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Oculometric responses to high emotional impact advertising stimuli: a comparison with autonomic and self-report measures

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Abstract

Covid-19 affected people's social lives and advertising (ADV) behavior. This study used implicit (oculometric and autonomic) and explicit (self-report) measures to understand the consumer's emotional and attentional involvement with ADV. Twenty participants watched Covid-19-related and neutral ADVs (No-Covid-19 stimuli) in two different exposure orders. Oculometric, autonomic, and self-report data were collected. Participants were randomly divided into two groups that watched Covid stimuli followed by No-Covid stimuli (Order 1) or the opposite (Order 2). Oculometric data showed a decrease in Time to First Fixation, Fixation Count, and Fixation Duration sum for the Covid compared to the No-Covid condition, suggesting the Covid stimuli were more salient. Lower cardiovascular mean values for Covid condition in Order 1 were interpreted as a parasympathetic inhibitory mechanism linked to a potential freezing effect. Self-report data confirmed eye-tracking and autonomic evidence. Given the emotional impact of Covid stimuli, using Covid-themed ADV can be a helpful marketing strategy.

Keywords: advertising; eye-tracker; autonomic measure; Covid; emotional impact

1. Introduction

The recent Covid-19 pandemic caused by SARS-cov-2 not only had a significant impact on people's social life and mental health by introducing strong social limitations for the containment of contagion (Rajkumar, 2020; Torales et al., 2020; Zhao et al., 2020). In the meantime, the pandemic led to one of the most significant change in the history of modern marketing, affecting the fundamental philosophy of consumer behaviour and attitude towards the advertising (ADV) (Cho & Chiu, 2021; Jiménez-Sánchez & Vayas-Ruiz, 2020; Taylor, 2020; Torales et al., 2020), and resulting in modifications to the consumer market and sociocultural conduct (Campbell et al., 2020).

Considering the role of the pandemic in shaping and influencing the relationship between consumers and brands (Balconi et al., 2022), it has become increasingly important to study the emotional responses and the cognitive processes underlying the consumer's analysis to ADV of a specific brand, product or consumer service (Balconi et al., 2022; Baños-González et al., 2020; Singh & Tanwar, 2021). Studies suggested that the urge for consuming arises both from the impression of product quality and the emotional responses elicited by the ADV (Guo et al., 2020; Poels & Dewitte, 2019). In this sense, ADV messages are designed and created to have a strong emotional impact on the consumers, boost the audience level of attention, and elicit a cognitive response that is conducive to the retention of an information in the memory (Poels & Dewitte, 2019).

Based on these assumptions, during the Covid pandemic, several ADV campaigns invested more in the emotional appeal of the ADV: they stressed more the emotional than informative sphere, created vivid content linked to emerging situations, gave greater weight to the unconscious than conscious components of information processing, and tried to match with the functional needs of the individuals (Jiménez-Sánchez & Vayas-Ruiz, 2020; Taylor, 2020). In fact, as demonstrated and supported by the "law of apparent reality" proposed by Frijda (1989), the feeling experienced by the customer will be more intense and genuine in a directly proportional way to the vividness of the content of the announcement.

Alongside the use of traditional marketing methods to study consumer responses to ADV, neuroscience, and in particular the consumer neuroscience field, has the advantage to offer a wide range of tools and bio- and neuro-metrics, that could be useful i) to explain the implicit attitudes, motivation, and expectations of a given ADV stimulus, and ii) to offer an overview of the cognitive resources needed for the ADV elaboration and its emotional impact on the audience (Balconi et al., 2014; Casado-Aranda & Sanchez-Fernandez, 2022; Lin et al., 2018; Sung et al., 2020). Autonomic measures recording and eye-tracking are among the psychophysiological and behavioral tools that are frequently adopted in consumer neuroscience (Acconito et al., 2023b; Alvino et al., 2020; Stasi et al., 2018).

Specifically, autonomic measures recording is a tool used to record the psychophysiological activity and peripheral electrodermal activity, as well as measure the body's autonomic parameters (skin conductance level and response [SCL and SCR], pulse volume amplitude [PVA], and blood volume [BVP], Heart Rate [HR], Inter-Beat Interval [IBI], HR Variability [HRV]). The functional significance of these indices allows unravelling consumers' emotional and attentional engagement, as well as implicit cognitive processing of the stimulus or context (Angioletti & Balconi, 2022; Fortunato et al., 2014; Fronda et al., 2021). Cardiovascular responses variations may be associated with exposure to stimuli that recall adverse experiences. Specifically, a marked decrease in cardiovascular response and, specifically, HR may be caused by exposure to stimuli with high emotional impact (Dielenberg et al., 2001; Zhang et al., 2004).

On the other hand, the eye-tracking allows the recording of patterns of fixations and saccades related to people eye movements in response to a visual stimulus. These behavioural indices could be exploited to better understand people reactions to ADVs (Sung et al., 2020; Wedel & Pieters, 2017), in terms of user's emotional excitement, visual attention, and cognitive workload. Among the most important parameters that it is possible to collect and analyze through the eye-tracking technique, there are i) the number of fixations of Fixation Count, which is related to the number of times the person looks at a specific area of interest (Casado-Aranda & Sanchez-Fernandez, 2022) and is useful for predicting the effectiveness of ADVs (Falsarella et al., 2017); ii) the Fixation Duration, which describes how eye-tracking can help in revealing the effects of discrete ADV elements (i.e. product, brand and endorser) on cognition and emotion in consumers (Sung et al., 2020); iii) the Time to First Fixation (TFF), which indicates the time it takes for a person to first place his/her gaze, and thus indirectly his/her attention, on a specific stimulus point (Casado-Aranda & Sanchez-Fernandez, 2022; Lai et al., 2013; Sciulli et al., 2017). TFF and Fixation Count can be understood as variables that measure cognitive as well as attentive aspects (Angioletti et al., 2022; Cassioli et al., 2022). Important information on the amount of cognitive and perceptual processing dedicated to that region can also be provided by the duration used to fix a region of interest (Rayner, 1998, 2009).

Literature underlines that the employment of autonomic indices and eye-tracking together could be helpful for interpreting the cognitive and emotional reactions triggered by visual stimuli (Fabio and Errante, 2015; Sung et al., 2020). Previous works demonstrated how emotions related to fear and anxiety can be conveyed by the perception of a pandemic threat through media or ADV stimuli (Bavel et al., 2020; Montefinese et al., 2021). In particular, these emotions with negative valence are typically accompanied by a high level of arousal (Langeslag & Surti, 2017). Thus, for obtaining a more comprehensive overview of the phenomenon investigated, self-report measures developed to measure emotional valence and arousal, and the subjective evaluation of the stimuli can be integrated. Between the others, the Self-Assessment Manikin (Bradley & Lang, 1994; Lang, 1980) and the Semantic Differential (Osgood et al., 1957) allow for the assessment of the emotional valence and arousal, and the stimulus evaluation respectively. Interestingly, these scales were previously exploited in former neuromarketing research investigating the explicit emotional impact of the ADV (Balconi & Lucchiari, 2005; Bradley et al., 2007; Chang & Thorson, 2004; Handayani et al., 2015; Leanza & Balconi, 2017; Sansone & Balconi, 2022).

Based on these assumptions, this research aims to clarify and investigate the implicit and explicit responses of consumers to Covid themed ADV compared to No-Covid related ADV. Autonomic measures recording, eye-tracking and self-report measures were exploited to collect implicit and explicit responses related to the different emotional, cognitive and attentional involvement of the consumers. Additionally, this study sought to investigate the possible influence of the effect of the order in which the Covid and No-Covid ADV was watched by the participant.

Regarding the oculometric data, it is expected that the vision of Covid stimuli, compared to the No-Covid stimuli, leads to a greater TFF and a lower Fixation Count and duration. This hypothesis is supported by the literature, which emphasizes that, even in different contexts, a stimulus with high emotional impact and high contextual familiarity requires less mental effort to be processed (Diana & Reder, 1985; Reder et al., 2016; Willems & Peelen, 2021).

Similarly, in line with previous evidence (Dielenberg et al., 2001; Zhang et al., 2004), about the autonomic measures, it is hypothesized to find a decrease in BVP, PVA, IBI, and HRV when participants watched the Covid compared to No-Covid stimuli.

Finally, as far as self-report measures are concerned, they are expected to complement and support the implicit measures. Specifically, for SAM it is expected to find higher arousal values for Covid compared to No-Covid stimuli. In fact, in agreement with the literature, salient stimuli can lead to greater engagement (Bujarski et al., 2015; Sansone & Balconi, 2022). Similarly, regarding the semantic differential scale, it is hypothesized that Covid stimuli are perceived as more arousing since they represent salient stimuli and may evoke unpleasant prior experiences (Snyder et al., 2015).

2. Method

2.1 Sample

A sample of 20 volunteer participants (5 male and 15 females; Mean age = 25.47; Standard Deviation age = 2.26) were randomly split into two groups. Specifically, one group watched the Covid-related ADV stimuli before the No-Covid stimuli (Order 1: Covid and No-Covid), while the other group watched the No-Covid ADV before the Covid-related ADV (Order 2: No-Covid and Covid).

The sample was gathered with the support of the Catholic University of the Sacred Heart in Milan, in Italy and in compliance with the following exclusion criteria: (a) psychopathological or neurological syndrome; (b) acute medical circumstances; (c) head trauma or currently underway psychopharmacological therapies; and (d) post-traumatic stress symptoms related to Covid experience as evaluated by the Covid-19-PTSD questionnaire (Forte et al., 2020).

Participants took part in the study without receiving any compensation and signed written informed consent. The Ethics Committee of the Department of Psychology, Catholic University of the Sacred Heart, Milan, Italy approved the study, which was carried out in conformity with the Declaration of Helsinki (2013).

2.2 Advertising stimuli

Six distinct ADVs from Nike brand, a well-known sportswear brand with a strong focus on corporate social responsibility and social advocacy, were shown to participants during the experiment. Three of the ADVs were Covid-related and the other three were not related to the pandemic.

"Play for the World", "You Can't Stop LA" and "You Can't Stop Us" were the three selected Covid-related stimuli, in which the brand's regular communication, characterized by inspirational and emotive aspects, was mixed with several references to the pandemic period.

Specifically, the first ADV, "Play for the World", illustrates some of the consequences of the restrictions imposed during the pandemic period: people forced to stay at home and practice inside their houses, and consequently empty playgrounds. The commercial "You Can't Stop LA" contrasts the human match against Covid, distinguished by social wins and losses, with the failures and successes of the Los Angeles Lakers basketball team. Lastly, the split-screen technique is employed in the "You Can't Stop Us" commercial to spread a hopeful message about the world's recovery from the pandemic. The video alternates between images of sporting events, deserted stadiums, and individuals looking for new ways to practice at home.

"What's your motivation?", "You can't be stopped", and "Steps" were the three selected No-Covid-related stimuli, in which the inspirational and emotional elements of the brand's regular communication are displayed.

In particular, "What's Your Motivation?" aims to spread the message that achievement does not happen by chance and without any difficulty, but requires commitment, dedication, and preparation. To represent this purpose, it illustrates the story of a young basketball player who trains hard and focuses on success. The video "You Can't Be Stopped," aims to remind the audience that playing by following one's inner motivation makes one unstoppable. Finally, the "Steps" commercial tells of a runner's obstacles and failures.

2.3 Procedure

The experimental procedure involved two sessions lasting about 20 minutes each, in which participants were comfortably seated in a darkened room and viewed ADV stimuli on a screen placed 80 cm in front of their eyes. Specifically, in the first session, the group assigned to the Order 1 was presented three Covid stimuli, and in the second session the three No-Covid ADVs. On the other hand, the group assigned to Order 2 saw the stimuli in the reverse order, so first No-Covid related ADV and then Covid stimuli. Regardless of session and order, all videos were presented randomly and interspersed with a 5-second black screen.

In addition, oculometric, autonomic and self-report data were collected about every single ADV. Specifically, the detection of oculometric measures was useful to investigate visual exploration of stimuli and potential differences in non-verbal language between Covid and No-Covid stimuli, the autonomic measures allowed to collect information on participants' implicit behaviour in relation to cognitive effort and emotional involvement and self-report data permitted to capture the subjective evaluation of each participant regarding the different stimuli.

2.4 Data acquisition

2.4.1 Oculometric data acquisition

A wireless Tobii Pro Glasses 2 eye-tracking technology (Version 1.95, 07/2018. Tobii Pro AB, Stockholm, Sweden) was adopted for collected oculometric data in this study. The tool was composed of a recording unit connected to the glasses, with a wide-angle scene camera and four infrared sensors as well as an accelerometer and gyroscope (Video resolution: 1920 x 1080). Reflection patterns are created and recorded on the pupil centre and cornea using near-infrared illumination.

Oculometric measures were analyzed through Tobii Pro Glasses Analyzer, after the identification of Areas of interest (AOI), defined as "area of a display or visual environment that is of interest to the research or design team" (Jacob & Karn, 2003). The AOI, specifically, were created for each ADV with specific attention to take into consideration video frames that are comparable to each other in terms of content, brightness, and duration. TFF, First Fixation Duration, Fixation Count, Fixation Duration mean, and Fixation Duration sum were finally extracted for each ADV's AOI, with specific attention to take into consideration only subjects' faces and playing fields represented in each ADV. Specifically, TFF denotes the time required for a subject to make the first fixation, the First Fixation Duration indicates the length of the first fixation, the Fixation Count represents the total number of fixations, while Fixation Duration mean, and Fixation Duration sum represent the average and sum of all fixation lengths.

2.4.2 Autonomic data acquisition

A portable X-pert2000 Biofeedback system with a MULTI radio module (Schuhfried GmbH, Modling, Austria) was adopted for collecting the autonomic data in this study, thanks to a peripheral sensor placed on the distal phalanx of the second finger of the non-dominant hand. The tool allowed measuring the following peripheral parameters: SCL, SCR, PVA, BVP, HR, IBI, HRV. Specifically, skin conductance indices were measured in μS and recorded with an EDA gold electrode using current-current measurement at a sampling frequency of 2 kiloHertz (kHz). The use of alternating voltage prevents polarization. The measurement resolution for the SCL calculation is 12 nanoseconds (ns) with a sampling frequency of 20 Hz. Cardiovascular parameters, on the other hand, were measured in beats per minute (bpm) via photoplethysmography with a sampling frequency of 500 Hertz (Hz). Furthermore, the mobility of the non-dominant hand was monitored with an accelerometer in meter/ square second (m/s2) integrated into the sending unit to ensure that the recordings were not compromised by hand movements.

2.4.3 Self-report data acquisition

The SAM scale (Bradley & Lang, 1994; Lang, 1980) and the semantic differential scale (Osgood et al., 1957) were adopted for collecting the self-report data in this study. Specifically, SAM is a non-verbal pictorial evaluation technique that quantifies the valence and arousal of an individual's emotional response to a particular stimulus, thanks to a 5-point Likert scale represented by five different pictures, where score one corresponds to a low-impact emotional response and value 5 to high-impact emotional reaction. The semantic differential scale, on the other hand, enables the evaluation of visual stimuli in terms of seven distinct features (Understandable, Familiar, Exciting, Engaging, Joyful, Motivating, Pleasant) each of one is specified by a 7-point Likert scale, where low values represent the negative pole of the feature, while high values correspond to the positive pole.

3. Results

3.1 Oculometric data analysis and results

Five repeated measures ANOVAs with *Order* (2: Order 1 [Covid - No-Covid], Order 2 [No-Covid – Covid]) as the between-subject factor and *Condition* (2: Covid, No-Covid) as the independent within-subject factors was separately applied to the eye-tracking dependent measure (TFF, First Fixation Duration, Fixation Count, Fixation Duration mean, and Fixation Duration sum).

Post-hoc comparisons were applied to the data in case of significant effects. Simple effects for significant interactions were further checked via pairwise comparisons, and Bonferroni correction was used to reduce multiple comparisons potential biases. For all the ANOVA tests, the degrees of freedom were corrected using Greenhouse–Geisser epsilon where appropriate. Furthermore, the normality of the data distribution was preliminarily assessed by checking kurtosis and asymmetry indices. The size of statistically significant effects has been estimated by computing partial eta squared (η^2) indices.

As shown by ANOVA for TFF, a significant main effect in within-subject factor *Condition* was found (F [18,1] = 27.640, $p \leq .05$, $\eta^2 = .606$). Post-hoc pairwise comparisons revealed a decrease in TFF in the Covid condition compared to the No-Covid condition ($p \leq .05$) (Figure 1a).

For Fixation Count, a significant main effect in within-subject factor *Condition* was found (F [18,1] = 31.410, $p \leq .05$, $\eta^2 = .636$). Post-hoc pairwise comparisons revealed a decrease in Fixation Count in the Covid condition compared to the No-Covid condition ($p \leq .05$) (Figure 1b).

Finally, for the Fixation Duration sum, a significant main effect in within-subject factor *Condition* was found (F [18,1] = 22.496, $p \leq .05$, $\eta^2 = .556$). Post-hoc pairwise comparisons revealed a decrease in Fixation Duration sum in the Covid condition compared to the No-Covid condition ($p \leq .05$) (Figure 1c).

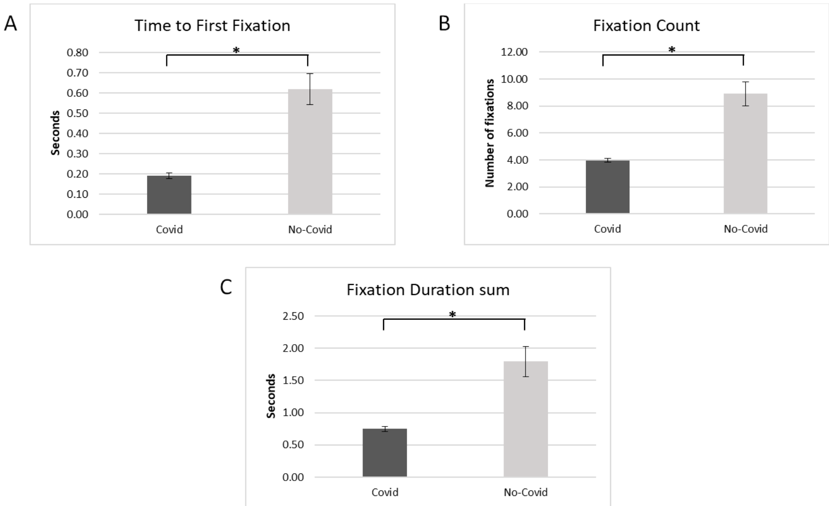

Figure 1ac. Oculometric results. Bar graphs show: a) significant differences for TFF between Covid and No-Covid conditions; b) significant differences for Fixation Count between Covid and No-Covid conditions; c) significant differences for Fixation Duration sum between Covid and No-Covid conditions. For all graphs, bars represent ± 1SE. Stars mark statistically significant pairwise comparisons

3.2 Autonomic data analysis results

Seven repeated measures ANOVAs with *Order* (2: Order 1 [Covid - No-Covid], Order 2 [No-Covid – Covid]) as the between-subject factor and *Condition* (2: Covid, No-Covid) as the independent within-subject factors was separately applied to the autonomic dependent measure (SCL, SCR, BVP, PVA, IBI, HR, HRV).

Post-hoc comparisons were applied to the data in case of significant effects. Simple effects for significant interactions were further checked via pairwise comparisons, and Bonferroni correction was used to reduce multiple comparisons potential biases. For all the ANOVA tests, the degrees of freedom were corrected using Greenhouse–Geisser epsilon where appropriate. Furthermore, the normality of the data distribution was preliminarily assessed by checking kurtosis and asymmetry indices. The size of statistically significant effects has been estimated by computing partial eta squared (η^2) indices.

ANOVA on autonomic data showed three significant effects for BVP: i) main effect in within-subject factor *Condition* (F [18,1] = 6.532, p = .020, η^2 =

.266) with lower BVP values in the Covid condition compared to the No-Covid condition (p = .020); ii) main effect in between-subject factor *Order* (F [18,1] = 4.741, p = .043, η^2 = .208) higher BVP values in Order 2 compared to the Order 1 (p = .043); iii) interaction effect *Order* × *Condition (F* [18,1] = 5.011, p = .038, η^2 = .218), where post-hoc pairwise comparisons revealed lower BVP values in the Covid condition compared to the No-Covid condition in Order 1 (p = .040) and higher BVP values in Covid condition in Order 2 compared to Order 1 (Figure 2a).

Another significant interaction effect *Order* × *Condition (F* [18,1] = 7.281, p = .015, η^2 = .288) was observed for PVA. Post-hoc pairwise comparisons revealed lower PVA values in the Covid condition compared to the No-Covid condition in Order 1 and higher PVA values in the Covid condition in Order 2 compared to Order 1 (p = .018) (Figure 2b).

For the IBI index, ANOVA showed two significant effects: i) main effect in within-subject factor *Condition* (F [18,1] = 6.863, p = .017, η^2 = .276) with lower IBI values in the Covid condition compared to the No-Covid condition (p = .017); ii) interaction effect *Order* × *Condition (F* [18,1] = 4.657, p = .045, η^2 = .206), where post-hoc pairwise comparisons revealed lower IBI values in the Covid condition compared to the No-Covid condition in Order 1 (p = .003) (Figure 2c).

Finally, a significant interaction effect was observed for *Order* × *Condition (F* [18,1] = 6.750, p = .018, η^2 = .273) for HRV. Post-hoc pairwise comparisons revealed higher HRV values in the Covid condition in Order 2 compared to Order 1 (p = .034) (Figure 2d).

No other significant differences were observed.

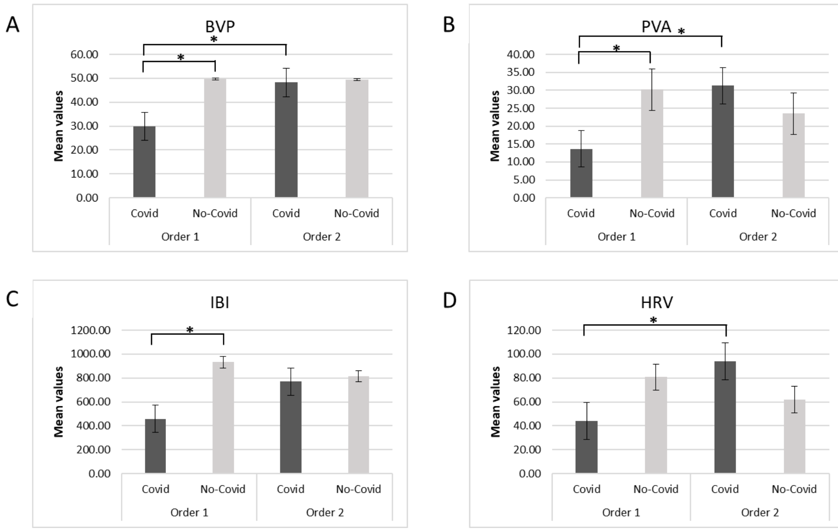

Figure 2ad. Autonomic results. Bar graphs show: a) significant differences for BVP values between Covid and No-Covid conditions in Order 1; b) significant differences for PVA values between Covid and No-Covid conditions in Order 1; c) significant differences for IBI values between Covid and No-Covid conditions in Order 1; d) significant differences for HRV values between Covid and No-Covid conditions in Order 1. For all graphs, bars represent ±1 SE. Stars mark statistically significant pairwise comparisons

3.3 Self-report data analysis and results

For SAM, arousal and valence subjective ratings were analyzed with two separated repeated measure ANOVAs with *Order* (2: Order 1 [Covid - No-Covid], Order 2 [No-Covid - Covid]) as the between-subject factor and *Condition* (2: Covid, No-Covid) as the independent within-subject factors.

For arousal ratings, a significant main effect in within-subject factor *Condition* (F [18,1] = 11.469, p = .003, η^2 = .389) was found. Post-hoc pairwise comparisons revealed higher arousal ratings in the Covid condition compared to the No-Covid condition (p = .003). No other main or interaction effect was significant (Figure 3a).

For the semantic differential scale, a mixed repeated measures ANOVA with *Order* (2: Order 1 [Covid - No-Covid], Order 2 [No-Covid - Covid]) as the between-subject factor and *Condition* (2: Covid, No-Covid) and *Valuation*

(7: Understandable, Familiar, Exciting, Engaging, Joyful, Motivating, Pleasant) as the within-subject factors was applied.

A significant main effect in within-subject factor *Valuation* (F [18,1] = 19.125, $p \leq .05$, $\eta^2 = .515$), where understandable ratings were higher than familiar ($p \leq .05$), exciting ($p \leq .05$), engaging ($p \leq .05$), joyful ($p \leq .05$), motivating ($p = .002$) and pleasant ($p = .002$) ratings, exciting ratings were higher than engaging ratings ($p = .001$), and pleasant ratings were higher than joyful ratings ($p = .006$)

A significant interaction effect *Order* × *Condition x Valuation (F* [18,1] = 2.900, $p = .035$, $\eta^2 = .139$) was also found for the semantic differential scale. Post-hoc pairwise comparisons revealed higher exciting ratings in the Covid condition compared to the No-Covid condition in Order 1 ($p = .021$). Similarly, in Order 2, higher familiar ratings in the Covid condition compared to the No-Covid condition ($p = .001$) and lower motivating ratings in the Covid condition compared to the No-Covid condition were found. Between Order, concerning the Covid condition, higher familiar ratings were found in Order 2 compared to Order 1 ($p = .041$) (Figure 3b).

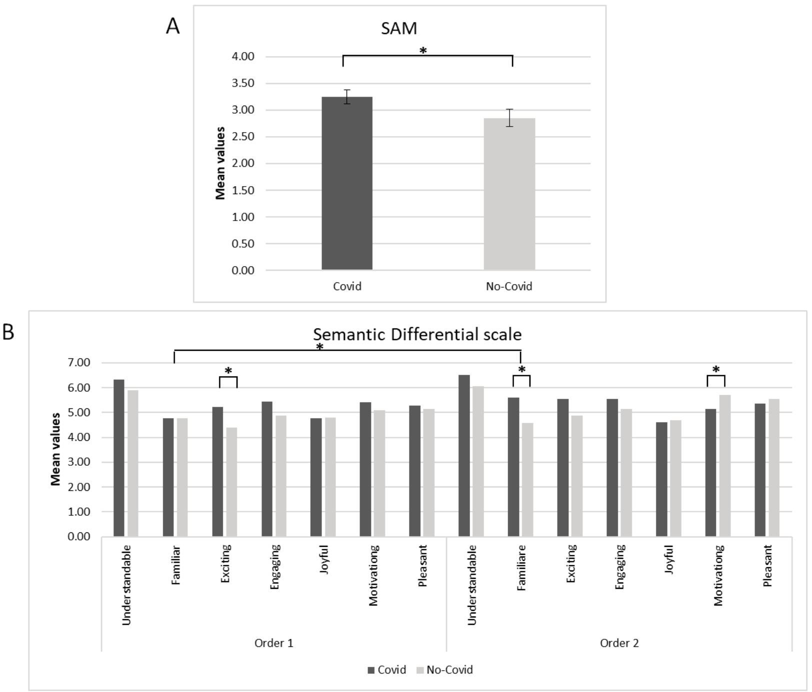

Figure 3ab. Self-report results. a) Bar graph shows significant differences for SAM arousal values between Covid and No-Covid conditions in Order 1. b) Bar graph shows significant differences for semantic differential scale values between Covid and No-Covid conditions in the two orders. For all graphs, bars represent ±1 SE. Stars mark statistically significant pairwise comparisons

The results also showed that in Order 1, in the Covid condition, there were also significant differences between understandable ratings and familiar ($p \leq .05$), exciting ($p = .022$) and motivating ($p = .006$). Similarly, in the No-Covid condition, there were significant differences between understandable ratings and familiar ($p = .024$) and exciting ($p = .010$), and also between exciting ratings and engaging ($p = .026$) (Figure 4a).

On the other hand, in Order 2, in the Covid condition, there were significant differences between understandable ratings than familiar ($p = .002$), engaging ($p = .046$), joyful ($p = .001$), motivating ($p = .004$) and pleasant ($p = .036$) ratings. Similarly, in the No-Covid condition, there were significant differences between understandable ratings and familiar ($p = .001$) and joyful ($p =$

.038) ratings, and between familiar ratings and motivating ($p \leq .05$) and pleasant ($p = .014$) ratings, and between exciting ratings and motivating (p = .017) ratings, and between joyful ratings and motivating ($p = .016$) (Figure 4b).

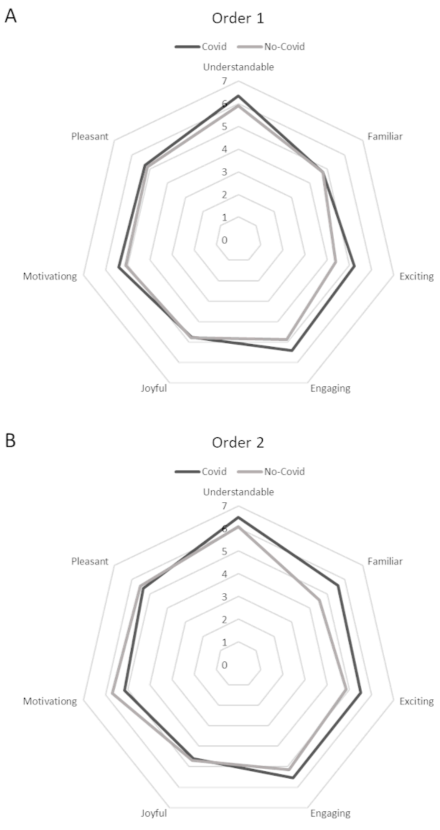

Figure 4ab. Semantic differential scale. Radar diagrams show: a) how the Covid and No-Covid stimuli are differentiated in Order 1, by the values obtained from the semantic differential; b) how the Covid and No-Covid stimuli are differentiated in Order 2, by the values obtained from the semantic differential

4. Discussion

The current research focused on the psychophysiological and behavioral analysis of Covid related ADV, considered to be stimuli with a strong emotional impact on the public audience. The main advantage of this research concerned in the application of a multi-level psychophysiological and behavioral approach including oculometric, autonomic and self-report measures, and in the comparison of the information deriving from implicit ADV processing, provided by oculometric and autonomic measures, with explicit information obtained from self-report measures. The significant findings observed for the three different levels of measures will be discussed below.

First of all, concerning the results derived from oculometric measures, shorter TFF was mainly found in the Covid compared to the No-Covid condition. In the context of non-profit ADV, Bebko et al. (2014) stated that the quicker is the TFF on the AOI, the greater will be the impression of that AOI. Thus, following the idea that the visual salience of a stimulus grabs the attention more quickly, this result could suggest that Covid stimuli, for which we have observed a shorter TFF, are considered more relevant and salient than No-Covid ADV.

In line with this result, it was also detected a decrease in the Fixation Count for Covid compared to the No-Covid condition. Assuming that a single fixation is an index of a single cognitive processing and more fixations represent a greater cognitive and attentive need, this evidence was interpreted as a lower demand for mental and cognitive effort, in relation to the greater relevance and attentional focusing of the Covid stimuli. In fact, previous studies showed that a greater number of fixations was linked to a greater cognitive processing (Ferreira et al., 2016; Just & Carpenter, 1980), thus, conversely, a lower number of fixations could represent the result of facilitation in cognitive processing.

In addition, a decrease in the sum of the Fixation Duration for Covid was observed in comparison with the No-Covid ADV condition. This oculometric index was previously exploited in the literature on lexical processing studies (Cole et al., 2011; Koglin, 2015), as a marker of the cognitive processing associated with the complexity of the stimulus, thus a shorter fixation time could suggest less cognitive effort in processing the conceptual relevance of the ADV stimuli.

Therefore, considering the oculometric results, it could be concluded that the Covid stimuli are more salient, as it would seem that they require less cognitive and mental effort than the No-Covid stimuli, the Covid stimuli more directly associated to relevant semantic representation. In this perspective, a themed Covid ADV could represent a facilitative strategy of communication featured by a greater emotional significance.

Regarding the findings collected from autonomic measures, a decrease in the values of cardiovascular indices (namely, BVP, PVA and IBI) was observed in the Covid condition compared to the No-Covid condition in Order 1, that is when the Covid stimuli were watched before the No-Covid stimuli.

Literature showed that during the exposure to emotionally engaging stimuli or negative events (as Covid stimuli could be, given the consequences of the pandemic caused by SARS-COV-2), individuals may feel actively threatened and, consequently, react with widely known defensive modes, including freezing and active fighting or flight reactions (Abadi et al., 2021; Bacon & Corr, 2020; Roelofs et al., 2010; Wester, 2011). However, while fight or flight reactions are associated with an increase in HR (as they are reactions driven by the sympathetic autonomous nervous system), freezing reactions depend on the parasympathetic branch and were linked to a form of behavioural inhibition, that is accompanied by a deceleration of cardiovascular measures in a generalized way (Roelofs, 2017). Roelofs et al. (2010) claimed that the freezing response can be considered as a defensive reaction to both social and physical stressors. Several studies in the literature confirmed this assertion, revealing that individuals typically experience a decrease in HR and, more generally, in cardiovascular parameters after seeing visual content recalling memories or events that have a significant emotional impact (Azevedo et al., 2005; Hagenaars et al., 2012, 2014). Additionally, the effect of freezing, which is frequently associated with emotionally charged events, serves as a mechanism that facilitates attentional and perceptual mechanisms, with the aim of helping the subject in identifying the appropriate cues to use as the basis for producing an appropriate response mechanism for the situation (Noordewier et al., 2020).

According to this evidence and to the research conducted by Roelofs (2017), a potential explanation for the present decrease in cardiovascular indices is that the vision of Covid stimuli was responsible for inhibitory mechanisms linked to the freezing response. This interpretation is also confirmed by the fact that in Order 1, the values of the autonomic results were lower than in Order 2.

Interestingly, the results obtained from self-report measures (SAM and semantic differential scale) were in line with the eye-tracking and autonomic data trends. In fact, for the SAM scale, higher arousal ratings in the Covid compared to the No-Covid condition were found and according to the Likert scale, a high rating corresponds to a high impact in terms of arousal. As observed in the literature, emotional arousal is one of the indicators of the intensity of a temporary emotional experience (Hoyt et al., 2015). In this context, it was possible to assume that the increase in arousal related to peak moments linked to Covid stimuli can be presumably associated with greater engagement, as the Covid stimulus could be conceived as more salient (Bujarski et al., 2015; Koole & Rothermund, 2022).

In addition, the semantic differential scale revealed that Covid stimuli were conceived as more exciting in Order 1. Moreover, individuals who were exposed to the Order 2 perceived the Covid theme ADVs as more familiar and less motivating. Taken together these results suggest that the content of a Covid ADV can be interpreted as more salient and engaging, also stimulating greater and deeper processing of affective components, which, as previously described, are among the key determinants of orientation, purchase, and analysis of consumer behaviour. Moreover, these results are in line with previous studies exploring Covid ADV (Morton et al., 2022; Sansone & Balconi, 2022).

To sum up, the present study explored consumers' responses to Covid ADV by exploiting a psychophysiological and behavioral approach based on the detection of implicit and explicit measures. Results showed that the use of Covid-themed ADVs can be considered as a facilitative strategy of communication, because of the strong emotional impact provoked by the nature of the stimuli. Regardless of the order, developing an ADV communication based on stimuli capable of eliciting strong emotional commitment can be considered a promising and effective strategy to raise the involvement of the user as well as his or her motivational levels.

Despite the novelty of the present study, it is also important to stress the existence of some limitations. First, it is recommended to increase the sample size in order to provide statistically more solid results. Secondly, being this research based on the analysis of physiological data recorded through the eye-tracking technique, combined with the analysis of autonomic and self-reported data (such as questionnaire or surveys; Angioletti & Balconi, 2023; Balconi et al., 2021; Crivelli & Angioletti, 2022), it might be interesting to integrate the current evidence with neurophysiological information based on the application of neuroscientific tools, such as Electroencephalography (EEG) (Acconito et al., 2023a) or functional Near Infrared Spectroscopy (fNIRS). Indeed, recent research displayed how the combination of fNIRS-EEG co-registration could be useful to explore more deeply the set of neural processes underlying the emotional processing of salient stimuli (Balconi et al., 2015, 2017; Balconi & Vanutelli, 2016, 2017; Liu et al., 2021).

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Declaration of interests

None.

Data accessibility

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

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