD=1.881	M=5.111 SD=1.748	M=4.067 SD=2.104	M=1.178 SD=0.386	M=2.222 SD=1.520	M=1.089 SD=0.287	M=1.467 SD=1.120	M=1.600 SD=1.543
Campaign 3	M=4.467 SD= 2.370	M=4.822 SD=2.208	M=3.667 SD=2.246	M=6.133 SD=1.358	M=4.644 SD=1.823	M=1.111 SD=0.317	M=2.511 SD=1.804	M=1.067 SD=0.252	M=1.467 SD=1.159	M=1.555 SD=1.545
F	27.800***	34.375***	11.374***	49.318***	40.035***	116.924***	21.318***	115.015***	29.720***	13.205***
Differences between campaigns	C1-C2-C3**	C1-C2-C3***	C1-C2-C3***	C1-C2-C3***	C1-C2*** C1-C3***	C1-C2*** C1-C3***	C1-C2*** C1-C3***	C1-C2*** C1-C3***	C1-C2*** C1-C3***	C1-C2*** C1-C3***

*** Significance level: 0.01; **Significance level: 0.05; C1: Campaign 1; C2: Campaign 2; C3: Campaign 3

Table 3. Data from neuroscientific techniques: main results

CAMPAIGNS	MESSAGE STRATEGY	ACTIVATION	ENGAGEMENT	VALENCE	ATTENTION	MEMORIZATION
Campaign 1	Gain-framed message Humorous narration	M=-16.563 SD=14.664	M=33.171 SD=5.072	M=-0.072 SD=8.805	M=29.736 SD=5.725	M=40.609 SD=7.639
Campaign 2	Loss-framed message Low intensity narrative	M=-8.321 SD=5.008	M=38.289 SD=4.983	M=2.525 SD=9.337	M=28.492 SD=6.674	M=30.623 SD=5.729
Campaign 3	Loss-framed message High intensity narrative	M=-10.238 SD=10.877	M=34.255 SD=5.590	M=0.445 SD=9.441	M=29.442 SD=6.051	M=37.148 SD=6.712
F		41.331***	71.477***	5.988***	3.815**	148.402***
Differences between campaigns		C1-C2*** C1-C3 ***	C1-C2-C3**	C1-C2*** C2-C3**	C1-C2** C2-C3**	C1-C2-C3***

*** Significance level: 0.01; **Significance level: 0.05; C1: Campaign 1; C2: Campaign 2; C3: Campaign 3

In order to test our second hypothesis (H_2), the sample was divided in two groups: high/low risk perception using the responses to the questionnaire. This variable was initially measured as a seven-point Likert scale and recoded by taking the values 0 (low risk perception) and 1 (high risk perception) depending on whether they were below or above the mean value of the variable, respectively. Thus, 23 participants were identified as having high risk perception and 22 as having low risk perception.

Considering the level of risk, overall, we observed that there were significant differences in the reported scores for anger, and fear, being higher in the high-risk perception group. In the rest of the emotions, no significant differences were observed.

When the results are detailed by campaign, we can observe the following. First, in campaign 1, those who have a greater risk perception present significantly higher levels of fear. Second, campaign 2 arouses higher levels of disgust and fear in those respondents with a higher perception of risk. For the rest of the variables, campaign 2 does not discriminate regarding the level of perceived risk. Finally, campaign 3 does not distinguish between the variables under study according to the level of perceived risk, since no significant difference is observed in the reactions between the two groups of participants.

The analysis of the neuroscientific results by campaign for these two groups (low/high risk perception) is presented in Table 4. Campaign 1 shows significant superior differences in the high-risk group in engagement and valence. While it shows better performance in the low-risk group for activation and memorization. Campaign 2 reports significant differences in the low-risk group in activation, valence and memorization, although in the engagement variable it changes to the high-risk group. With respect to campaign 3, significant differences were found in the high-risk group in both activation and engagement. Interestingly, the attention variable does not show significant differences in any of the three strategies presented.

Considering these results, there is empirical evidence not to reject our second hypothesis (H_2), since the reactions are partially different if both groups of participants.

Table 4. High versus low risk perception analysis by campaign: main results

CAMPAIGNS	MESSAGE STRATEGY	RISK PERCEPTION	QUESTIONNAIRE EMOTIONS SCORES	Mean /SD	ACTIVATION	ENGAGEMENT	VALENCE	ATTENTION	MEMORIZATION
Campaign 1	Gain-framed message Humorous narration	HIGH RISK	FEAR	M=1,227 SD=0.528 4 t=2.510**		M=35,000 SD=7,093 t=7,533***	M=-2,407 SD=13,00 t=-5,309***	NO SIGNIFICANT DIFFERENCES	
		LOW RISK			M=-1,382 SD=6,212 t=-23,795***				M=41,646 SD=10,357 t=-2.922***
Campaign 2	Loss-framed message Low intensity narrative	HIGH RISK	FEAR	M=3.364 SD=2.172 t=2.095**	M=-5,656 SD=4,210 t=-10,586***	M=38,956 SD=6,627 t=2,071***	M=-5,195 SD=12,905 t=-4,235***	NO SIGNIFICANT DIFFERENCES	M=32,164 SD=7,460 t=-4,167***
			DISGUST	M=3.273 SD=1.956 t= 2.296**					
		LOW RISK							
Campaign 3	Loss-framed message High intensity narrative	HIGH RISK	NO SIGNIFICANT DIFFERENCES		M=-2,384 SD=7,105 t=13,582***	M=36,716 SD=7,326 t=7,067***	NO SIGNIFICANT DIFFERENCES		
		LOW RISK							

*** Significance level: 0.01; **Significance level: 0.05

DISCUSSION

COVID-19 pandemic has completely changed both economic and social context. The recovery after the pandemic demands new social values and behaviours. Institutions have a duty to protect society as a whole, which requires some population groups to change certain modes of behavior. To this end, social campaigns arise as effective tools to change values and behaviors. This study contributes to a better understanding of the role of social health campaigns in promoting the adoption of healthy behaviors in the context of the COVID-19 pandemic. Specifically, this research focuses on the study of the effectiveness of different types of message strategies and the emotions elicited in young university students. This target group is of special interest to the authorities due to the high levels of non-compliance with health regulations. Likewise, we want to evaluate whether the risk perceived by individuals influences what type of message or strategy is more effective.

In this paper we have offered new empirical evidence on the role of both the narrative frame of the communication strategy and the intensity of the message for the population being studied. As previous research has been criticized because of the bias of using self-reported data, we analyzed data collected by neuroscientific techniques too.

Evidence has shown that campaigns generating more negative emotions declared (campaigns 2 and 3) are those that provoke greater intention to change behavior too. Moreover, such campaigns are the ones that generate higher levels of physiological activation. Campaign 1 generates cognitive involvement of the subject, with high levels of attention and memorization evaluated through EEG. However, it does not seem effective neither in terms of negative emotional response (declared, or physiological), nor in terms of behavioral change. Accordingly, gain-frame narratives are less persuasive in this crisis situation, since positive emotions are not so linked to intention to change behaviours of individuals.

Regarding the analysis of the level of intensity of the negative narrative, in line with previous authors (Lennon *et al.*, 2010), our study confirms that the higher the narrative campaign, the greater the emotional response and the greater the intention to change behavior. These self-reported data are consistent with the results obtained for the physiological arousal variable. However, in line with Bowaraska's study (2020), the neural measures are not consistent with the reported emotion data. In this sense, the EEG data show that the low-intensity campaign (campaign 2) generates significantly higher levels of engagement and attraction than the high-intensity campaign (campaign 3). These controversial results deserve more attention in future research.

Nevertheless, to deepen this field some additional variables must be taken into consideration. While main relationship is true for the overall sample, the analysis has to focus on specific targets more difficult to mobilize. To this end, we discriminated between individuals with low and high COVID-19 perceived risk.

In this case, the results indicate that the negative emotions (fear and disgust) play a prominent role in both gain-frame (campaign 1) and low intensity loss-frame strategies (campaign 2), but only for those with a high level of perceived risk. In other words, the mobilizing effect of negative emotions is present in this particular group of population, which is already aware of the danger they are in, so it is not necessary to change their behavior.

Moreover, the results of neuroscience techniques indicate that the intensity of the message does not benefit to comply with the social objectives of the strategy. For the low risk target, the

low-intensity loss strategy (campaign 2) is the one that works best according to neuroscience techniques, since it is the one that provokes the most activation but is also better in valence and memorization. After analyzing the results of the neurophysiological variables, we can observe that, for subjects with low risk perception, the humorous campaign (campaign 1) and the low narrative campaign (campaign 2) generated greater physiological activation than the campaign with high narrative (campaign 3). In other words, when discriminating between high and low risk subjects, the high narrative campaign is the one that would have the least impact on this type of subjects.

In relation to the variables collected through the EEG, firstly, subjects with high perceived risk presented significantly higher levels of engagement in all the campaigns than subjects with low risk. We could point out that high-risk subjects show a higher level of concern and would be more willing to get involved in any type of awareness campaign against COVID-19. However, it is interesting to analyze which type of campaign generates greater processing in low-risk subjects.

Subjects with low risk perception obtain significantly higher scores in the memorization variable in the gain and loss campaign with low narrative intensity, that is, campaigns 1 and 2, respectively, while valence appears as relevant also in the low narrative intensity campaign. In short, according to the data provided by the neurophysiological tools, for individuals with low perceived risk to COVID-19 the campaign with explicit narrative (campaign 3) would be the least effective, in terms of affective and cognitive processing. In this sense, for low-risk subjects, the other two campaigns, campaign 1 (gain-framing) and, particularly campaign 2 (low narrative loss-frame) seem to be more effective, with significant differences compared to high-risk subjects in the activation, valence and memorization variables.

The results of this research contribute to the advertising literature in several ways. Firstly, regarding the different framing strategies, loss-framed versus gain-framed, the results obtained indicate that loss-framed strategies are more persuasive than gain-framed strategies. This may contribute to clarify the contradictory results so far present in the literature on health campaigns (Teng *et al.*, 2019).

Secondly, concerning the intensity of emotions, there are several contributions. On the one hand, positive emotions have less persuasive power than negative ones, as shown by previous studies. Also, in line with the literature, more intense negative emotions are more persuasive overall as Lennon *et al.* (2010) stated. However, an interesting contribution of this work with respect to the level of intensity is that for certain population groups the boomerang effect (Brehm & Brehm, 1981) occurs, as identified by authors such as Roskos-Ewoldsen *et al.* (2004) and Bowaraska *et al.* (2020). The results provide evidence of how the low intensity strategy is more persuasive for the low-risk group, the main audience of this campaign. This reaffirms the importance of knowing and defining in detail the target audiences in order to properly define the objectives of the campaign.

At the methodological level, the application of neuroscientific techniques combined with declarative measures is becoming common in academic research due to the advantages it provides. This work is an initial contribution in this sense and highlights the importance of contrasting the results.

The results of the present study should be interpreted with some caveats in mind. The sample size is limited and all participants were young Spanish university students, so neither

lower socioeconomic and educational levels nor cultural differences with other countries were considered. Likewise, the number of campaigns used could be increased to include more examples of different frames and, especially, greater variety of storytelling intensity. Finally, the intention to change behavior has been measured in a self-reported way, being impossible to verify the real subsequent behavior.

This study opens the way for future lines of research. A further study of the similar nature, with a larger sample and a wider number of campaigns to be analyzed in different countries, would be of great interest. Also, replicating the study in other social marketing contexts, not directly related to health, would help to better understand this type of campaigns. On a broader level, deepening the impact of campaigns on behavioral change by using neuroscientific techniques in controlled experimental settings would be a great complement to the existing literature on consumer behavior.

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