Neuropsychological Trends

33
April 2023 - Special Issue

The social representation and social action effect of critical issues: autonomic system and self-report measures

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ABSTRACT

By combining words and images that impact emotions and generate empathetic storytelling, advertising (ADV) has evolved into a form of communication for promoting consumer awareness, positive social change, and ADV-related decisional processes, even on topics of high-social relevance such as crisis communication. This study explored consumers' emotional and cognitive responses to crisis-related ADVs using implicit (autonomic) and explicit (self-report) measurements. Nineteen participants watched twelve high-impact social communications about Covid-19, personal health, safety, and prosociality, while autonomic and self-report data were collected. Personal health, safety, and prosociality had higher skin conductance than Covid-19 stimuli, indicating higher arousal and engagement. Personal health reported lower heart rate variability values than Covid-19, suggesting greater emotional reactions for personal health topics, but also lesser mental load for Covid-19 stimuli. Self-report results confirmed autonomic findings. In conclusion, communications about personal health, safety, and prosociality generate higher emotional impact and allow for effective storytelling that facilitates viewer identification, developing a high level of empathy.

Keywords: advertising; decisions; autonomic; self-report; critical issue; storytelling

1. Introduction

Nowadays media advertising (ADV) has evolved from a kind of communication that just attempts to persuade the consumer to purchase into a communicative artefact that also seeks to encourage social actions and beneficial societal change.

But how does the general public react to commercials that deal with issues of great social importance (such as the pandemic, individual health, safety, and prosociality)? What kind of mechanism does this type of advertising use to induce action in the public?

To answer these questions, it can be useful to focus on the possible nature of communicative stimuli in their verbal or nonverbal form. Verbal stimuli, specifically, are the most used in communicative processes and require focusing on language. An example of verbal communication is using the narrative technique, which is an attempt to convey information in the form of a story (Bal & Van Boheemen, 2009), grabbing the attention of individuals and creating memorable images through words (Green, 2008). Furthermore, several studies have demonstrated that this method is successful in influencing people's beliefs and attitudes about the real world (Appel & Richter, 2007; de Graaf & Hustinx, 2011; Green, 2006; Green & Brock, 2000). To this aim, ADV exploit images and words to develop storytelling that can enhance the emotional power of the advertisement itself, promoting memorization and increasing its impact (Kang et al., 2020). An ADV's storytelling elements are also a powerful persuasive tool that can change customer attitudes and behaviours by appealing to their emotions (Park & Lee, 2014).

This capacity for change, specifically, is related to the mechanisms of mirroring and empathy. In particular, the mirroring mechanism refers to the ability of the observer to activate the same fronto-parietal circuits involved in the execution of the action observed, as if the observer was performing that action in the first person (Balconi, 2020; Balconi & Fronda, 2020a, 2020b, 2021b, 2022b; Freedberg & Gallese, 2007). This activation allows the individual to plan his actions (Balconi, 2020; Balconi & Fronda, 2020a, 2020b, 2021b, 2022b; Freedberg & Gallese, 2007) and to understand the meaning of the observed actions (Rizzolatti et al., 2001; Rizzolatti & Craighero, 2004), establishing a connection between the observation and the execution of the action (Holle et al., 2008; Huxam et al., 2009). Mirroring mechanisms underlie the multidimensional construct of empathy (Balconi, 2020). As stated by de Waal (2008), empathy can be defined through three different abilities.

First, the ability to share another person's emotional state is known as emotional empathy. Related to this ability, specifically, there can be two

distinct emotional reactions to another person's perceived need: emphatic concern and personal distress. In the first case, specifically, there are feelings of compassion directed toward the person in difficulty (Davis, 1994), while in personal distress the emotional response of anxiety and discomfort is personal and directed toward oneself (De Waal, 2008).

Secondly, the ability to identify and analyze the causes of another's state which can be defined as cognitive empathy. This term, specifically, refers to the ability to recognize and understand the emotions of others, but also what triggered them (Strayer, 1990).

Finally, the third skill is identification, which can be defined as the ability to identify with others and adopt their point of view (Busselle & Bilandzic, 2008; Cohen, 2001). The individual, in particular, can imagine events happening to another person and adopts his or her own emotions, forgetting about his personal experience (Balconi et al., 2020; Balconi & Angioletti, 2022; Balconi & Canavesio, 2016; Balconi & Vanutelli, 2017; Green, 2006; Oatley, 1994, 1999; Slater & Rouner, 2002).

Moreover, identification not only leads to emotional modifications but is also capable of leading to behavioural changes, such as the development of prosocial behaviours (Balconi & Bortolotti, 2012; Balconi & Canavesio, 2013; Busselle & Bilandzic, 2008; Hinyard & Kreuter, 2007). Specifically, this term is used to mean all those social and positive behaviours that are voluntarily enacted by an individual with the intention of benefiting another person or group (Brief & Motowidlo, 1986; Eisenberg et al., 2006). Regarding the development of prosocial behaviours, several researchers have investigated how they are also closely related to socio-emotional variables (Blair, 2018; Mesurado et al., 2014), including empathy, positive emotions, gratitude and forgiveness (Karremans et al., 2005; Ma et al., 2017; Marsh et al., 2007; Yost-Dubrow & Dunham, 2018) Emotions, actually, help people cope in complex social and cultural contexts, promoting interpersonal understanding and social connection (Baumeister & Lobbestael, 2011).

All these communicative aspects can be used in any form of ADV: radio, newspapers, magazines, and especially television. ADV, specifically, aims to create a relationship between the object of the communication (i.e., the message) and the audience through the evocation of different emotions. Advertisements are created in such a way as to promote the development of empathy in the audience, in order to develop a relationship with what they are looking at and participate directly in depicting events, feelings, and behaviours, as if you were part of the scene in the first person (Schlinger, 1979; Stewart et al., 2007). Even in advertising, in fact, emotions are used to develop empathy and promote affective and behavioural changes (Chaudhuri & Holbrook, 2001). Several research has pointed out that feeling empathy and positive

emotions are closely related to the development of prosocial behaviours (Bagozzi & Moore, 1994; Barraza & Zak, 2009; Lee et al., 2014). For this purpose, advertisements use various techniques, including the modification of colour, light, sound, and other visual elements, which have an impact on stimulating emotions.

The application of advertising strategies outside of the commercial sector has grown significantly during the past few years. Government, educational, health, and social service organizations, charities, as well as many other sorts of non-profit (public and nonprofit) institutions who want to spread a message or encourage a specific behaviour now use marketing. Among the various types of advertising, an important part is represented by Public Service Ads (PSAs), which can be divided into two categories. The first group is designated for people who require health assistance or are at risk for health issues or other difficulties (such as women with breast cancer or patients with addictions). Instead, the other one is to encourage individuals to contribute to a good cause by volunteering their time or money (Bagozzi & Moore, 1994). For example, an empathic response in the context of charity ADVs is a message viewer's immersion in the emotions of a person in need that prompts an urge to take action to improve the other person's condition (Bennett, 2015).

The effectiveness of this type of ADV, in addition to the ability to elicit empathy, could be represented by the use of the leverage of kindness, responsibility, and the need to always do one's best. These aspects, in fact, represent some of the principles that are taught from an early age, with the hope that they can be a guide for all types of behaviour (Smith & Ellis, 2001).

Message elaboration has been generally assessed using self-reported measures or thought-listing techniques (Escalas, 2004; Shen & Seung, 2018).

However, thanks to neuroscience it is possible to fully understand the emotional and cognitive processing of a message, grasping not only the explicit, conscious, and verbally reported aspects, but also the implicit, and unconscious ones (Balconi, 2014). Thanks to psychophysiological and behavioural tools used in neuroscience (Alvino et al., 2020; Stasi et al., 2018) is possible i) to explain the implicit attitudes, and expectations of a given ADV stimulus, and ii) to provide 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).

The use of neuroscience, therefore, makes it possible to overcome the traditional separation between rationality and emotions, supporting Damasio's insight that the ability to express and experience emotions is essential for the implementation of rational behaviour (Damasio, 1994). In studying behaviour and reaction to a stimulus, in fact, it should be considered that these are the result of the interaction between two different systems, one conscious and

cognitively mediated and one unconscious and emotionally mediated. The former system, specifically, is called the deliberative system, while the latter is called the intuitive system (Balconi, 2008, 2009; Deppe et al., 2005; Kahneman & Tversky, 1981; Loewenstein, 2000).

Finally, Russell's model of the appraisal process (Russell & Carroll, 1999) which states that each emotion is a particular reaction to a specific type of significant event and is judged by the subject in accordance with his motivational significance and his primary goals, contributes to the importance of emphasizing the emotional component (Balconi, 2014) Specifically, two criteria regulate this appraisal process: the arousing strength of the emotional stimuli (high or low) and its valence (positive or negative).

In particular, indirect measurements of arousal are derived from psychophysiological autonomic markers, such as skin conductance, heart rate, and blood pressure (Balconi & Venturella, 2017). The functional significance of autonomic indices, in fact, allows for 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). Specifically, the activity related to the autonomic nervous system consists of cardiovascular measures, such as Heart Rate Variability (HRV), and electrodermal activity (EDA), as Skin Conductance Level (SCL).

The SCL attempts to measure small variations in the skin's electrical activity caused on by sweat glands. This measurement is sensitive to tonic modulation of arousal responses and has been linked to emotional reactivity, reflecting the overall level of activity (Khalfa et al., 2002; Malmo, 1959; Yuan et al., 2014; J. Zhang et al., 2017; S. Zhang et al., 2014).

Similarly, HRV is linked to regulated emotional reactions (Appelhans & Luecken, 2006; Balconi et al., 2019; Kim et al., 2004): higher arousal is indicated by lower HRV, which has been related to stress, panic, anxiety, and concern (H. G. Kim et al., 2018; Shaffer & Ginsberg, 2017). In the meantime, research suggests that greater HRV is also a physiological indicator of decreased mental load (Denson et al., 2011).

To gain a more exhaustive and more complete understanding of the phenomenon under investigation, alongside autonomic measures, aspects of valence and arousal as well as subjective evaluation of stimuli can also be investigated by self-report measures (Balconi et al., 2015; 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 explore the psychophysiological reactions and self-report responses to critical issues conveyed through ADV. Specifically, the chosen ADV stimuli addressed the following high-impact themes: Covid-19, personal health, safety, and prosociality. Through the use of autonomic measures recording and self-report

measures, implicit and explicit responses related to the different emotional, cognitive and attentional reactions of consumers to these ADV were collected.

Regarding autonomic data, in line with the literature, it is expected that the representation of issues in which a person feels more involved and called to take active action may be perceived as more engaging (Chaudhuri & Holbrook, 2001; Schlinger, 1979; Stewart et al., 2007). Therefore, it is hypothesized that personal health, safety, and prosocial stimuli induce greater identification and report higher SCL values. Similarly, cardiovascular parameters are also expected to confirm this result, reporting lower HRV values in these more activating subjects.

Finally, self-report measures are expected to support and complement implicit metrics. Particularly for Self-Assessment Manikin (SAM), higher arousal ratings for safety stimuli are predicted. According to the literature, salient cues can increase engagement (Bujarski et al., 2015; Sansone & Balconi, 2022) and safety, both personal and public safety, is not only a current issue but also a priority. Likewise, it is possible to speculate that stimuli related to the pandemic may be perceived negatively, as an event that profoundly impacted and changed many aspects of daily life (Rajkumar, 2020; Torales et al., 2020; Zhao et al., 2020). For the semantic differential scale, which permits investigating subjective attitudes, perceptions, and representations of stimuli, it is expected that social and critical issues such as safety and prosociality stimuli, impact the population more and are perceived as more responsive and engaging.

2. Method

2.1 Sample

The sample was composed of 19 participants, divided into two groups: a healthcare professional' group (N = 10 people; 4 males and 6 females; Mean age = 25.47; Standard Deviation age = 6.48) and a student group (N = 9 people; 4 males and 5 females; Mean age = 25.12; Standard Deviation age = 6.76). Health professionals have been recruited in collaboration with health centers in Milan, in Italy, including "Centro Cardiologico Monzino", "Ospedale Sacco" and "Società Umanitaria di Milano", while the student group was gathered in partnership with the Catholic University of the Sacred Heart in Milan, in Italy. A convenience sampling approach was adopted for this study.

The study excluded subjects with significant levels of depression, global cognitive functioning and short- and long-term memory function outside the norm. Also, the presence of post-traumatic stress symptomatology linked to the

COVID-19 experience was evaluated through the COVID-19-PTSD questionnaire and represents an exclusion criterion (Forte et al., 2020). Finally, all participants were right-handed and had normal-to-corrected vision.
Participation in the study was free and voluntary; all participants signed written informed consent before being enrolled. The research protocol has been approved by the Ethics Committee of the Department of Psychology, Catholic University of the Sacred Heart, Milan, Italy and conducted in accordance with the Helsinki Declaration (2013).

2.2 Stimulation condition

The set of selected stimuli consists of twelve communication spots that deal with crisis scenarios. The term crisis refers to typical events caused by the complexity of the system itself, misjudgments, and interactions between technical systems and the people trying to manage them (Pauchant & Mitroff, 1992). In accordance with this definition, therefore, the stimuli chosen concerned social and individual situations of high complexity and impact conditions, representing communications that have been adopted to cope with a crisis and promote individual and collective safety and security. Specifically, these stimuli can be divided into four different topics dealing with crisis, individual and collective safety: Covid-19, personal health, safety, and prosociality.

Covid-19 stimuli. The three Covid-19 stimuli address the pandemic issue by providing advice on the appropriate behaviours to adopt and highlighting how the vaccination campaign can be a useful strategy to prevent the spread of the disease. Three spots issued by the Italian Ministry of Health are included in this category The videos describe the spread of Covid-19 as a result of adopting incorrect behaviour, including lowering or not wearing a face mask in an elevator or on public transport services, rubbing eyes without first sanitizing hands, or touching common surfaces like the bank counter right after coughing on hands. Also, the recommendations to avoid infection are presented, such as properly wearing the mask in closed places, not shaking hands, keep a safe distance.

Personal health stimuli. The personal health topics in represented by three stimuli and illustrate the Italian Ministry of Health's efforts to improve individual understanding of healthy lifestyle choices while highlighting the value of health prevention measures. For instance, in the prevention communication campaign for type 2 diabetes, a well-known Italian television presenter illustrates the possible prognostic factors behind diabetes, such as familiarity, obesity, overweight and sedentary. In the final part of the campaign, the characters of the spot highlight the prevention factors, including healthy and balanced nutrition and adequate physical activity.

Safety stimuli. The three stimuli about safety are issued by "Croce Rossa

Italiana" and illustrate the recent emergency situation following the war in Ukraine, highlighting the need to help refugees. For instance, in these spots the Director of Emergency and Relief describes the arrival of Ukrainian refugees in Italy. The focus of the video shifts to the fact that these people do not ask anything in return but instead express gratitude through words and actions for being spared the sounds of air guns and sirens.

Prosociality stimuli. These three stimuli represent the theme of prosociality by inviting the population to put into practice behaviours of help and support towards others. For instance, the "Croce Rossa Italiana" ADV on the occasion of World Blood Donor Day 2019 was shown to participants. In this video, the background speaker explains that he started giving blood thirty years ago with his colleagues after a friend's accident, while images of elderly people, young people, men, and women giving blood run in the background. On the other side, the closing section of the spot emphasizes how each donation can make a difference and how just an hour's donation can help save three lives.

The stimuli were evaluated for the following perceptual characteristics: duration, size, brightness, and content. The duration of the selected spots was circa 50 s, and they were validated for the content.

2.3 Procedure

The experimental procedure had a duration of about one hour and began with an assessment phase in which psychometric tests were administered to the whole sample. Then, a non-invasive autonomic measures recording device was placed on the non-dominant hand and recorded participants' psychophysiological baseline activity for 120 seconds with eyes closed.

For the experimental phase, the participants were sitting in a comfortable chair in a darkened room, with the monitor screen about 80 cm in front of their eyes and watched the twelve social communications with high-impact conditions. All the videos were presented in randomized order (separated by a 5 s inter-stimulus interval during which a black screen was displayed) in the centre of the computer monitor, while autonomic data were collected continuously through the task.

At the end of the experiment, participants filled in the SAM and the Semantic Differential for each stimulus.

2.4 Data acquisition

2.4.1 Autonomic data acquisition

To collect autonomic data, a portable and non-invasively X-pert2000 Biofeedback system with a MULTI radio module (Schuhfried GmbH, Modling, Austria) was adopted. The tool, thanks to a peripheral sensor placed on the distal phalanx of the second finger of the non-dominant hand, allowed measuring the following peripheral parameters: skin conductance level and response (SCL and SCR), pulse volume amplitude (PVA), blood volume pulse (BVP), Heart Rate (HR), Inter-Beat Interval (IBI), Heart Rate Variability (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.

2.4.2 Self-report data acquisition

The SAM scale (Bradley & Lang, 1994; Lang, 1980) and the semantic differential scale (Osgood et al., 1957) were adopted to collect self-report information on emotional valence and arousal and to investigate attitudes, perceptions, and representations of visual stimuli.

In particular, by using five different pictures to represent a 5-point Likert scale, where score one represents a low-impact emotional response and value 5 represents a high-impact emotional reaction, SAM is a non-verbal pictorial evaluation technique that specifically quantifies the valence and arousal of a people's emotional response to a specific stimulus.

Contrarily, the semantic differential scale enables the evaluation of visual stimuli in terms of seven distinct descriptive polar-adjectival scales ("Understandable", "Familiar", "Exciting", "Engaging", "Joyful", "Motivating", and "Pleasant"), on a 7-point equal-interval ordinal scale, where low values represent the feature's negative pole and high values its positive pole

3. Results

3.1 Data analysis

A preliminary analysis of the sample was conducted before performing the analysis on the autonomic and self-report data. In particular, it was assessed if there would be a significant age difference between the student group and the healthcare professionals' group. The result revealed no statistically significant differences, which supported the assumption that the chosen sample is representative of the total population overall. In light of this evidence, it was decided to perform the subsequent analysis on the entire sample rather than the two distinct groups.

Repeated measures ANOVAs with *Crisis topics* (4: Covid-19, personal health, safety, prosociality) as independent within-subject factors were separately applied to autonomic and self-report measures dependent variables. In particular, seven ANOVAs were applied to the autonomic dependent measures (i.e., to SCL, SCR, BVP, PVA, IBI, HR, HRV), two ANOVAs were applied to SAM (for arousal and valence subjective ratings) and seven ANOVAs were applied to the semantic differential scale (for the following descriptive polar-adjectival: "Understandable", "Familiar", "Exciting," "Engaging", "Joyful", "Motivating", "Pleasant").

Pairwise 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 (⍰2) indices.

3.2 Autonomic data results

ANOVA on autonomic data showed for SCL a main effect in within-subject factor *Crisis topics* ($F [1,18] = 13.262$, $p \leq .05$, ⍰2 = .424), with higher mean values for personal health stimuli ($p = .011$), safety ($p = .001$), and prosociality stimuli ($p = .002$) compared to Covid-19 stimuli (see Figure 1a)

A main effect in within-subject factor *Crisis topics* ($F [1,18] = 2.932$, $p = .041$, ⍰2 = .140) was also found for HRV (see Figure 1b), whit higher mean values for Covid -19 stimuli compared to personal health ($p = .022$).

No other significant differences were observed for the other autonomic indices.

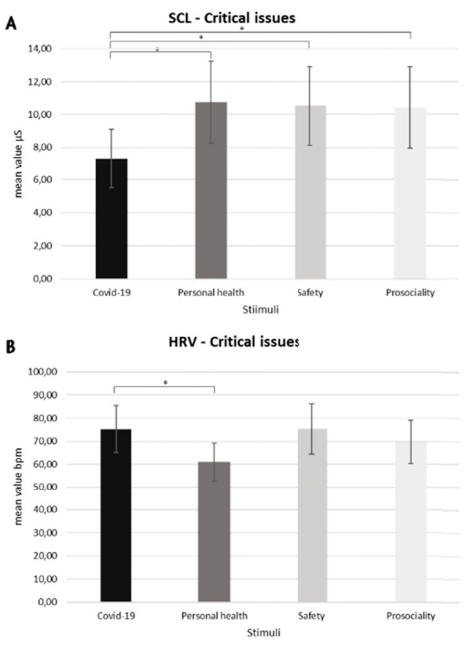

Figure 1a-b. Autonomic results. A) The bar graph shows significant differences for SCL values between critical issues. Bars represent ±1 SE. Star (*) marks statistically significant pairwise comparisons. B) The bar graph shows significant differences for HRV values between critical issues. Bars represent ±1 SE. Star (*) marks statistically significant pairwise comparisons

3.3 Self-report data results

For arousal ratings, a significant main effect in within-subject factor *Crisis topics* ($F [1,18] = 11.569$, $p \leq .05$, $\eta^2 = .391$) was found (see Figure 2a), with higher arousal ratings for the safety stimuli compared to Covid-19 stimuli ($p = .003$), personal health stimuli ($p \leq .05$) and prosociality stimuli ($p = .013$).

Also, for valence ratings, a significant main effect in within-subject factor *Crisis topics* ($F [1,18] = 6.545$, $p = .004$, $\eta^2 = .267$) revealed higher valence ratings for the prosociality stimuli compared to Covid-19 stimuli ($p = .001$) and to safety stimuli ($p = .009$).

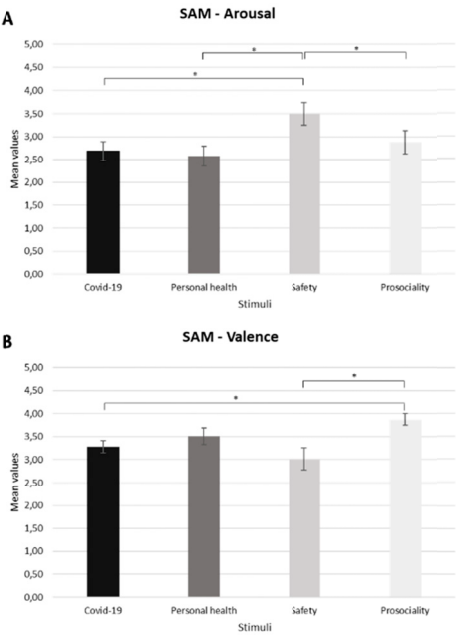

Figure 2a-b. Self-report results: SAM. A) The bar graph shows significant differences for SAM arousal values between critical issues. Bars represent ±1 SE. Star (*) marks statistically significant pairwise comparisons. B) The bar graph shows significant differences for SAM valence values between critical issues. Bars represent ±1 SE. Star (*) marks statistically significant pairwise comparisons

A significant main effect in within-subject factor *Crisis topics* ($F [1,18] = 10.659$, $p \leq .05$, $\eta 2 = .372$) was found for "Exciting", with lower mean ratings for the Covid-19 stimuli compared to the safety stimuli ($p = .023$) and lower mean ratings for the personal health stimuli compared to the safety ($p \leq .05$) and the prosociality stimuli ($p = .001$) (see Figure 3a).

Another significant main effect was found for the "Engaging" descriptive polar-adjectival ($F [1,18] = 6.283$, $p = .001$, $\eta 2 = .259$) and pairwise comparisons revealed lower mean ratings for personal health stimuli compared to the safety ($p = .028$) and the prosociality stimuli ($p = .047$) (see Figure 3b).

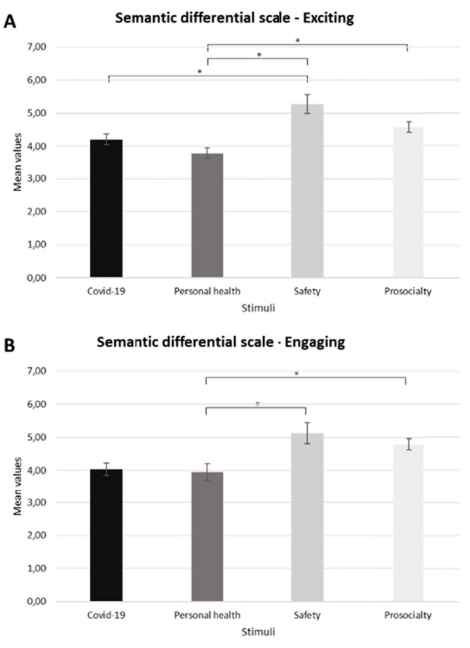

Figure 3a-b. Self-report results: semantic differential scale. A) The bar graph shows significant differences for the "Exciting" descriptive polar-adjectival values between critical issues. Bars represent ±1 SE. Star (*) marks statistically significant pairwise comparisons. B) The bar graph shows significant differences for the "Engaging" descriptive polar-adjectival values between critical issues. Bars represent ±1 SE. Star (*) marks statistically significant pairwise comparisons

ANOVA performed to the dependent measure of "Joyful" relieved a significant main effect in within-subject factor *Crisis topics* ($F [1,18] = 19.132$, $p \leq .05$, $\eta 2 = .515$), where higher mean ratings were found for the Covid-19 stimuli ($p \leq .05$) and for the personality health stimuli ($p \leq .05$) compared to the safety stimuli, and also lower mean ratings were reported for the safety stimuli compared to the prosociality stimuli ($p = .001$) (see Figure 4a).

The analysis of the semantic differential showed also a significant main effect for "Motivating" ($F [1,18] = 2.887$, $p = .044$, $\eta 2 = .138$) revealing lower mean ratings for the personal health stimuli compared to prosociality stimuli ($p = .015$) (see Figure 4b).

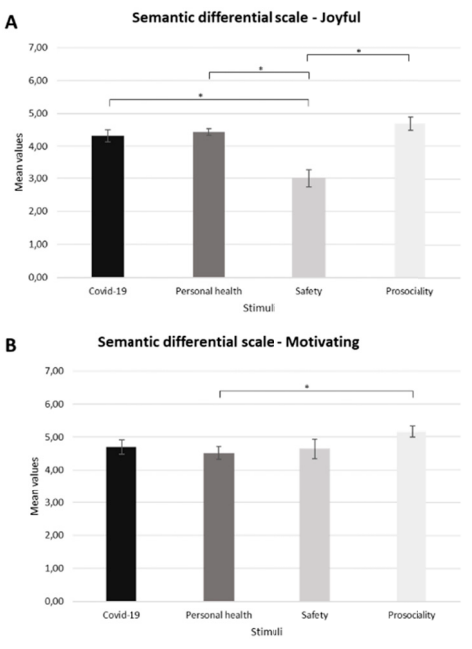

Figure 4a-b. Self-report results: semantic differential scale. A) The bar graph shows significant differences for the "Joyful" descriptive polar-adjectival values between critical issues. Bars represent ±1 SE. Star (*) marks statistically significant pairwise comparisons. B) The bar graph shows significant differences for the "Motivating" descriptive polar-adjectival values between critical issues. Bars represent ±1 SE. Star (*) marks statistically significant pairwise comparisons

Finally, a significant main effect in within-subject factor *Crisis topics* ($F [1,18] = 5.856$, $p = .001$, $\eta 2 = .245$) was found for "Pleasant", where lower mean ratings were found for the safety stimuli compared to the prosociality stimuli ($p = .021$) (see Figure 5).

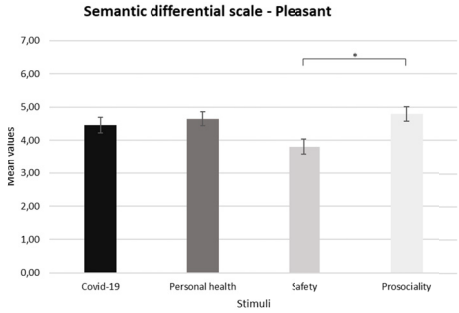

Figure 5. Self-report results: semantic differential scale. The bar graph shows significant differences for the "Pleasant" descriptive polar-adjectival values between critical issues. Bars represent ±1 SE. Star (*) marks statistically significant pairwise comparisons

4. Discussion

The current study focused on the psychophysiological and behavioural correlates of social and critical issues related to ADV, which were supposed to be strong emotional stimuli for the public audience. The main strength of this study was the application of a two-fold-level psychophysiological and behavioural approach including autonomic and self-report measures, in relation to possible effects on final decision of people to follow ADV suggestions. This approach, in fact, permitted the comparison of the ADV processing's implicit information, provided by autonomic measures, with explicit information obtained from self-report measures. The significant findings observed for the two different levels of measures will be discussed below.

First of all, concerning the results derived from autonomic measures an increase in the electrodermal activity parameter represented by SCL was found for personal health, safety, and prosociality stimuli compared with the Covid-19 theme. According to the literature, an increase in skin conductance levels indicates more arousal and engagement (Balconi, Venturella, Fronda, & Vanutelli, 2019; Balconi, Venturella, Fronda, De Filippis, et al., 2019; Balconi & Fronda, 2021a, 2022a; Khalfa et al., 2002; Malmo, 1959; Yuan et al., 2014; J. Zhang et al., 2017; S. Zhang et al., 2014). So, from this result, it might be deduced that personal health, safety, and prosocial themes are more strongly activated than the Covid-19 theme. Two hypotheses could either be used to

explain this activation. First, although Covid-19 has a significant influence on daily life (Balconi et al., 2021; Rajkumar, 2020; Torales et al., 2020; Zhao et al., 2020), this concept may now be seen as an outdated conception that has no connection to the contemporary life conditions. Nevertheless, a second explanation could be found in the videos that contain promotion of personal health, safety and prosociality: they could allow better identification in the observes, and, in line with the literature, the capacity for identification with the characters portrayed enables greater empathy and first-hand experience (Balconi et al., 2020; Balconi & Angioletti, 2022; Balconi & Canavesio, 2013, 2016; Balconi & Vanutelli, 2017; Chaudhuri & Holbrook, 2001; Schlinger, 1979; Stewart et al., 2007).

Another significant evidence from autonomic measures concerns the cardiovascular HRV index. A decrease in HRV levels was found in the personal health stimuli compared to the Covid-19 stimuli. This evidence, specifically, can be interpreted as a confirmation and support of the significant difference found in SCL for the same stimuli. In fact, according to the literature, lower HRV levels are interpreted as a marker of difficult management of greater emotional reactions (Appelhans & Luecken, 2006; Balconi, Fronda, et al., 2019; Kim et al., 2004). In particular, several studies demonstrate how this lower activation can be related to themes of stress, anxiety, and worry (Kim et al., 2018; Shaffer & Ginsberg, 2017). In agreement with this perspective, therefore, it is possible to hypothesize that the theme of personal health represents one of the most important and impacted issues for the population (Figliozzi & Unnikrishnan, 2021; Leibowitz, 2004) and, when this theme is depicted in ADV stimuli, this can generate an high emotional impact.

At the same time, the interpretation of the HRV index can also be explained from a cognitive point of view. Specifically, higher levels of HRV are indicative of lower mental load. Covid-19 stimuli, therefore, are found to be processed and elaborated with less cognitive effort (Denson et al., 2011). One explanation could be to interpret the pandemic as a well-known and outdated topic. At the same time, however, this decrease in cognitive load could be attributed to too much overexposure and reiteration of Covid-related messages (Guan et al., 2022).

Concerning the results obtained from self-report measures (SAM and semantic differential scale), it is possible to state that the results were in line with the autonomic data trends. In fact, for the SAM scale, higher arousal ratings in the safety stimuli compared to the Covid-19 theme were found and according to the Likert scale, a high rating corresponds to a high impact in terms of arousal. This result is in line with SCL's evidence (Bujarski et al., 2015).

Interestingly, safety stimuli were also perceived as having more impact in

comparison to personal health and prosociality. At first analysis, this result would seem to contradict what was previously discussed for electrodermal activity, but it could be explained through the phenomenon of social approval. When, in fact, the subject is required to explicitly evaluate the impact that the issue of security, and war in this specific case, has on him/her, he/she may be affected by social approval and desirability (Chung & Monroe, 2003).

A similar interpretation can be made for the results about the valence of stimuli, also collected with the SAM. The data show that the prosocial theme, which promotes helping others, is perceived more positively than the Covid-19 and safety stimuli. These results may indicate that current issues such as Covid-19 and security, in this case due to the war in Ukraine, are experienced as more negative since they are profoundly impacting many aspects of daily life and bringing high levels of concern (Balconi et al., 2021; Rajkumar, 2020; Torales et al., 2020; Vuorio et al., 2022; Zhao et al., 2020).

Finally, the semantic differential scale reported that, in general, safety and prosociality stimuli were perceived as more impactful and activating. These kinds of commercials, in fact, are defined as more exciting, engaging and joyful. Prosociality stimuli are also indicated as more motivating and pleasant. These results might indicate that safety and prosociality are issues that, perhaps always because of social desirability (Chung & Monroe, 2003), are perceived to be most impacted. Despite this, however, this result can also be explained by appealing to the theme of empathy: seeing people in distress and need of help allows for firsthand experience and activates the individual more (Balconi & Angioletti, 2022; Balconi & Vanutelli, 2017; Busselle & Bilandzic, 2008; Cohen, 2001; De Waal, 2008; Strayer, 1990), ready to enact prosocial behaviour toward others and, consequently, toward oneself (Green, 2006; Oatley, 1994, 1999; Slater & Rouner, 2002) therefore impacting on future decision to act.

To sum up, the present study explored the public's responses to social and critical issues related to ADV by exploiting a psychophysiological and behavioural approach based on the detection of implicit and explicit measures. Results showed that the use of personal health, safety and prosociality-related ADVs can be considered a useful strategy of communication and decision, because of the strong emotional impact provoked by the nature of the stimuli. However, it is important to emphasize that one of the variables in making effective and memorable communication is the use of storytelling. This approach, in fact, allows people to feel empathy toward the characters represented, identify with their stories, and experience their own emotions. Experiencing a situation first-hand also leads to greater awareness of the issue represented and being more likely to engage in pro-social behaviour.

Despite the originality of the study, it is also crucial to emphasize some

limitations. First, it is suggested to expand the sample size in order to provide results that are statistically more reliable. Secondly, this research is based on the analysis of autonomic and self-reported data: it might be interesting to integrate the current evidence with neurophysiological information based on the application of neuroscientific tools, such as Electroencephalography (EEG) or functional Near Infrared Spectroscopy (fNIRS). Indeed, recent research displayed how the combination of fNIRS-EEG co-registration could be interesting for exploring more deeply the set of neural processes underlying the emotional processing of salient stimuli (Balconi et al., 2015b, 2017; Balconi & Vanutelli, 2016; Liu et al., 2021).

Funding: Università Cattolica del Sacro Cuore contributed to the funding of this research project and its publication (grant D3.2 2023).

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