



# It is all about our impulsiveness – How consumer impulsiveness modulates neural evaluation of hedonic and utilitarian banners

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## ABSTRACT

The increasing number of active Internet users has encouraged companies to compete to design the most efficient online ads for their target audience. While some companies build their ads based on the functional and instrumental benefits of their advertised products (i.e., utilitarian banners), others emphasize the experiential, personal, and emotional advantages of purchasing their product (i.e., hedonic banners). This is the first study to use neuroimaging to address the debate in the literature regarding the processing and effectiveness of these types of messages. By means of functional Magnetic Resonance Imaging (fMRI), we explored the neural mechanisms by which an individual consumer trait, namely consumer impulsiveness, influences the evaluation of hedonic and utilitarian banners. The neural results revealed that more impulsive consumers exhibit a higher level of activation in brain regions linked to reward, trust, emotion, as well as a reduction of activity in self-control brain networks, when viewing hedonic banners. Consumers reporting lower levels of impulsiveness (i.e., prudent users), in turn, exhibited stronger activation in brain regions associated with self-control and cognition when evaluating utilitarian banners. Consequently, on the basis of an objective and neuropsychological approach, these results can be used to inform companies about the type of online advertising they should use based on the characteristics of their target audience.

## 1. Introduction

With the proliferation of active Internet users, online advertising has become the pivotal strategy that companies employ in order to trigger consumer value, reward, and interest in the advertised product. This is because the feelings experienced have been shown to increase the likelihood of consumers purchasing particular goods (Ghosh et al., 2021). There is a good probability that before reading this manuscript, you have been exposed to one of the many different types of digital advertising formats. These include interstitials, advertorials, and layers, and, the most widely used form, banners, a type of digitally paid ad that is typically made up of an image and that directs the audience to the firm's website (Campbell et al., 2014). Given the relevance of online advertising for a company's success (in Spain, the country in which this study was conducted, online advertising revenue increased by 5% in 2021 compared to in 2020; Statista, 2022a), firms invest huge amounts of resources in designing effective and distinctive banners that include those attributes that impact and engage the audience to the greatest extent (Alalwan, 2018). The relevance of banner ads is reflected in the

money spent on them per user in Spain, which grew without interruption from \$8.9 per user in 2017 to \$10.2 in 2021 (Statista, 2022b).

In view of the importance of banners in online advertising, recent studies have evaluated how various ad attributes, such as banner size (Namin et al., 2020), complexity (Chun et al., 2014), and animation (Palcu et al., 2017), impact consumer reward, impulsiveness, and even purchase intention and behavior. One extensive line of research assesses the effects of utilitarian and hedonic banners on consumers: two of the most widely used banner types (Hazari et al., 2017). While utilitarian banners present a message through a combination of attributes focused on factual information (e.g., product attributes, use, and performance), hedonic banners emphasize the experiential, social, and ludic benefits of buying the product (e.g., vivid and enjoyable photos). An increasing number of studies have attempted to elucidate the differences in persuasion of both types of banners, without success. While certain studies concluded that utilitarian banners facilitate a more reliable and committed decision (Bilgihan and Bujisic, 2015), others state that the vivid and experiential nature of hedonic banners provokes greater reward, attention, and recognition, which increase the appeal of the

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advertised product (Samson et al., 2020).

The literature concerning retailing and consumer services largely shows that consumer characteristics (i.e., personality traits, socio-demographics, expertise, and consumer typologies) are key drivers and moderators in the processing of online ads and can affect consumer reactions. One of the personality traits that has been shown to exert a key influence on online purchasing decisions is consumer impulsiveness: an individual characteristic that provokes a sudden and immediate purchase willingness with no pre-shopping intentions either to buy the specific product category or to fulfill a specific buying task (Amos et al., 2014). The consumer behavior literature confirms that consumers with high degrees of impulsiveness develop a pleasure-seeking tendency while prudent shoppers show stronger self-control and reasoning in decision-making processes (Hubert et al., 2018). Because of the differences in pleasure goals between more impulsive consumers and less impulsive consumers, and building upon goal theory and the elaboration likelihood model (Kruglanski et al., 2002; Petty and Cacioppo, 1986), it was found that more impulsive consumers tend to prefer hedonic and experiential products, while prudent purchasers select more functional and reason-related goods (e.g., Sengupta and Zhou, 2007). To the best of our knowledge, however, no study has identified the underlying (neuro) physiological mechanisms by which consumer impulsiveness modulates the evaluation of and preference towards hedonic and utilitarian banners. In fact, prior research delved into how consumer impulsiveness influences the evaluation of low-order hedonic or utilitarian items (such as single products or a single sentence, Chopdar et al., 2022; Chung et al., 2017) but failed to explain whether the effect of consumer impulsiveness triggers similar mechanisms in the processing of combinations of banner attributes (namely, higher-level mixture of elements: pictures, texts ...) that together form more reality-based hedonic and utilitarian ad appeals.

The current research attempted to fill this research gap by means of consumer neuroscience: a branch of marketing that uses tools and theories from cognitive and affective neuroscience to provide objective, unbiased, and real-time measurements of the audience's innermost mental states when processing marketing contexts. We contend that the use of neuroimaging is of remarkable relevance in the online environment, in which consumer decision making tends to be faster and, in most cases, motivated by introspective and implicit processes, which are, by definition, difficult to measure with traditional self-reported tools (Casado-Aranda et al., 2021). Accordingly, it would be academically and practically stimulating to know **how consumer impulsiveness influences the neural processing of hedonic and utilitarian banners**. In the current research, for the first time, we used a neuroimaging tool, namely, functional Magnetic Resonance Imaging (fMRI), to reveal the underlying neuropsychological mechanisms by which consumer impulsiveness affects the evaluation of hedonic and utilitarian banners. The results not only serve to examine the psychological origins of the differences in the processing of these ads considering consumer impulsiveness, but also provide insights into the design of more efficient banner strategies based on individual consumer characteristics.

## 2. Theoretical background

### 2.1. Impulsive buying and consumer impulsiveness

Impulsive behavior has been explored in a wide range of disciplines, from eating and gambling, to drug abuse and consumer shopping. Researchers have traditionally proposed several mental processes that determine this behavior. Various studies suggest that impulsive behavior has a cognitive origin and derives from a tendency to overvalue the immediate benefits (e.g., sudden consumption utility) and undervalue the long-term outcomes (e.g., costs or regrets) (Puri, 1996). Investigators supporting dual processing models state that impulsive behavior results from the combination of affective ("hot") and cognitive ("cold") processes: a person who reacts impulsively to a tempting stimuli

experiences strong low-order emotional reactions and an underdevelopment of rational cognition (Shiv and Fedorikhin, 1999). According to more recent theoretical approaches, such as the dynamic model of impulsiveness by Ramanathan and Menon (2006), impulsive behavior derives from strong desires that materialize in a higher reward sensitivity and pleasure-seeking in situations that favor such rewards. A large number of studies characterize impulsive behavior as behavior motivated by failure in self-control and self-regulation and fast activation of hedonic feelings, such as joy and pleasure (Hofmann et al., 2009). In the field of consumer behavior, impulsive buying has been traditionally defined as the "consumer's tendency to buy spontaneously, unreflectively, immediately and kinetically" (Liao et al., 2009, p. 274). Stern (1962) further identified four broad categories of impulse buying: pure (consumers break their normal purchase pattern and develop a novelty purchase pattern quickly), reminder (recall of one's prior experience about a product), suggestion (a consumer encounters a new product and imagines needing it), and planned (when consumers make purchases beyond their shopping goals and search for promotions). These four classifications coincide when considering impulsive buying as the behavior that occurs prior to an actual purchase without it being a planned action, i.e., based on one's impulsive emotion (Beatty and Ferrell, 1998).

A major research direction in consumer behavior research focuses on studying individual differences in consumer behavior by evaluating impulsivity as a personality trait that affects the processing of marketing contexts (Puri, 1996). Gray (1987) defines impulsivity as an overactive tendency to approach rewards and an underactive tendency to inhibit such behavior. In the purchase context, Amos et al. (2014) defined consumer impulsiveness as the personality trait that provokes an immediate purchase willingness with no pre-shopping intentions either to buy the specific product category or to fulfill a specific buying task. Sharma et al. (2014) further completed this definition and conceived consumer impulsiveness as a three-dimensional construct with cognitive (imprudence, or an inability to think clearly), affective (self-indulgence, or a tendency to buy things for one's own pleasure), and behavioral dimensions (lack of self-control, or an inability to control oneself and regulate emotions).

The consumer behavior literature is largely interested in revealing the mechanisms underlying the behavior of impulsive consumers. Certain studies explain differences between impulsive and prudent consumers based on goal systems theory, which was developed by Kruglanski (1996). According to this theoretical framework, goals are knowledge structures associated with experiences or concepts that individuals store in their memory (e.g., winning a prize or eating a cookie); therein, the mere exposure to any of these objects or experiences can spontaneously trigger the search or avoidance of such a goal and more broadly guide individual behavior. The extent to which exposure to that object promotes goal attainment depends on the type of goal that each person seeks (Shah, 2003). In the domain of consumer impulsiveness, Ramanathan and Menon (2006) state that impulsive people tend to increase their goals to seek pleasure in aesthetic, sensory, or sense-related domains. In other words, these authors state that "impulsive behavior is driven by the activation of reward-seeking goals that create a feeling of desire for objects/environments/products related to those goals". Hence, impulsive people have stronger pleasure-seeking goals and weaker self-control goals, whereas prudent people tend to have weaker pleasure-seeking goals and stronger self-control purposes. Following a similar approach, theories of individual motivation have elucidated differences in stimulus processing between more and less impulsive individuals. Particularly, Higgins (1998) states that there are two main motivational systems for individual decision making, namely, promotion and prevention systems. The former regulates aspiration-related goals and involves a greater emphasis on positive outcomes, ideal benefits, and a greater insensitivity to negative outcomes and ought-related benefits; the prevention system, on the other hand, regulates safety goals and needs associated with responsibilities. In accordance with this

reasoning, [Shiv and Fedorikhin \(1999\)](#) proposed that impulsive consumers tend to have a disproportionate focus on the upside derived from gratification of desire, while prudent purchasers show greater sensitivity to security and protection and a prevention focus when it comes to ideal accomplishments. The traditional Elaboration Likelihood Model ([Petty and Cacioppo, 1986](#)) also helps to elucidate the way in which impulsive and prudent consumers process information. According to this approach, individuals who process messages effortlessly, quickly, and based on cues use a peripheral route that uses less cognitive control and has immediate effects on their attitudes and behaviors (impulsive consumers). In contrast, consumers who consider the quality of information as valuable and comprehensive develop a more deliberate and reasoned attitude and behavior (prudent consumers). Along this line, [Zheng et al. \(2019\)](#) suggest that prudent consumers focus on finding content which suits their purposes through thoughtful cognitive mechanisms, while impulsive purchasers process stimuli quickly and hedonically without a deliberative consideration of alternatives. These differences in motivations and goals may explain why people with different levels of impulsiveness process marketing information differently.

It could be argued, therefore, that the immediate reaction of impulsive consumers (who, by nature, are more sensitive to pleasure, seek rewarding goals, and exhibit a promotion orientation) to tempting stimuli (such as contexts favoring experiential or aesthetic pleasure) is a feeling of desire and pleasure much sharper than in any neutral or informative situation. In turn, when prudent consumers are exposed to a temptation (such as those experiential or aesthetic stimuli), they experience an avoidance situation aligned with their higher-order control goals and prevention motivations. Additionally, impulsive (vs. prudent) consumers would be likely insensitive to stimuli emphasizing security and protection. Several studies confirm this reasoning. [Sengupta and Zhou \(2007\)](#), for example, concluded that when impulsive (vs. prudent) eaters are exposed to hedonically tempting food (such as chocolate), their promotion focus activates strongly because of their disproportionate motives in terms of satisfying the craving for the sweetness. In the context of social commerce, [Chung et al. \(2017\)](#) showed that desirable attributes on websites, such as limited time and quantity of products (e.g., “1 min left”), greatly increased the urge and actual purchases among impulsive (vs. prudent) consumers. [Liao et al. \(2009\)](#) further indicated that “free gifts” and points that highlight novelty and fashion generated a stronger desire and reward in impulsive as compared to prudent consumers. In turn, prudent (vs. impulsive) purchasers were more likely to choose discount promotions as these strongly fulfilled their safety needs, such as a reduction in search and decision costs and monetary savings. More recently, [Zhang et al. \(2018\)](#) found that highly impulsive consumers focus more on the hedonic values of online reviews (i.e., they enjoy and feel a reward on reading online reviews), whereas prudent customers are more sensitive to the utilitarian value of reviews (i.e., they infer the quality of goods and optimize their outcomes). Along the same line, [Chopdar et al. \(2022\)](#) pointed out that more impulsive consumers develop a higher intention to install mobile shopping applications due to the higher enjoyment, speed, and gratification of using a new platform.

Consequently, these differences in motivational and goal systems between more and less impulsive consumers justify different information processing paths being embedded in advertising. In particular, the current research proposes that, due to the different nature of the descriptions in terms of “tempting” cues offered by hedonic vs. utilitarian banners, consumer impulsivity may play a key role in the neuropsychological processing of both ads.

## 2.2. Designing tempting ad attributes: hedonic and utilitarian banners

The literature on advertising persuasion, in general and banner effectiveness in particular, broadly confirms that the attributes with which the message is designed directly affect the user’s perception of the advertisement and product, and decisively influence their

attractiveness, interest, and willingness to buy the advertised product ([Tutaj and van Reijmersdal, 2012](#); [Molinillo et al., 2021](#)). The ease with which the Internet makes it possible to design static vs. pop-up vs. animated banners, and even locate them in different places within the website, has drawn the attention of persuasive advertising scholars, who are interested in evaluating the effects of these attributes on consumer reactions ([Abbasi et al., 2021](#); [Ketelaar et al., 2015](#)). Two of the advertising attributes that receive the most attention in the online ad persuasion literature are the appeals of hedonic and utilitarian ad. According to the dimensions specified by [Chiu et al. \(2014\)](#), **utilitarian banners** are those that include: (i) diverse views of a company’s product portfolio; (ii) detailed information about the functional benefits of the product (e.g., refund policy or device characteristics); (iii) data about the time and effort required to use the product (convenience); and/or (iv) information about offers. In turn, **hedonic banners** use a combination of attributes to vividly describe the feelings and pleasure of product consumption. More specifically, hedonic banners place emphasis on benefits such as: (i) images to accentuate the experience related to the purchase of the product; (ii) customized advantages of purchasing the product (e.g., photos inspiring relaxation and personal value); (iii) links with social networks that allow one to share with friends and relatives; (iv) the level of product innovation and novelty (e.g., recent technological advances); and (v) triggering the audience’s experience and emotions ([Chiu et al., 2014](#)). Consequently, hedonic banners constitute pleasure-focused ads that emphasize a “tempting” and sensory experience related to consumption or fun, whereas utilitarian banners are designed based on a cognitively motivated and goal-oriented consumption.

The online advertising literature has attempted to clarify, without consensus, which of these two appeals is more effective in attracting the user’s attention, and improving their recognition, recall, and intention to purchase the advertised product. Various scholars found that functional information typical of utilitarian banners may decrease uncertainty about the advertised product ([Abernethy and Franke, 1996](#)), which in turn facilitates consumers to make more informed, rational, and convincing purchases ([Khachatryan et al., 2018](#)). [Bilgihan and Bujisic \(2015\)](#), indeed, corroborate that utilitarian environments increase the customer’s qualitative commitment, which refers to the intention to maintain a relationship with the company, based on the costs and benefits associated with the purchase of the product. Conversely, building upon the limited capacity model of motivated mediated message processing [LC4MP] ([Lang, 2006](#)), other studies conclude that motivationally relevant, vivid, experiential, and arousing messages (i.e., close to hedonic ads) trigger a higher cognitive resource allocation, which enables their gain and maintenance of attention and memory, and increases purchase intention behavior more broadly ([Samson et al., 2020](#)). Other scholars confirmed that the effectiveness of hedonic or utilitarian banners could vary according to the type of product being advertised. Ads for typically hedonic products (e.g., cookies or hotel vacations) are more effective when presented with hedonic attributes, while utilitarian products (e.g., a calculator or an oven) increase purchase intention when accompanied with a utilitarian environment ([Motoki et al., 2019](#)). Other studies indicate that “in a product category that is neither clearly hedonic nor utilitarian, there are no significant differences in variety-seeking motivation when variation stems from sensory or functional attributes” ([Baltas et al., 2017](#)).

## 2.3. The current research: the role of consumer impulsiveness in the processing of hedonic vs. utilitarian banners

The current study is the first attempt to address the debate regarding the processing and persuasion of hedonic vs. utilitarian banners. We propose that: (i) because these two types of banners depict “temptation” contexts differently, i.e., hedonic banners elicit stronger vivid and pleasure-related cues than utilitarian ones; (ii) and because more impulsive consumers may experience a strong reward (and have little

self-control) towards environments that favor pleasurable and “tempting” experiences; we hypothesize that the level of consumer impulsiveness plays a key role in the processing of hedonic and utilitarian banners. Certain researchers have already taken the first steps in this direction and suggest that, when confronted with product descriptions (Moore and Lee, 2012) or images categorized as hedonic (Chung et al., 2017; Chopdar et al., 2022; Ramanathan and Menon, 2006), impulsive consumers show greater preference and may override their self-control goals and strengthen their desires and rewarding experiences. In turn, more prudent consumers may greatly prefer the functional and neutral contexts that characterize utilitarian environments because of their higher levels of reasoning and self-control. These investigations, however, found it difficult to explain the psychological mechanisms by which more cautious (impulsive) consumers show these preferences toward functional (hedonic) environments. They also assessed how consumer impulsiveness affects the evaluation of low-order hedonic/utilitarian items (such as a single product, a single sentence, or a single picture) but failed to explore whether such personalities trigger similar mechanisms in the processing of combinations of banner attributes (namely, higher-level mixture of elements) that together form more reality-based hedonic and utilitarian ad appeals. Remarkably, prior research was based on self-reports, which, unfortunately, cannot successfully capture the internal cognitive and low-order emotional processes of consumers in real time (Hubert et al., 2018). Consequently, data from these techniques cannot entirely explain the innermost processes underlying ad perception and online consumer behavior, leading to an incomplete understanding of the effects of consumer impulsiveness on banner processing.

With the aim of addressing the aforementioned research gaps, the current research makes headway in this regard and, for the first time, makes use of neuroimaging tools, which are more suitable for fully capturing the neuropsychological, introspective processes by which consumers evaluate marketing ads (Casado-Aranda and Sánchez-Fernández, 2022). Our research aligns with recent studies in the field of **consumer neuroscience**, which seek to identify the neuropsychological origins of consumer decision making using tools and knowledge from psychology, neurology, cognitive, and affective neuroscience. Unlike the measurements derived from traditional market research tools, such as focus groups, interviews, and questionnaires, neuroimaging methods allow one to capture processes that the participant may not be able to manipulate, facilitate exploring automatic reactions from the nervous system (such as level of skin perspiration, heart rate, and facial muscle activity) and revealing individual thoughts about sensitive information (such as political orientation or impulsive behavior), and allow for continuous measurement during (and not after) task exposure (Sánchez-Fernández and Casado-Aranda, 2021). In summary, consumer neuroscience provides additional, hidden insights into the origin of consumer decision making in general, and, in particular, the processes of banner exposure. The use of consumer neuroscience tools is even more crucial in online environments, in which decision-making processes tend to be more spontaneous, unaware and implicit than in other environments (Hubert et al., 2018).

We utilized functional Magnetic Resonance Imaging (fMRI) to assess the neural mechanisms by which consumer impulsiveness influences the processing of hedonic and utilitarian banners. Appendix 1 includes a detailed explanation of the definition and functioning of fMRI. We expected that the more affective, self-relevant, and rich media attributes of hedonic (vs. utilitarian) messages undermine self-control of more impulsive (vs. prudent) shoppers. This strengthens their experience of rewards and feelings of pleasure, and thus leads to a stronger involvement of brain regions linked to increased value and reward. Specifically, prior neuroimaging studies related the caudate nuclei and striatal areas (such as the postcentral gyrus and insula) with the anticipation of affective and rewarding stimuli (Bartra et al., 2013; Hubert et al., 2018). In turn, it would be logical to expect lower levels of activation in brain regions associated with reasoning and cognition-based decision making,

such as the dorsolateral prefrontal cortex (dlPFC). Thus, the first question empirically investigated in this research was:

**RQ1:** Do more impulsive consumers exhibit more activity in the reward- and value-related brain areas (namely, caudate nuclei, postcentral gyrus and insula) and less activity in the self-control centers (namely, dorsolateral prefrontal cortex) when viewing hedonic banners?

In turn, the higher levels of self-control of less impulsive users may lead them to a more focused, deliberate, and cognitive evaluation of the detailed and factual information of utilitarian (vs. hedonic) banners. They may even experience lower levels of activation in reward-associated brain areas during the evaluation of utilitarian banners. Consequently, they may exhibit more activity in brain areas linked to cognition-based decision making, such as the dorsolateral prefrontal cortex (dlPFC) or anterior cingulate cortex (Chen et al., 2007), and lower levels of activation in areas such as the postcentral gyrus and the insula. Against this background, the second research question that we address was:

**RQ2:** Do more prudent consumers exhibit more activity in the cognition-based brain areas (namely, dlPFC or anterior cingulate) and less activity in the reward-related brain areas (namely, caudate nuclei, postcentral gyrus, and insula) when viewing utilitarian vs. hedonic banners?

### 3. Materials and methods

#### 3.1. Participants and experimental design

Through the institutional website of the University of Granada, we recruited 12 right-handed men (average age = 23.20, SD = 4.30) and 15 right-handed women (average age = 25.10, SD = 5.80), who completed a screening questionnaire and the consent forms approved by the Ethics Committee of such University. In social neuroscience experiments, the use of right-handed participants is common, as the differences with left-handed individuals can cause noise in the final results. While the left hemisphere controls right-handedness, the right hemisphere controls dominant **left-handedness**. Furthermore, the left hemisphere is specialized for language and logic, whereas the right hemisphere specialization is associated with intuition and creativity (Corballis, 2021). Therefore, with the aim of avoiding any confounding factor (e.g., handedness) that affects the evaluation of banners, we used right-handed participants. It is worth noting that in social neuroscience research, samples sizes from 20 to 40 participants are fairly common. Therefore, the objective nature and high spatial resolution of fMRI (Casado-Aranda et al., 2021; 2022; Solnais et al., 2013), coupled with the a priori Region of Interest approach and the use of multiple trials in the current study (i.e., repetitions of conditions within participants), justify our sample of 27 participants and guarantee the significance of the observations throughout the whole sample. All participants reported an average of 19 years of educational experience (SD = 2.1) and an annual income of less than 14000 €. Only subjects with a high frequency of online shopping in the last 6 months (88% of them) were selected. Furthermore, all participants stated an average online proficiency level of 5.52 (SD: 1.12) on a 7-point Likert scale (anchored at 1 = low expertise to 7 = high expertise).

The experimental task consisted of exposing these 27 participants to static hedonic and utilitarian banners. All banners advertised headphones, a product category used in previous neuroimaging research (Casado-Aranda et al., 2018a), which represents one of the most sold categories online in the country of study, Spain. We confirmed that all participants expressed a medium-high interest in purchasing headphones. An independent sample (n = 60) served to corroborate the hedonic or utilitarian nature of headphones and classify 100 initial banners into hedonic and utilitarian categories. Since the type of advertised

product may affect banner evaluation, we used Motoki's scale (Motoki et al., 2019) to assess the hedonic and utilitarian nature of the product and confirmed that headphones cannot be classified as a predominantly hedonic (mean hedonic = 5.45, SD = 0.93) or utilitarian product (mean utilitarian 5.79, SD = 0.53) ( $p = .123$ ). Thereafter, the authors followed the guidelines specified by Chiu et al. (2014) for the design of 100 initial hedonic and utilitarian banners. More specifically, utilitarian banners included: (i) views of the advertised headphone; (ii) product characteristics (e.g., cable length or battery hours); (iii) convenience (e.g., shipping information); and (iv) savings. Conversely, hedonic ads contained elements of: (i) experience (images of athletes wearing headphone or the text, e.g., "Enjoy the music"); (ii) gratification (e.g., pictures reflecting relief or highlighting the individual value, e.g., "Headphones 100% adapted to you"); (iii) links to social networks; and (iv) headphone innovation. Apart from these differences, all of the on-line ads incorporated identical characteristics based on the banner attributes indicated by Hussain et al. (2010), i.e., they were all static with the same size, the same spatial position on the screen, and the same font type, size, and line spacing; they all included both colorless and colorful images within the banner as well as text; and they all incorporated a box with the bottom (saying "buy") with the same fictitious brand name ("Tecnobuy"). The 60 participants of the independent sample classified these 100 ads into utilitarian and hedonic by means of a 7-point Likert scale, ranging from 1 (informative, convenient, and utilitarian banner, i.e., utilitarian ads) and 7 (visually attractive, joy-focused, interactive, and hedonic banner, i.e., hedonic ads). We categorized those banners that received less than 3 points as utilitarian and those that received higher than 5 points as hedonic. A paired-samples  $t$ -test showed significant differences ( $p < .001$ ) between the 30 slides finally selected as hedonic and the 30 selected utilitarian banners. Fig. 1 illustrates hedonic and utilitarian banners.

### 3.2. Procedure

Once we had corroborated that all 27 subjects met fMRI standards (no metal in the body, claustrophobia, or pregnancy), they were introduced into a fMRI scanner and told to look at 30 static hedonic and 30 static utilitarian banners. Each set of banners started with a baseline period (i.e., cross exposed for 1–3 s), followed by a randomly selected hedonic or utilitarian banner (8 s). For orthogonal objectives unrelated to the current study, participants then had to reimagine the banners displayed during a retrieval phase (6 s). The total task time was 24 min, and stimuli were designed with the E-Prime Professional 2.0 software. For the assessment of individual levels of impulsiveness, participants completed the Prudence Subscale of the Consumer-Impulsiveness Scale (Hubert et al., 2018) after the scanner, in which they indicated the

extent to which the adjectives *self-controlled*, *farsighted*, *responsible*, *restrained*, *rational*, *methodical*, and *planner* described them, in a 7-Likert scale (1 = Does not describe me at all, and 7 = Describes me a lot).

### 3.3. Image acquisition and analysis

We introduced participants into a 3T Trio Siemens Scanner equipped with a 64-channel head coil. Functional images were acquired by a T2\*-weighted echoplanar imaging sequence (TR = 2000 ms, TE = 25 ms, FA = 90°, thickness = 3.5 mm; slices = 35, slice order = descending). A distance factor of 20% resulted in a total of 790 slices with a FoV of 238 mm.

Neuroimaging data were analyzed using standard software (SPM12, Wellcome Department of Cognitive Neurology, London, UK, <https://www.fl.ion.ucl.ac.uk/spm/software/spm12/>) run on MATLAB R2012a. Default settings were applied in SPM. After inspecting the functional images for artefacts, these were realigned to correct for motion, co-registered, segmented, normalized into standard stereotactic space, and smoothed (FWHM = 7 mm). We then estimated a general linear model (GLM) for each participant with the following regressors: (i) an onset picture in the hedonic banners (HED) and (ii) an onset picture in utilitarian banners (UTI). To identify the brain regions in which hedonic and utilitarian banner activation varied between individuals with different impulsiveness levels, the images of HED and UTI were entered into a one-sample  $t$ -test in the second level random effect analyses. For the fMRI analysis, we followed a theoretically-driven Region of Interest (ROI) approach using small volume correction (SVC) as implemented in SPM at an FWE-corrected threshold of  $p < .05$ . Specifically, we applied 10 mm spheres around the anatomical coordinates reported in prior research to evaluate the processing of reward and cognition/self-control. We took the brain results stated by Hubert and colleagues in a recent study as a reference (Hubert et al., 2018) with which to evaluate how impulsiveness affects the neural evolution of trustworthy online environments. We further performed a whole-brain exploration for the main contrasts of interest using a threshold of 20 contiguous voxels at an uncorrected  $p$  value of .001 (FWE = 0.05). Then, we made use of Marsbar to extract parameter estimates (10 mm radius spheres) from the significant set of ROIs from the SVC analysis in the contrasts related to the hedonic and utilitarian banners and correlated them with the impulsivity levels of each participant. The aim was to explore whether the expected brain areas associated with reward, value, and reasoning correlated significantly with consumer impulsiveness levels during the evaluation of hedonic and utilitarian banners.

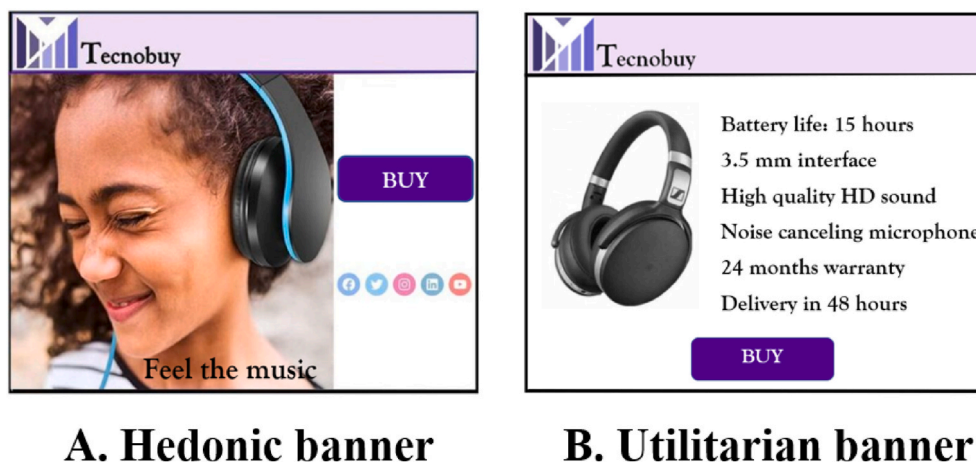


Fig. 1. Examples of (A) hedonic and (B) utilitarian banners.

#### 4. Results

After averaging the scores of each participant to the adjectives included in the Subscale of the Consumer-Impulsiveness Scale (Hubert et al., 2018) (Cronbach's alpha = 0.85), the results suggest a high variability in the sample, with an average medium-high level of participant caution of 5.06 and a standard deviation of 2.15.

As regards the neural findings, activation in the ROIs caudate nuclei (involved in reward-related processing), and the insula and postcentral gyri (both responsible for emotion and affect-processing), covaried positively and significantly with consumer impulsiveness levels during the evaluation of hedonic banners ( $r_{\text{caudate nuclei}} = 0.46$ ;  $p = .015$ ;  $r_{\text{insula}} = 0.44$ ;  $p = .02$ ;  $r_{\text{postcentral}} = .55$ ;  $p = .003$ ). The whole-brain results corroborated these findings. In other words, more impulsive participants experienced stronger reward- and emotion-related brain activity when viewing the hedonic banners. Furthermore, the dorsolateral prefrontal cortex (linked to cognition and self-control) was associated negatively and significantly with consumer impulsiveness levels when participants were exposed to hedonic banners, i.e., the more impulsive participants were, the fewer self-control activations were observed while processing hedonic banners ( $r_{\text{dlPFC}} = -0.627$ ;  $p < .001$ ).

The visualization of utilitarian banners provoked less activity in the dlPFC (a brain area responsible for cognitive control) in more impulsive viewers ( $r_{\text{dlPFC}} = -0.63$ ;  $p < .001$ ). However, none of the brain areas related to reward and emotion correlated significantly with impulsiveness levels during the evaluation of utilitarian banners:  $r_{\text{caudate nuclei}} = 0.09$ ,  $p = .64$ ;  $r_{\text{insula}} = -0.16$ ;  $p = .42$ ;  $r_{\text{postcentral}} = -0.11$ ;  $p = .58$ ). Put differently, more impulsive individuals experienced greater self-control when viewing utilitarian banners, although higher levels of impulsivity did not trigger significantly fewer activations in reward-related brain areas.

In summary, the participants with higher impulsiveness levels exhibited a significantly higher amount of activation in brain areas related to reward and emotion while evaluating hedonic (though not utilitarian) banners. In turn, these impulsive users exhibited fewer neural self-control and rational-related processes when viewing both utilitarian and hedonic banners (see Figs. 2 and 3 and Table 1).

#### 5. Discussion

The increase in users who use digital devices to shop online has

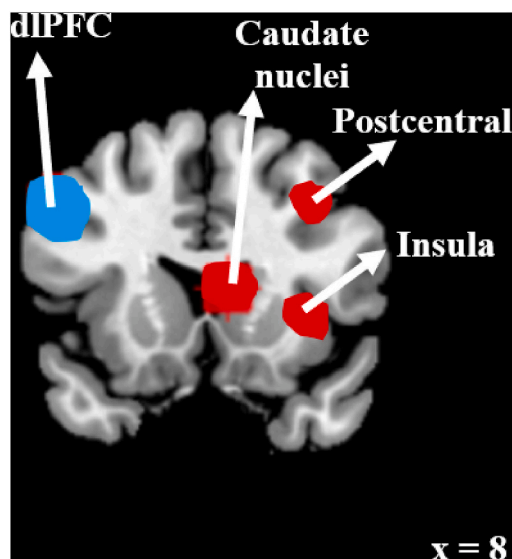


Fig. 2. The main regions of interest related to reward and emotion (red: caudate nuclei, postcentral, and insula) and self-control and cognition (blue: dorsolateral prefrontal cortex (dlPFC)).

encouraged companies to compete to design the most efficient online ads for their target audience. While some companies build their ads based on the functional and instrumental benefits of their advertised products (i.e., utilitarian banners), others emphasize the experiential, personal, and emotional advantages of purchasing their product (i.e., hedonic banners). This is the first study to use neuroimaging to address the debate in the literature concerning the processing and effectiveness of these types of messages. We contend that because these two banners depict different “temptation” contexts and because more impulsive consumers experience a strong reward (and little self-control) towards environments that favor “tempting” experiences, the level of consumer impulsiveness likely modulates the processing of these two ad appeals, so that the effectiveness of each typology may depend on the user's level of impulsivity. Our neural results confirm such reasoning and reveal that more impulsive consumers exhibit stronger activation in brain regions linked to reward, trust, emotion, and self-control while viewing hedonic banners. When exposed to utilitarian banners, more impulsive consumers do not exhibit activity in reward-related brain areas, but show lower levels of activation in brain regions associated with self-control and cognition.

In particular, users with higher levels of impulsiveness exhibited stronger activation in several brain regions when exposed to hedonic banners, including the caudate nuclei, insula, bilateral postcentral gyri, and dlPFC, which confirmed RQ1. Traditional neuroimaging studies largely relate the caudate nuclei with the evaluation of rewarding (high calorie) food (Siep et al., 2009), reward expectation (Haruno and Kawato, 2006), and the subjective reward value of visual sexual images (Klein et al., 2020). The insula and postcentral brain areas, in turn, are traditionally associated with visual emotional processing (Casado-Aranda et al., 2019), positive personal value (Bartra et al., 2013), and even prospective behavior changes (Imhof et al., 2017). Interestingly, the peak levels of these three brain areas used in the current study were reported by Hubert and colleagues (Hubert et al., 2018), who, for first time, found that more impulsive users exhibited activity in these neural networks to a greater extent when processing more trustworthy online environments. Hedonic banners also activated the dlPFC, a brain area largely responsible for the deliberate and rational processing of ads (Couwenberg et al., 2017), reflective decision making (Hare et al., 2011), and cognitive control (Hubert et al., 2018). Indeed, the study by Hubert et al. (2018) found that more impulsive participants exhibited activity in the dlPFC coordinates, similar to those from the present study, when evaluating less reliable purchase environments. Therefore, these results suggest that more impulsive users experience greater neural reward, trust, affection, and less neural self-control while evaluating banners that vividly emphasize the experiential and pleasure of product consumption.

In summary, our first findings align with those from previous studies that concluded that due to higher pleasure-related, reward-related, and undeliberate goals, environments that favor these motivations facilitate reward processing in more impulsive shoppers. For example, Ramanathan and Menon (2006) showed that when exposed to sweet products (such as cookies) or cash, impulsive people first experience a conflict, but this is quickly resolved (faster than in the case of prudent individuals) by increasing desire and reducing their self-control towards the temptation. Similarly, Sengupta and Zhou (2007), Chung et al. (2017), and Zhang et al. (2018) concluded that impulsive (vs. prudent) consumers experience greater urgency and disproportionate motives for enjoying and satisfying their reward needs when encountering hedonic food, promotions, and hedonic online reviews. The aforementioned authors, nevertheless, did not strictly pretest and control the manipulation of hedonic and utilitarian elements, nor the presence of different colors or words, which could greatly affect the individual processing and act as confounding factors (Sharma, 2021). They also evaluated whether the presentation of items such as products or reviews affected the preferences and choices of impulsive and prudent consumers, thus ignoring the psychological mechanisms that determine such

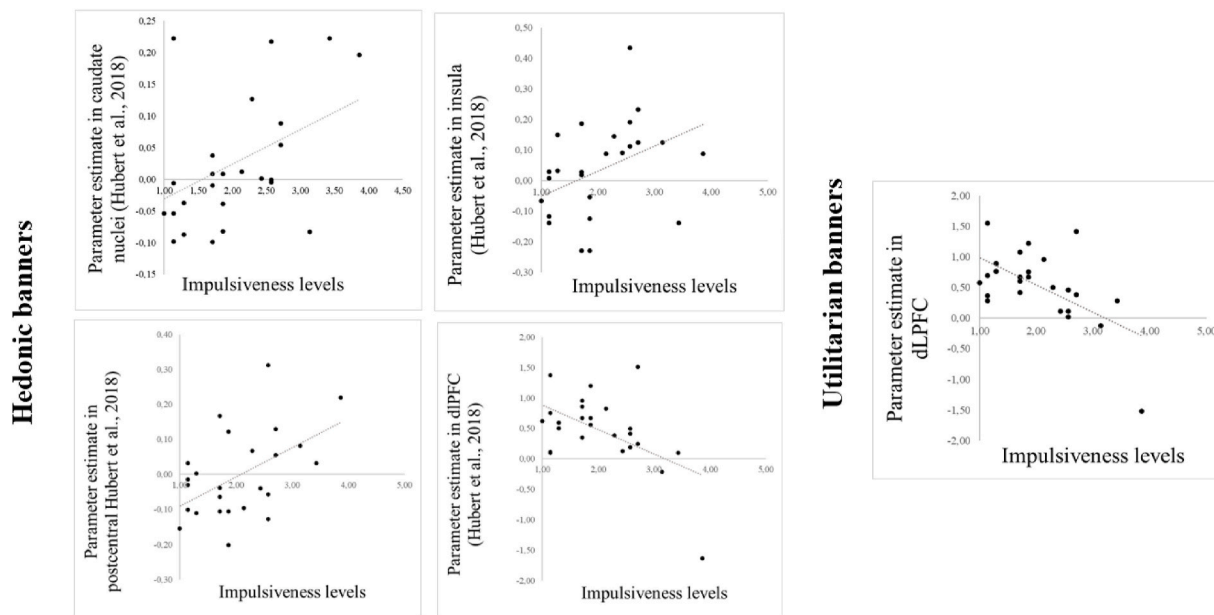


Fig. 3. Plots illustrating a positive significant correlation between parameter estimates of the ROIs postcentral, caudate nuclei, insula (associated with reward and emotion), and impulsiveness levels, and a negative covariation between the dlPFC (related to self-control) and impulsiveness levels while visualizing hedonic and utilitarian banners.

Table 1

Brain regions which were activated while viewing hedonic and utilitarian banner ads covaried with levels of impulsiveness.

| Brain regions                               | Coordinates MNI (mm) x y z |     | k <sup>a</sup> | T  | Z    | Effect size <sup>b</sup> |      |
|---|----------------------------|-----|----------------|----|------|--------------------------|------|
| <b>Evaluation of hedonic banner ads</b>     |                            |     |                |    |      |                          |      |
| <i>Region of Interest (SVC)</i>             |                            |     |                |    |      |                          |      |
| Caudate nuclei                              | 8                          | 16  | 10             | 4  | 3.58 | 3.18                     | 0.61 |
| Insula                                      | 44                         | -20 | 12             | 7  | 3.97 | 3.47                     | 0.67 |
| Postcentral                                 | 54                         | -14 | 39             | 2  | 3.46 | 3.27                     | 0.63 |
| Dorsolateral prefrontal cortex              | 41                         | -35 | 46             | 26 | 6.47 | 4.95                     | 0.95 |
| <i>Whole-brain results</i>                  |                            |     |                |    |      |                          |      |
| Postcentral                                 | 43                         | -14 | 35             | 20 | 4.40 | 3.75                     | 0.72 |
| Postcentral                                 | -55                        | -14 | 18             | 3  | 3.90 | 3.41                     | 0.66 |
| <b>Evaluation of utilitarian banner ads</b> |                            |     |                |    |      |                          |      |
| <i>Region of Interest (SVC)</i>             |                            |     |                |    |      |                          |      |
| -   |                            |     |                |    |      |                          |      |
| <i>Whole-brain results</i>                  |                            |     |                |    |      |                          |      |
| Dorsolateral prefrontal cortex              | -52                        | 14  | 39             | 28 | 4.88 | 4.25                     | 0.82 |

<sup>a</sup> Spatial extent of the cluster in voxels.

<sup>b</sup> Effect size = Z-score/ $\sqrt{N}$ .

preferences. The current research makes headway in this regard, as it explores the neural mechanisms underlying the processing of manipulated combinations of banner attributes (not just a single item, a single product, a single sentence, or a single picture, but a higher-level mixture of communication elements) that together form more reality-based hedonic and utilitarian ad appeals. In addition, the current research is the first to use a combination of self-reported and neural data derived from online ad evaluations to explore the psychological mechanisms underlying consumer impulsiveness. These results also demonstrate that attractive interactive graphics and fantastical product descriptions (closer to our hedonic ads) may undermine accurate and timely self-observation in more impulsive shoppers as a result of deficient self-regulation, a state in which conscious self-control diminishes (LaRose and Eastin, 2002).

Interestingly, our neural findings indicate that the strong neural reward triggered in impulsive shoppers by hedonic banners is accompanied by neural mechanisms involved in trust and emotion. This is key because previous studies showed that the involvement of reward- and trust-related brain areas can constitute an antecedent of approach behavior (e.g., preference or choice for a product) (Casado-Aranda et al., 2021; Yun et al., 2021). For example, the nucleus accumbens (a typical area associated with reward and trust) was found to be predictive of market-level performance of music sales (Berns and Moore, 2012) and success of public health campaigns (Doré et al., 2020). Accordingly, our results extend traditional psychological models of goal systems (Kruglanski, 1996) and individual motivation (Higgins and Zanna, 1998) by emphasizing the role of trust and emotion during goal establishment on the part of impulsive consumers. Particularly, the results suggest that the promotion focus of impulsive consumers not only implies a greater emphasis on positive and rewarding outcomes but, importantly, the attainment of and search for trustworthy environments and objects. This reasoning, indeed, would corroborate the crucial role of trust and emotion in engaging in impulsive behavior (Chen and Ku, 2021). These neural findings contrast with those of Ramanathan and Menon (2006), which confirmed that more cautious consumers, when exposed to “tempting” environments (such as hedonic banners), initially experienced rewards that were later eliminated by their higher self-control goals. Contrary to those results, our study suggests that more cautious consumers do not experience an increase in reward and emotion in more hedonic environments, but a direct suppression of these mechanisms.

Following a similar line, more impulsive participants exhibited significantly less activation in the dlPFC when evaluating utilitarian banners. Moreover, no increases in the reward-associated brain areas were found to correlate with impulsiveness levels, thus giving partial support to RQ2. Consequently, it seems that, similar to the evaluation of hedonic environments, banners informing about the factual and instrumental benefits associated with the advertised product elicited greater rational and reflective processing among prudent shoppers. These results extend prior research in that the effortful, deliberate, and highly cognitive states elicited by utilitarian banners in general (Park et al., 2012) are even stronger among prudent users (which have stronger self-control goals, preventive focus, and fewer pleasure motivations) and lead them to engage in deeper-level processing and to

experience higher qualitative commitment with the company (Bilgihan and Bujisic, 2015). Furthermore, our findings confirm that cautious consumers are not only more sensitive to utilitarian products (Liao et al., 2009) or overvalue quality as specified in utilitarian online reviews (Zhang et al., 2018), but that this higher sensitivity, as indexed in our study in the increased activity in brain areas related to cognitive control and deliberate reasoning, is also present in higher order utilitarian contexts such as banners (where images, text, and products are combined). The absence of increased activation in regions involved in reward in the most impulsive users during the viewing of utilitarian banners could be due to the lack of pleasure and promotion goals triggered by these types of banners. Therefore, in accordance with the individual motivation theory (Higgins and Zanna, 1998), more impulsive consumers are characterized by a constant self-control state and a promotion focus, which is mainly activated in hedonically tempting contexts that aim to destabilize motives in terms of satisfying cravings.

Theoretically, our results provide insights into the debate in the online ad literature regarding the effectiveness of hedonic and utilitarian banners. Moreover, it elucidates, for the first time, the neural introspective mechanisms by which a consumer individual trait, namely, consumer impulsiveness, influences the differing evaluations of these two banner typologies. Prior research evaluated how impulsive tendencies affect purchase intentions in mobile text advertising (Drossos et al., 2014), intentions to install mobile shopping apps (Chopdar et al., 2022), trust in online environments (Hubert et al., 2018), and consumer social posting (J. V. Chen et al., 2016). Unlike previous studies, our research makes use of neuroscience to explain the neural mechanisms by which consumer impulsiveness affects the processing of hedonic and utilitarian banners. Previous scholars in the field of consumer neuroscience only analyzed neural differences in the processing of functional and experiential physical ads (Couwenberg et al., 2017), divergences in the perception of online purchase risks (Casado-Aranda et al., 2018b), and the use of brain regions to predict behavioral changes after advertising (Manippa et al., 2017). Using neuroimaging, our findings go some way to explaining how the impulsiveness trait affects the evaluation of communication banners. Furthermore, our findings demonstrate that the pleasure-seeking goals of more impulsive consumers lead them to exhibit not only stronger reward-related mechanisms (as suggested by goal systems theory, Kruglanski et al., 2002), but also greater reactions that are associated with trust and visual emotion, and thus extend traditional models of goal systems and individual motivation. These findings could be key as previous studies suggest that greater visual emotions are crucial predictors of purchase intentions and behaviors towards the advertised product. Therefore, the mechanisms that we found in more impulsive buyers could be a vital factor in their purchases.

Our findings may also have key implications for retailers who wish to design effective online advertising campaigns. First, the results reveal that banners that vividly emphasize the affective experience and emotional benefits of buying the product generate greater psychological reward, emotion, and trust in the most impulsive consumers. Prior studies in the field of retailing and consumer services stated that there are specific purchase circumstances and product categories in which consumers implicitly increase their impulsive tendencies. For example, individuals who are highly involved with a product or brand increase their knowledge about it and are more likely to experience strong emotions in response to this product, which, in turn, may facilitate more impulsive behavior (Jones et al., 2003). Furthermore, consumer decision making tends to be more irrational in highly affective and complex shopping environments such as super- and hyper-markets and in contexts with sweet foods (such as grocery shopping) (Steils, 2021). Consequently, firms that identify a type of customer involved with their product or brand (e.g., loyal customers), and retailers that provide a complex and affective shopping process (e.g., supermarkets), should include hedonic attributes in their ads and design direct marketing strategies directed at this type of consumer, as their psychological emotional reward, trust, value, and willingness to purchase and share

the banner (Casado-Aranda et al., 2018b) may increase. In turn, companies should make use of utilitarian content (e.g., detailed information about the product and its convenience) in direct marketing strategies targeted at audiences with little involvement with their brand (e.g., sporadic users), as they will strongly increase deliberative and thoughtful processing among the target, allow them make a more informed decision, and ultimately trigger a higher cumulative attachment and a potential purchase. Furthermore, given the key role of trust in the focus and evaluation of hedonic stimuli in more impulsive consumers, it is advisable to direct efforts towards the inclusion of more trustworthy elements on the banner or website, such as seals of approval, privacy policies, and ratings from previous clients (Casado-Aranda et al., 2019), as these may facilitate an approach behavior and positive intentions towards the advertised product among this type of consumer. Finally, the study by Sengupta and Zhou (2007) reported that inducing a prevention focus (e.g., emphasizing negative consequences or security factors) while impulsive consumers make decisions helped decrease their tendency to select hedonic over healthy snacks. Considering such conclusions, and given the relevance of trust in the promotion goals of impulsive consumers, elements that foster mistrust or risk should be included in online ads when impulsive purchase behavior needs to be corrected (for example, in banners inserted in online gambling).

The current study provides insights into the different neural mechanisms underlying the evaluation of banners in impulsive and prudent consumers; however, it contains several limitations. **First**, given the methodological requirements and types of purchases analyzed in this research (i.e., online consumption), we recruited participants with specific characteristics in terms of age (young consumers), a gender-equal sample, level of Internet expertise (medium–high), and an absence of marked prudent buying tendencies, which may reduce the generalizability of the results. Therefore, future research should corroborate our findings in older consumers with marked impulsive/prudent purchase tendencies in different consumption environments (e.g., offline purchases) and even with gender differences. **Second**, our research focused on analyzing different mechanisms by which impulsiveness tendencies affect the evaluation of banners but did not test how such neural processing affects consumer attitudes, intentions, or behavior toward the advertised product. These exploratory brain mapping results constitute an underexplored, novel contribution to the current knowledge in the field of consumer neuroscience (e.g., Casado-Aranda et al., 2020; Charbonnier et al., 2015; Riedl et al., 2010); however, further studies are required to analyze links between neural reactions and consumer behavioral responses. For example, future research in the fields of retail and consumer services should go a step further and evaluate the extent to which neural responses to utilitarian and hedonic banners predict future behavior (click-through rate). **Third**, scholars should corroborate the results of this study using typically hedonic (such as chocolate or movie tickets) and utilitarian (such as microwaves or knives) products. **Furthermore**, because of the nature of hedonic environments (namely experiential, personal, and vivid), this type of banner only included images of individuals, which may have introduced some bias; however, we designed the banners as close to real online ads as possible by controlling the experimental design as much as possible (namely color, size, location, images, words, and elements typical to hedonic and utilitarian contexts). The potential fatigue of the participants after 24 min of experimentation could have also caused some bias. It is worth noting that future research is in a good position to develop a between-subject design experiment (i.e., creating two groups: a highly impulsive and a highly prudent one) to more clearly understand the differences between them when it comes to processing hedonic and utilitarian banners. **Finally**, research in the field of online consumer behavior could confirm the findings of this study using additional consumer neuroscience techniques, such as eye-tracking, skin conductance, and electroencephalography, as these tools can provide insights into the attention, emotional intensity, and engagement experienced by



impulsive and prudent consumers while evaluating different typologies of banners.

#### Author disclosure statement

No competing financial interests exist.

#### Appendix 1

Functional Magnetic Resonance Imaging (fMRI) is a non-invasive scanning tool that detects changes in the level of blood oxygenation in the brain (namely, the fMRI's BOLD signal) derived from metabolic fluctuations in blood flow produced by neural activation. fMRI researchers usually compare levels of activity resulting from different tasks within a region of interest. For example, the current research is interested in the activation within reward-, value- and cognition-based brain areas while participants are exposed to hedonic and utilitarian ads. As specific regions of interest are linked to particular mental functions (for example, the postcentral gyrus and insula are largely associated with reward, see Weber et al., 2015), the method is able to visually locate the neural origin of activations triggered by information by means MR brain images (Casado-Aranda et al., 2020). The fMRI technique is therefore an excellent means to assess specific brain areas in high resolution (1 mm<sup>3</sup>) with an acceptable temporal resolution (1–3 s). The main drawbacks are its high cost (the price for each participant is approximately 400€) and the difficulty in recruiting enough participants as they require decent incentives.



Fig. A1. Image of Functional Magnetic Resonance Imaging (fMRI) scanner.

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