VISUAL REVIEW | Vol. 16, No. 1, 2024 | ISSN 2695-9631
International Visual Culture Review / Revista Internacional de Cultura Visual
https://doi.org/10.62161/revvisual.v16.5225

PUBLIC COMMUNICATION STRATEGIES FOR THE PREVENTION OF CANNABIS CONSUMPTION
Eye Tracking and Facial Expression

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KEYWORDS

Cannabis
Neurocommunication
Communication
Public Health
Persuasion
Internet
Social Networks

ABSTRACT

Cannabis is the most extensively consumed illicit substance globally, as reported by the United Nations Office on Drugs and Crime in 2021, thereby constituting a significant public health concern. This investigation posits the analysis of the interplay between cognition and emotion as applied to cannabis-related information within the framework of persuasive communication and the utilization of neurocommunication tools. The research aims to achieve the following objectives: 1) discern consumption patterns and perceptions regarding cannabis among the youth demographic, 2) assess implicit responses linked to the utilization of different framing techniques, and 3) investigate the interaction produced by diverse communication strategies.

Received: 01 / 07 / 2024
Accepted: 03 / 02 / 2024

1. Context

According to official data, cannabis, a drug extracted from the cannabis sativa plant, is one of the most widely consumed substances in the world by young people between the ages of 15 and 34. The effects on the brain are associated with THC, its active ingredient, which is found in different proportions depending on the preparation used (marijuana, hashish, or hashish oil). After consumption, THC quickly reaches the brain, attacking the endogenous cannabinoid system, "a system specific to the brain that carries out functions related to behaviour, learning, gratification, food intake, pain and emotions, among others" (Spanish Observatory on Drugs and Addictions -OEDA., 2022, p. 23). Once there, the body takes several days to expel the substance, so THC tends to accumulate, producing alterations in the functions of that system (Bara et al*.,* 2021).

The socio-health consequences of this process and, therefore, of its effects not only on the central nervous system but also on other systems such as the respiratory, cardiovascular, ocular, digestive, immunological, endocrine, and reproductive systems, have different levels of severity (OEDA, 2022), which are related to three facts:

1. The commencement age of usage: Presently, this stands at approximately 15 years of age, a phase during which the maturing brain "is more vulnerable to the effect of cannabis use" (OEDA, 2022, p. 25) with its repercussions being more profound (Albaugh et al., 2021; Bara et al., 2021).
2. Prevalence of use: According to data from the European Monitoring Centre for Drugs and Drug Addiction (2021) in Spain, the prevalence of drug use overall (37.5%) and in the last 12 months (19.1%) is well above the European average (27.2% and 15.4% respectively) in young adults (15-34 years).
3. The amount and type of cannabis consumed: In a study involving secondary school students, OEDA (2022) discovered that "students who have smoked cannabis in the last month admit that, on the day they use, they smoke on average 3 joints" (p. 36). According to the same study, 16.7% mainly used hashish, especially girls" (p. 36).

Considering this data, the present study posits that cannabis usage has emerged as a public health concern, wherein communication assumes a significant role as a preventive measure. In this context, the conceptualization is twofold. Firstly, the theoretical framework underscores the necessity to investigate persuasive communication for the formulation of more efficacious messages. Secondly, the empirical aspect employs neurocommunication techniques and tools to gain a deeper understanding and analysis of the context to which these messages are applied.

It reveals the significance of the perception of risk regarding consumption, which gives us clues not only about young people's perceptions regarding the effects of cannabis but also about the role that public administrations are adopting in the field of prevention. Also, the relevance of the internet as a means of transmitting messages is studied.

1.1. Variations in Risk Perception About Consumption

Academic research around the world has been investigating the effects of cannabis for decades (Quiroga, 2000; Font-Mayolas et al., 2006; Fernández-Artamendi et al., 2011; Galván et al., 2017; Albaugh et al., 2021; Feingold and Weinstein, 2021; Han et al., 2021). At the same time, an increasingly important line of research focusing on risk perception of drug use has recently emerged (Hjorthøj et al., 2021; Levy et al., 2021; Marcotte et al., 2022). Risk perception is understood as the extent to which the population thinks "that a certain behaviour may cause problems" (OEDA, 2022, p. 38) and, consequently, it is appreciated that "the risk associated with use behaves as a protective element against use" acting as a "deterrent to use, especially in students who are considering trying cannabis" (OEDA, 2022, p. 38).

Studies conducted by national and international entities, including the United Nations Office on Drugs and Crime and the Spanish Observatory on Drugs and Addictions, have also played a pivotal role in contributing to the available data on this matter. Thanks to their efforts, we are now cognizant of the fact that the perception of the risk associated with occasional cannabis smoking has witnessed a declining trajectory. In 2006, 70.6% of young individuals believed that cannabis use entailed significant health consequences, whereas by 2021, only 52.2% concurred with this perspective (OEDA, 2022).

Furthermore, in contrast to other substances, the perceived risk associated with cannabis smoking "decreases with increasing age" (OEDA, 2022, p. 39).

This apparent normalisation of cannabis usage among young individuals, coupled with a perception of increased accessibility (as per OEDA 2022 data, 6 out of 10 students believe it is easy or very easy to obtain), has captured the interest of public administrations. In Spain, a National Strategy on Addictions has been in place since 2017, and an Action Plan on Addictions for the period 2021-2024 was implemented in 2021, aligning with the European Union Strategy on Drugs (2021-2025).

The proliferation of these programmes, which pursue objectives such as the intention to "reduce the unjustified perception in society, especially among minors, of the 'normality' of drug use, fundamentally cannabis and alcohol" (Government of Spain, 2021, p. 31), have focused on the internet and social networks as a communication channel that supports both health prevention messages and discourses that decriminalise drug use.

1.2. The Internet and Social Networks: Allies in the Discourse of Decriminalisation or Preventive Messages?

As described, we are currently witnessing "a major societal shift in the perception of the harm of cannabis use" (Bara et al., 2021, p. 424). This coincides not only "with its widespread legalisation for recreational and/or medicinal use" (p. 424), which "has grown rapidly in the last 20 years" (Schlag et al., 2021, p. 773), but also with the expansion of the internet. The "decriminalisation of cannabis use" is one of the major consequences of this change in perception, which "increases the potential for derived harm, especially in the most vulnerable populations" (Bara et al., 2021, p. 424).

While it has been determined that, for the general population, the internet is not a primary source of information on drugs with media, acquaintances, and health professionals being more prominent sources (Government of Spain, 2017), some research has delved into the potential of this medium to extensively disseminate information with a direct impact on health (Ballesteros, 2020; Cuesta et al., 2019; Piqueiras et al., 2022; Martínez et al., 2023; Piqueiras et al., 2023). In this context, Al Khaja et al. (2018) identified that most drug-related messages on social media consisted of potentially misleading or unsubstantiated claims lacking scientific evidence.

At least one conclusion is clear from these previous studies. Due to concerns about the dissemination of drug-related information online, there is a necessity to formulate and implement "internet communication strategies to counteract the counter-preventive messages that appear online" (Ballesteros, 2020, p. 55). The use of such communication strategies is anticipated to underpin public health decision-making grounded in information that is devoid of both misleading and ambiguous elements.

This study posits an examination of persuasive communication to formulate more efficacious messages within the domain of health prevention, specifically tailored for the online environment.

2. Theoretical Framework

As previously mentioned, the overarching framework of this research centres on preventive messages in health. Given that the basis of this conception is the intention to modify attitudes and behaviours to increase the perception of risk in consumption and decriminalising consumption through the internet, it is necessary to study the persuasive strategies deemed effective in the domain of public communication. To achieve this, it is necessary to understand how the elaboration likelihood model of persuasion works in order to understand the cognitive processing of messages relevant to changing attitudes and behaviours.

2.1. The Elaboration Likelihood Model of Persuasion

Persuasion is defined by the Royal Academy of the Spanish Language as the act of "inducing, moving, obliging someone with reasons to believe or do something" (RAE, n.d., primary meaning). In this definition, the relevance of two disciplines can be intuited: communication, because of the need to explain reasons, which implies that in order to persuade, a link must be established with another party, and psychology, because of the intrinsic characteristic of persuasion to modify beliefs.

The relationship between these two fields has already been elucidated by the first psychologists who explored persuasion (Hovland et al., 1949; Hovland et al., 1953; Hovland and Janis, 1959; McGuire, 1961a, 1961b, 1964, among others). They expounded that, for a message to modify someone's attitude and behaviour, and consequently, for a message to be persuasive, certain essential elements must be present. These include a credible source, a message comprising both emotion and rationality, an effective channel, a contextual framework upon which to construct a narrative, and a receptive audience.

Some of the later postulations questioned the role of the receiver as an active subject in the cognitive processing of the message (Groves and Thompson, 1970; Petty et al., 1981a; Petty et al., 1981b; Petty and Cacioppo, 1983; Eagly and Chaiken, 1993; Petty and Wegener, 1998), which led to the elaboration likelihood model of persuasion (Petty and Cacioppo, 1986). This model unifies much of the earlier literature, including the Dual Process Theory of associative thinking and reasoned thinking that was pioneered by William James in the 1890s.

The elaboration likelihood model of persuasion argues that attitude changes are achieved not only by the validity of the message or the effectiveness of the source but by the effectiveness of the different routes by which the information can travel in the mind of the receiver. Broadly speaking, two processing routes are established:

- The central route is employed when the recipient pays heightened attention to the message to comprehend it rationally. This approach necessitates cognitive effort and deliberate, analytical reflection. The processing of this information activates top-down attention, which is voluntary and motivated by the subject's goals or needs.
- The peripheral route, where conscious processing of information is not required to effect a change of attitude. This implies that the recipient does not need to evaluate the message's arguments in-depth to be convinced. Thus, a more emotional and less rational communication may suffice for persuasion. This form of processing entails bottom-up attention, occurring when the subject does not initiate any intentional mechanism, and stimuli control and direct the subject's attention (Martínez et al., 2021).

According to this model, it should be noted that the route through which the received information is processed is conditioned by three factors: 1) the depth of thought required by the receiver to process the information, 2) the receiver's motivation to devote time to reflect on the messages received, and 3) the receiver's ability to engage in the elaboration of cognitive responses (Cacioppo et al., 1983), i.e. the receiver's knowledge of the subject matter.

The notion of the coexistence of superficial and profound processing underscores the necessity for strategic contemplation in public health communication campaigns. As previously mentioned, this domain heavily relies on its persuasive efficacy to instigate shifts in thinking and attitude trends. In this context, it is essential to recognise that messages with an implicit appeal to emotions will trigger the peripheral processing route, thereby stimulating bottom-up attention. Conversely, more specialized messages, typically disseminated by authorities and experts, are inclined to activate processing associated with the central route, thereby prompting top-down attention (Stanovich, 2005; Okuhara et al., 2018).

Prior research cautions that stimuli fostering bottom-up processing are more persuasive (Okuhara et al., 2018), and the use of simple language and attention-grabbing images is recommended for its promotion (Kahneman, 2011; Cuesta et al., 2019). The rationale behind this observation is that these elements aid in capturing attention non-consciously and do not elicit a pre-existing judgment upon encountering them.

Familiarity with these strategies, their mechanisms, and their implications can contribute to a more precise delineation of communicative strategies aimed at achieving the desired objective of encouraging young people to refrain from using cannabis by fostering an awareness of its detrimental effects on their health.

3. Objectives

The general objective of this paper is to examine the interplay between cognition and emotion in cannabis prevention in order to understand how the intensity of emotion influences the efficacy of persuasion. In pursuit of this goal, the following specific objectives were addressed: 1) investigate the

patterns of cannabis usage among young individuals, their perceptions regarding its use for various purposes, and its legalization, 2) scrutinize the implicit responses (attention, attraction, engagement, visual pathways, and emotion) generated by the utilization of distinct framing types (emotional versus neutral), and 3) explore the nature of interaction brought about by diverse communicative strategies.

Based on this, the following research questions were posited:

- RQ1: What is the frequency and manner of cannabis use (social or individual) by young people?
- RQ2: To what extent do they endorse its legalisation?
- RQ3: How does the framing (emotional versus neutral) impact the attention, engagement, and emotion of young individuals?
- RQ4: Which type of framing will elicit the highest level of interaction with the publication?

4. Method

An intrasubject experimental design was used with a convenience sample of 74 participants (30% male and 70% female) aged 18-23 years.

Participants viewed two social media posts (emotional versus neutral) from the Public Administration of the Spanish Ministry of Health and answered a 16-item questionnaire on demographics, cannabis use, opinion on its use for different purposes, and intention to interact with the post. During the viewing, the implicit responses (attention, engagement, visual pathways, and emotion) provoked by the publications were recorded with eye tracking and facial expression tools from the Neurolabcenter of the Complutense University of Madrid.

- Independent variable

Type of Frame: A social media post made by the Ministry of Health about the effects of cannabis consumption causing tachycardia or bronchitis was used, where a very neutral photograph appears (a close-up of a marijuana plant). To analyse the type of frame, an emotive-aversive image was created using the same post with the addition of a symbol of danger (yellow triangle with a skull) to the image. To ensure validity, the two posts maintained the same elements: an image, source name, text, link to further information, and interactions (Figure 1).

Figure 1. Stimuli presented.

Source: Author's elaboration.

- Dependent variables

Cannabis Usage: To find out the frequency and type of use, before viewing the images of the publications, participants were asked about their frequency of usage with different ranges ("I have never used", "I have tried it, but I don't use it", "2 or 3 times a month", "once a week", "2 or 3 times a week" and "every day". To find out how it is consumed, they were asked whether consumption occurs

with friends, alone, or both alone and with friends. Finally, they were asked their opinion on the different uses of cannabis (recreational, therapeutic, cosmetic use), and its legalisation.

Interaction with the Publication: After each image, participants completed a three-item questionnaire on their intention to interact with the post ("Would you like it?", "Would you click on 'share post'?", "Would you follow the link in the post?") using a 5-point Likert scale, with 1 being "very unlikely" and 5 being "very likely".

Attention, Engagement, and Visual Pathways: For the analysis of attention, engagement, and visual pathways, an eye-tracking tool was applied. Participants viewed the images with the programme Sticky by Tobii Pro (https://www.tobiipro.com/es/products/sticky-by-tobii-pro/), a tool developed by Tobii and validated in neurocommunication research (Martinez, 2021), which allows the eye tracking of individuals to be recorded online through the computer's webcam via a link provided to participants. The programme detects the subjects' face and pupils and predicts the point of gaze at a frequency of 15 Hz. At the start of the experiment, participants perform a series of tasks to calibrate the system and then randomly view the two stimuli (10 seconds per image). The programme allows the analysis of attention and engagement through heatmaps, visual pathways, and areas of interest. For the analysis, the data was cleaned, leaving it complete and noise-free, thus guaranteeing the validity of the eye-tracking results. Based on this, the final sample was 60 subjects.

Emotion Triggered: While viewing, the Sticky programme performed facial recognition using the computer camera, allowing micro-expressions to be analysed and defined as valence (positive, neutral, or negative) and triggered emotions (disgust, fear, joy, confusion, sadness, and surprise).

Subjects were informed of the objective of the research following the ethical protocols validated by the Department of Communication Theories and Analysis of the Complutense University of Madrid.

5. Results

In terms of frequency and type of usage, 42% of respondents indicated non-utilization, juxtaposed with 51% who acknowledged experimenting without continued usage. A mere 7% professed sporadic usage (2 to 3 times monthly), typically in social settings with companions (35%). Regarding favourable attitudes towards its usage, 24% expressed endorsement of recreational use, 62% favoured therapeutical use, and 22% supported cosmetic usage. Conclusively, 25% advocated for its legalisation.

Regarding attention, engagement, and visual pathways provoked by both stimuli, Figure 2 shows the comparative heat maps, which allow us to identify the areas that attract the most attention and the visual pathway of the participants. The study of the areas of interest shows the ratio of participants who view an area (Sb), time spent looking at it (TUN), time spent (TV), percentage of people who look at it first (SFb), and percentage of those who look at it again (Rb). This also allows us to detect engagement by studying time spent and looking again (Table 1).

In both cases, we see that what they looked at first were the images, followed by the text, the source, and then the link. However, the analysis of attention shows some differences. In the emotional publication, what attracted the most attention was the image (2.71s), followed by the text (2.43s), while in the neutral publication, the text got considerably more attention (3.28s) than the image (2.63s). These elements are also the ones that produce the most engagement in both cases.

Figure 2. Comparison of heat maps and visual pathways.

Source: Author's elaboration.

In this respect, when analysing the response and fixation times in Table 1 for the emotional publication, we observe that the image captures the attention sooner and for longer than the neutral one, motivating greater attention to the source.

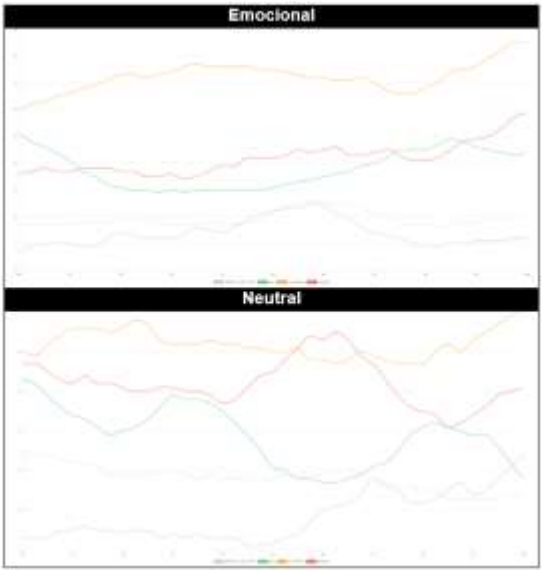
Table 1. Comparison of ratio, time until seen, and fixation time.

AOI	EMOTIONAL					NEUTRAL				
	Sb (%)	TUN(s)	TV(s)	SFb (%)	Rb (%)	Sb (%)	TUN(s)	TV(s)	SFb (%)	Rb (%)
Source	80	1.87	1.56	1.7	87.5	81.7	1.48	1.36	5	87.8
Image	100	0.55	2.71	81.7	100	100	0.6	2.63	71.7	100
Link	93.3	2.58	0.46	5	82.1	81.7	2.64	0.54	6.7	85.7
Text	98.3	0.96	2.43	11.7	100	98.3	0.83	3.28	16.7	100

Source(s): Author's elaboration.

The analysis of the emotions provoked also shows some differences between stimuli (Figure 3). In the case of the emotional stimulus, we observed that it produced more confusion with increased fear and disgust when reading the text. This stimulus also elicited some joy when revisiting the skull after reading the text. The neutral stimulus shows higher levels of surprise when reading the text, joy and disgust at the end of the text followed by fear.

Figure 3. Comparison of emotions provoked.



Source: Author's elaboration.

For engaging with posts (liking, sharing, and following links), the data reveals variances contingent upon the nature of the post (emotional versus neutral). Across both types of posts, 23% expressed an inclination to "like" the content. Nevertheless, the emotional post incited a greater propensity to "share" (12% versus 7% for the neutral post) and to follow the embedded link (19% versus 15%). Both posts engendered minimal inclination for "commenting" (5% for the emotional post and 4% for the neutral post).

6. Discussion and Conclusions

Cannabis use has become an important public health problem, being one of the most widely used substances in the world by young people (OEDA., 2022). Despite this, the data shows a low percentage of usage, although more than half have tried it at some time (possible bias because they do not want to admit it). The fact that it is consumed with friends does coincide, as it is a social drug (Fernández et al.,

2002). As for the positive perception of cannabis, this is shown above all in its therapeutic use, where more than half of the sample agrees with it. This is representative of the reality noted above, where we found that associating cannabis with other aspects such as therapeutic use makes individuals relate more persuasively to the drug (Martínez et al., 2023).

Concerning the stratagems employed to frame content (emotional versus neutral) and their impacts on attention, engagement, and visual pathways, our observations reveal that an emotionally charged image garners attention sooner and sustains it longer compared to a neutral counterpart, whilst also directing increased attention towards the source. These findings align with prior research demonstrating the rapid capture of bottom-up attention and its potent persuasive influence (Martínez et al., 2021; Okuhara et al., 2018). Unexpectedly, the inclusion of elements denoting danger and mortality within the emotionally aversive imagery did not evoke heightened levels of fear. Nonetheless, analogous investigations exploring the effects of such sensationalist emotional imagery, such as the depiction of syringes in the COVID-19 anti-vaccine movement, have demonstrated this effect (Martinez et al., 2021). This discrepancy might be attributed to the markedly low perception of risk associated with cannabis (OEDA, 2022), wherein individuals within this context do not perceive the symbol as menacing, as evidenced by the shift from joy to confusion upon revisiting the skull image after textual comprehension. Nonetheless, it still elicits heightened negative emotion through confusion, consequently fostering a greater inclination towards sharing and thereby facilitating its dissemination and bolstering its credibility. Such perplexity also instigates a desire among individuals to delve deeper into the content, thereby motivating them to pursue the link embedded within the post.

Two important conclusions can be drawn from this result. On the one hand, the low perception of risk related to cannabis means that messages of danger or death related to it are not perceived as important and do not provoke fear. As such it is essential to design useful and striking strategies that raise awareness among young people of the real risks of cannabis use. On the other hand, the use of emotional resources in publications provokes a certain cognitive dissonance and confusion that helps the publication be more visualised and the information to be more in-depth. This is important to consider when designing prevention campaigns on cannabis and public health.

7. Limitations and Future Lines of Research

The current study acknowledges certain limitations pertaining to the characteristics of the sample, encompassing both its size and the selection criteria applied to the subjects. While the exploratory nature of the results is deemed valuable, it is recommended for future research endeavours to expand the study population and enhance its representativeness.

Concerning expanding the study universe, it is proposed that forthcoming investigations consider broader sampling. This entails encompassing a larger number of participants and extending the age range to ensure representation beyond solely the younger demographic, notwithstanding their higher consumption rates.

To enhance the sample's representativeness, it is advised that future studies aim for a more equitable distribution of participants. Currently, the gender composition deviates significantly from a balanced 50% representation for each gender. Moreover, there should be a deliberate effort to include a greater number of cannabis users among the subjects. Such adjustments are anticipated to contribute to heightened accuracy in certain outcomes.

It is our earnest aspiration that these issues will be duly attended to in future studies, thereby sustaining our contribution to the field of public health communication research. As underscored by the findings of this study and corroborated by extant literature, there persists a compelling need to elucidate the intricacies of persuasive communication. Such understanding is imperative for crafting strategic messages capable of fostering attitudinal shifts conducive to the preservation and safeguarding of public health. In this context, public administrations have a pivotal role to fulfil.

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