

**The processing of price during purchase decision making: Are there neural differences
among prosocial and non-prosocial consumers?**

Author 1 (corresponding author)

Name: Carlos Alberto Guerrero Medina^{ab}

Affiliation addresses: Campus Cartuja, s/n 18071 Granada, Spain

E-mail: cguerrero@correo.ugr.es

Author 2

Name: Myriam Martinez-Fiestas^a

Affiliation addresses: Campus Cartuja, s/n 18071 Granada, Spain

E-mail: mmfiestas@ugr.es

Author 3

Name: María I. Viedma-del-Jesús^a

Affiliation addresses: Campus Cartuja, s/n 18071 Granada, Spain

E-mail: iviedma@ugr.es

Author 4

Name: Luis Alberto Casado Aranda^a

Affiliation addresses: Campus Cartuja, s/n 18071 Granada, Spain

E-mail: lcasado@ugr.es

a. University of Granada, b. ESAN University

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Abstract

International organizations, governments and companies are increasingly committed to developing measures that encourage adoption of sustainable consumption patterns among the population. However, their success requires a deep understanding of the everyday purchasing decision process and the elements that shape it. Price is an element that stands out. Prior research concluded that the influence of price on purchase decisions varies across consumer profiles. Yet no consumer behavior study to date has assessed the differences of price processing among consumers adopting sustainable habits (prosocial) as opposed to those who have not (non-prosocial). This is the first study to resort to neuroimaging tools to explore the underlying neural mechanisms that reveal the effect of price on prosocial and non-prosocial consumers. Self-reported findings indicate that prosocial consumers place greater value on collective costs and benefits while non-prosocial consumers place a greater weight on price. The neural data gleaned from this analysis offers certain explanations as to the origin of the differences. Non-prosocial (vs. prosocial) consumers, in fact, exhibit a greater activation in brain areas involved with reward, valuation and choice when evaluating price information. These findings could steer managers to improve market segmentation and assist institutions in their design of campaigns fostering environmentally sustainable behaviors.

Keywords: consumer neuroscience; prosocial consumers; non-prosocial consumers; price; sustainable purchase behavior; purchase decision-making.

1. Introduction

Purchasing and consumption patterns prevailing today are a concern due to their negative impact on the planet's social and environmental well-being (Foteinis 2020; Niva 2019). They account for a yearly waste of 1.3 billion tons of food while almost 2 billion people suffer from hunger or malnutrition. Moreover, four fifths of global energy consumption are from non-renewable sources, two billion people are overweight or obese, and drinking water is consumed more quickly than it takes for nature to replenish it (United Nations [UN] n.d.).

International organizations (e.g., Organization for Economic Co-operation and Development [OECD], Organization of American States [OAS], UN) have warned of the need to shift toward a more efficient consumption of resources in order to guarantee social and environmental sustainability (Lim 2017, 2016; Liu et al. 2016). Furthermore, these organizations encourage the participation of various actors (e.g., companies, governments, non-governmental organizations) to develop measures that contribute to this change (UN 2015; OECD 2016). However, the rate of success of these measures depends on a deep understanding of how individuals carry out their daily purchasing decisions and what are the elements that make up these decisions (Yu et al. 2019; Wen et al. 2018). Among these elements, the price stands out (Xing et al. 2010; Van Doorn and Verhoef 2015).

Price is a key variable in purchase decision-making. Economic reports and news indicate that the increase of a product's price can discourage consumption and promote the purchase of substitutes (Maté 2017; Cheng 2019). The subject of price is gaining importance in academic circles and the number of studies addressing this variable from the perspective of marketing has soared in the last two decades¹. Much of this research reveals the implication of price in the purchase decision-making (Konuk 2018). In this regard, price generates expectations as to quality and performance (Golder et al. 2012; De Langhe et al. 2014) and influences brand image and perceived value (Calabuig et al. 2014; Graciola et al. 2018). It also allows comparing different products based on monetary value and perceived value (Papatheodorou et al. 2012). These studies also point out that the influence of price on decision making can vary between different consumer profiles (Umashankar et al. 2017).

Given the importance of this variable for purchase decision-making, it is necessary to delve deeper into the understanding of how price is processed by each type of consumer. There is in fact little literature enquiring into how price is processed by consumers that have adopted sustainable habits (prosocial) compared to those that have not (non-prosocial). This comparative analysis is therefore relevant given that prosocial (vs. non-prosocial) consumers reveal a favorable (vs. unfavorable) impact on environmental and social sustainability. Furthermore, although the prosocial segment remains small, it is in constant expansion (Euromonitor 2017a, 2017b; Ethical consumer 2019).

Worth highlighting is that research delving into consumer decision-making processes acknowledge the vital role of automatic and implicit mechanisms (e.g., Venkatraman et al. 2015). These mechanisms are difficult to identify and measure by conventional methods such as self-reports. Due to this, several researchers have begun to apply neuroimaging methods (e.g., functional magnetic resonance imaging [fMRI], Electroencephalography [EEG]) to gain insight into how consumers come to decisions. These methods explore neural activations provoked by specific marketing cues such as price. This has ushered in a new field referred to as neuromarketing (Hubert 2010).

¹ The Web of Science reports that the number of annual articles in the business and administration categories that include the terms price and marketing in the subject rose from 151 in 2000 to 964 in 2018.

Following this line of thought, this study applied a neuroscientific tool (fMRI) to compare the neural processes of prosocial and non-prosocial consumers while evaluating the price of everyday products. Delving into the neural processes triggered by price information between these two types of consumers is essential to identify the cognitive and motivational asymmetries involved in the purchase-making decision process. The findings of this study offer companies, governmental and non-governmental organizations information that can serve them to formulate strategies that promote, or at least not halt, sustainable consumption.

2. Theory

2.1. Information processing when making purchase decisions

The Theory of Social Exchange (Homans 1958; Cropanzano and Mitchell 2005) suggests that information provided by companies is processed by consumers through an exchange scheme. This is due to the fact that consumers and companies interact through resource exchange relationships (cognitives, emotional, socials, economics, physicals) in order to obtain rewards (Bagozzi 1975; Lusch and Watts 2018). The Equity Theory (Adams 1963, 1965), along these lines, offers indications on how information is processed by the consumer through the exchange scheme.

The Equity Theory proposes that the parties (e.g., consumers and companies) will consider exchanges to be equitable when their contributions and returns are perceived to be proportional (Adams 1963; Bechwati et al. 2009). Equity perception promotes the continuity of exchange relationships. In the event that one of the parties does not perceive equity, it will be motivated to promote it (e.g., increasing or decreasing the contributions or the returns) or desist from carrying out the exchange (Adams 1963; Huppertz et al. 1978). Equity perception is based on the relevance afforded by each party to the resources that are exchanged. The degree of relevance is determined by each cultural and personal configuration (Adams 1963, 1965).

Several authors, based on this theory, have delved deeper into the responses of consumers to situations of equity/inequity. Ha and Park (2013), for example, propose that perceived equity between benefits (utilitarian and hedonic) and costs (monetary and non-monetary) influence consumer satisfaction and loyalty. Malc et al. (2016) conclude that the inequity perceived in an exchange can generate self-protective behavior (complaining) or revenge (negative WOM). Konuk (2018) suggests that the perception of a fair price, an expression of equity, influences satisfaction, confidence and purchase intention. Blanchard et al. (2018) conclude that sale strategies that increase perceived equity of an exchange raise the probability of purchase. Finally, Casaló and Romero (2019) identify that equity perception can generate recommendations, positive WOM and interaction in social networks.

2.2. Information processing and the role of price

According to the notions advanced in the previous section, the Equity Theory suggests that consumers process information from companies by means of a cost (contribution) - benefit (return) analysis with a view on whether the potential exchange will be fair/equitable (Ha and Park 2013; Casaló and Romero 2019). As this analysis is subjective, it varies for each individual according to their cultural and personal characteristics (Adams 1963, 1965; Spencer and Sommer 2018).

The costs and benefits in this analysis fall into the classification as either individual and collective (Thøgersen and Crompton 2009; Spencer and Sommer 2018; Rice et al. 2018; OECD 1993). Individual costs and benefits directly affect the consumer as a participant in the exchange (Rice et al. 2018; OECD 1993).

Individual costs refer to the contributions of the consumer in the exchange (Adams 1963), that is, the resources (monetary and non-monetary) sacrificed to access a good. These resources are related to the transaction process (search, negotiation and monitoring) (Rindfleisch and Heide 1997; Wu et al. 2014) and the adaptation and learning period (Akbar and Hoffmann 2018). The

individual cost that nonetheless stands out most in purchasing decisions is price (Xing et al. 2010; Van Doorn and Verhoef 2015). Price, strictly understood, is an individual cost and is defined as the amount of money the consumer must pay to acquire a good (Kotler and Armstrong 2018). Price from the microeconomic perspective determines the acquisition of goods. In this sense, its increase/decrease usually discourages/encourages purchases due to consumer budget restrictions (Mankiw 2018).

Individual benefits refer to the return or value obtained by the consumer in the exchange (Adams 1963). This value is linked to satisfying consumer needs (Park et al. 1986; Warren et al. 2018). Hence, individual benefits can be utilitarian (efficiently fulfilling a functional task), hedonic (satisfying sensory needs) or symbolic (satisfying self-assessment or group membership needs) (Pelozo and Shang 2011; Luchs and Kumar 2017). It is nonetheless necessary to obtain information prior to the purchase in order to recognize these benefits. This information can stem from the production or retail companies, from references or influencers or from previous consumption experiences. But when the consumer does not receive enough information, he/she will resort to the price as an indicator of these benefits (Hoffman et al. 2002; De Langhe et al. 2014). Thus, price, in a scenario of scarce information or in the case of ignorance of the brand, company and/or the product, represents and supports the individual benefits under which the consumer evaluates the purchase (Hoffman et al. 2002). This notion is supported by previous research such as that of De Langhe et al. (2014), Shiv et al. (2005), Yoon et al. (2014) and Graciola et al. (2018). According to De Langhe et al. (2014) and Shiv et al. (2005), price can generate expectations as to quality and performance. Likewise, Yoon et al. (2014) and Graciola et al. (2018) suggest that price also influences value perception and brand image. Along this line of thought, the decision makers in the field of Marketing has focused on means for the consumer to perceive price as a reflection of the value of a product, that is, as a reference as to whether the product will satisfactorily meet their needs (Kotler and Keller 2016; Stanton et al. 2007).

Price therefore allows the consumer to evaluate if the exchange is fair/equitable in particular in contexts where there is little information as to the brand, company and/or product. Bechwati et al. (2009), based on the Equity Theory, determined that the price of a product is thought to be unfair if there is a perception that the company gains excessive benefits, acts immorally or if consumers do not understand the company's price strategies. The consumer will then come to a decision based on this perception. A price deemed unfair, increases the perception of monetary sacrifice, reduces a product's perceived value and generates feelings of disappointment or anger (Calabuig et al. 2014). This leads to product distrust (Konuk 2018), reduction of the disposition to purchase (Graciola et al. 2018), negative WOM (Xia et al. 2004) and low loyalty or satisfaction (Calabuig et al. 2014; Prayag et al. 2019).

Collective costs and benefits, on the other hand, relate to the concept of externalities (Rice et al. 2018). An externality is defined as the impact (negative or positive) that an individual, or an interaction of individuals, has on the well-being of a third party (Buchanan and Stubblebine 1962; Mankiw 2018). Accordingly, the production, distribution and consumption of goods imposes costs and benefits that affect actors outside the consumer-business exchange. This implies a negative/positive impact on the economic, social and environmental well-being of the community (global, regional, national and/or local) (Rice et al. 2018; Dorner 2019; OECD 1993).

Under this premise, collective costs are the resources that the community (as a whole or specific sectors) sacrifices during the production, distribution and individual consumption of goods (Rice et al. 2018; Mankiw 2018; Dorner 2019; OECD 1993). Examples of collective costs are the use of natural resources that are limited on the planet, deforestation stemming from the dependence on wood as raw material for different products, pollution deriving from production, distribution and/or consumption of goods affecting the health, deterioration in the quality of life of individuals living near a production plant, etc. In these cases, Consumers concerned with

social and environmental issues will be able to evaluate collective costs through the basic information offered by the product, but not through the information offered by the price.

It is worth highlighting that certain companies, as part of their policies of corporate social responsibility, develop initiatives allowing them to reduce collective costs which usually implies an increase in the price of the product (e.g., the use supplies that are non-toxic for the consumer and the environment in the manufacture of cleaning products or the implementation of reforestation programs by companies dependent on wood). Taking this into account, consumers concerned with social and environmental issues will only be able to assess the price in terms of collective cost reduction if they are offered additional information as the company's production, marketing and social responsibility initiatives. In this case, a higher price can serve as a reference for actions of a company to reduce its collective costs.

Collective benefits, on the other hand, refer to the return/value for the community (as a whole or specific sectors) gained through the production, distribution and individual consumption of goods (Rice et al. 2018; Mankiw 2018; Dorner 2019; OECD 1993). For example, the purchase of a product bolsters businesses that manufacture the good, generates new jobs leading to an improvement in the quality of life of employees and their families. This indirectly supports small businesses that supply raw materials. Consumers concerned with social and environmental issues will be able to evaluate the price in terms of collective benefits in the decision-making process of product purchasing, if he has additional information on the production, distribution and/or marketing of the manufacturer.

It should be noted that the CSR policies certain companies advance initiatives to reinforce collective benefits which usually implies an increase in the price of the product (e.g., participation in fair trade and living wage initiatives or the carrying out programs that promote the development of businesses that operate around the company). This implies that consumers concerned with social and environmental issues will only be able to evaluate price in terms of increased collective benefits if he has access to additional information on the initiatives of a company's corporate social responsibility. In this case, a higher price can provide the prosocial consumer with a reference on the actions that the company carries out to increase the collective benefits.

Considering the above, collective costs and benefits allow the consumer to evaluate if the exchange is fair/equitable for society in general. However, this evaluation is only possible when the consumer is privy to that information.

All in all, consumer cost-benefit analyses can be carried out both at individual and collective levels. Although consumer decisions are essentially aimed at achieving personal welfare (Peloza and Shang 2011), certain research suggests that there are differences at to the level of importance granted by different consumer profiles to individual and collective costs.

2.3. Differences between prosocial and non-prosocial consumers when processing information

According to Mohr (2001), sustainable or socially responsible purchasing behavior refers to incorporating the desire to minimize or eliminate any harmful effect and maximize the beneficial impact on society into the purchasing decision-making process. This implies consideration the performance of companies with regard to their employees (e.g., living wage, child exploitation), the community (e.g., discrimination against minorities, support for vulnerable sectors) and the environment (e.g., using renewable energy sources, adopting environmentally friendly production processes), as well as the environmental and social impact of the products themselves (e.g., use of toxic components). When sustainable purchasing behavior is carried out continuously, it forms part of a consumer's routine, thus becoming habitual. This implies a stabilization and repetition of the behavior requiring less effort (Carrington et al. 2014). This definition allows distinguishing two consumer profiles: those who

adopt sustainable consumption behavior as part of their habits (prosocial) and those who do not (non-prosocial).

Prosocial consumers possess high self-transcendence values (Peloza and Shang 2011; Ladhari and Tchegtga 2017), high social conscience (Sunderer and Rössel 2012; Ladhari and Tchegtga 2017) and social and personal norms that favor sustainable consumption (Park and Ha 2012; Golob et al. 2019). Given these characteristics, they positively perceive the socially responsible business initiatives (González-Rodríguez et al. 2019) and recognize value in these initiatives (Peloza and Shang 2011). Moreover, these consumers engage in sustainable consumption practices (Ladhari and Tchegtga 2017; Lee and Cho 2019) and experience pleasant sensations through their participation (Luchs et al. 2012). They also engage in actions that penalize environmentally irresponsible businesses (Russell et al. 2016). This suggests that prosocial consumers will seek exchanges that are fair to both themselves and society. That is, they will take into account during their purchase decision-making the costs and both the collective and individual benefits. They may therefore be willing to sacrifice the fairness/equity perception of the exchange as individuals (either by reducing their individual benefits or increasing their individual costs) in pursuit of an exchange they perceive to be fair/ equitable to society (increasing collective benefits or reducing collective costs). The purchase of more expensive and less effective but environmentally friendly cleaning products is an example. Hence awareness of price in contexts with scant information as to brand awareness, the company and/or the product will not suffice for these consumers to come to a decision because this element only offers data as to individual costs, and, where appropriate, individual benefits. So, when not having information as to collective costs and benefits, they will not be prepared to evaluate and make a purchase decision.

Non-prosocial consumers, on the other hand, reveal low levels of self-transcendence values (Peloza and Shang 2011; Ladhari and Tchegtga 2017), low social conscience (Sunderer and Rössel 2012; Ladhari and Tchegtga 2017) and unfavorable social and personal norms toward sustainable consumption (Park and Ha 2012; Golob et al. 2019). Due to this, they mainly recognize value in business initiatives that benefit themselves (Peloza and Shang 2011) and do not commit to sustainable consumption (Ladhari and Tchegtga 2017; Lee and Cho 2019) or actions that penalize environmentally irresponsible companies (Russell et al. 2016). This suggests that this type of consumer is oriented to pursue an exchange based mainly on an individual cost-benefit analysis. Since price provides information as to individual costs and can also offer information related to individual benefits, this variable allows non-prosocial consumers to make a purchase decision in contexts of little information as to the product, brand and the company. Collective costs and benefits are therefore not as relevant hence will not influence this consumers decision process.

This leads to the following hypothesis:

H1: Non-prosocial (vs. prosocial) consumers attach greater value on individual costs and benefits. Prosocial (vs. non-prosocial) consumers, by contrast, attach greater importance to collective costs and benefits.

2.4. Price processing from the neuromarketing perspective: differences between prosocial and non-prosocial consumers

The use of neuroimaging techniques to identify the mechanisms involved in consumer decisions (i.e., neuromarketing) has recently sparked interest among consumer behavior specialists (Harris et al. 2018). Tools from neuroscience and psychology (e.g., fMRI, EEG) currently serve to explore how marketing cues affect consumer evaluations and decisions. Along this line, Enax et al. (2015) applied fMRI to assess the effects of sustainability by evaluating the neural signals and taste-experience of food. Their results reveal a reward-related mechanism underlying the evaluation processes of sustainable food. Bruce et al. (2014) also carried out an fMRI study aimed at revealing neural responses to different foods. Their findings suggest that the more

attributes presented to consumers, the greater the neural activation in the dorsolateral prefrontal cortex, a region associated with working memory and uncertainty.

A growing number of fMRI studies have focused on exploring the neural predictors of purchases. Building on microeconomic theories, they support the notion that purchases are driven by a combination of preference and price (Knutson et al. 2007). Some of these studies assess the neural correlates of product preferences. For example, males who view pictures of sports cars as opposed to less desirable cars reveal greater activations in regions related to reward and value such as the Medial Prefrontal Cortex (MPFC) or the midbrain (Erk et al. 2002). Both males and females when tasting preferred versus nonpreferred drinks (McClure et al. 2004) and those who view pictures of preferred versus nonpreferred brands of beer also reveal greater MPFC activation (Deppe 2005). Reimann et al. (2010) in turn, found that aesthetic packages greatly increase activation in the nucleus accumbens and the MPFC, two areas linked to reward and value. The results of the studies of Hubert et al. (2013) and Van der Laan et al. (2012) also align with these findings. The dorsal portion of the anterior cingulate cortex (ACC) is also linked to reward-based decision making as evidenced by listening to preferred music (Menon and Levitin 2005) or overestimating the probability of experiencing positive life events (Blair et al. 2013). The current literature also suggests that the anterior insula, inferior frontal gyrus and cerebellum encode the subjective value of a decision (Bartra et al. 2013) and constitute key elements in trustworthy purchase environments (Dimoka 2010).

The corpus of the current state of research has also explored how an extrinsic cue (i.e. price) affects the neural processing of products. These studies base themselves on recent behavioral economic theories that postulate that individuals tend to place more value on outcomes deriving from product acquisition than on the potential loss deriving from the burden of paying (Knutson et al. 2007). Price here works as a symbolic cue that informs as to future outcomes. Plassmann et al. (2008) state that increasing the price of wine increases subjective reports of flavor as well as activation in the MPFC, an area that is widely thought to encode pleasantness during experiential tasks. This area also linked to encoding expected values of outcomes (Alexander and Brown 2014) and correlates to the price a purchaser is willing to pay (Bartra et al. 2013; Enax et al. 2015). Levy et al. (2011) suggest that activation in the MPFC with the absence of choice can predict future choices. These findings as a whole implicate an activation of the mesolimbic dopamine projection areas as a representation of preferred items and the perception of price (due to the anticipated gain or pleasure of acquisition).

It would thus be expected that price play a more relevant role in purchase decisions of non-prosocial consumers (vs. prosocial) as it is the main individual cost and a reference of individual benefits in contexts with little information as to the product, brand and/or company. This situation is common to that of a number of products to which consumers are exposed during their daily shopping and would lead to the factor of price generating stronger activation among non-prosocial consumers (vs. prosocial) in the brain regions linked to choice, preference and value. These arguments lead to the following hypothesis:

H2: In purchasing contexts with a reduced amount of information as to the product, non-prosocial (vs. prosocial) consumers experience greater neural processes linked to reward, valuation and choice when processing price information. This leads to a stronger activation of brain regions such as the MPFC, anterior insula, anterior cingulate cortex or inferior frontal gyrus.

3. Material and methods

3.1. Participants

Eighteen right-handed subjects were recruited via the institutional website of the University of Granada between June and September 2018. All live independently, are household decision-makers Spanish residents. All were prescreened according to their sustainable habits by an adapted version of the Socially Responsible Purchase and Disposal Scale (Webb et al. 2008).

The items were rated on a 5-point scale (1=Never true and 5=Always true). They instructed to answer according to their current behavior. Those classified as prosocial obtained average scores of 4 or higher, whereas those considered non-prosocial obtained average scores of 2 or less. An additional question was formulated based to help define their attitude toward corporate social responsibility (Webb et al. 2008; Mohr et al. 2001). The prosocials reported having an action or maintenance behavior whereas the non-prosocials reported displaying a pre-contemplation behavior. Appendix A presents the tools serving in the selection process while Appendix B lists the demographic characteristics of the participants. A debriefing revealed that they spend between 200 and 300 € a month for food. Moreover, none of these students received a salary.

The experiment applied standard fMRI exclusion criteria. Access to private medical data and an ethical commitment consent form were obtained from each participant. Furthermore, the experiment was approved by a local ethical committee along the lines of the Protocol of the World Medical Association Declaration of Helsinki (2013).

3.2. Procedure

Prior to the scanning session, each participant was asked questions, once again, about their sustainable habits. This served to verify if their consumption tendencies were prosocial or non-prosocial. They were likewise presented a number of distracter questions.

A within-subject design was applied to the fMRI experiment. Each participant viewed 50 products (twice) while in the scanner (100 total products). The products consist of a choice of typical low-involvement food, office and household cleaning articles (e.g., cereals, pencils) common in supermarkets at a cost of less than 10€. The categories of the products were commonly consumed by the participants. This was controlled both at pre-experimental (through a pretest applied to a similar profile of participants) and post-experimental level (through participant debriefing). Although the products are real their brands remain unknown to the participants as they are not marketed in their geographical region This was controlled both at pre-experimental (through the participant selection process) and post-experimental level (through participant debriefing). They were viewed in the form of images that show basic information (identification of their category, product size and unknown brand). The participants were presented with a fictitious purchasing scenario that prompted them to stock up on food, office and household cleaning articles according to the usual criteria, preferences and priorities (cf. Appendix C). These measures required the participants make their purchases in a context characterized by little information as the product, the brand and the company. They also increased the realism of the stimulus and isolate the factors foreign to the experiment (e.g., brand preference, third-party ratings, previous experience with the product, reputation of the company as to socially responsible/irresponsible behavior). Products were presented randomly. As in the case of Linder et al. (2010), each product was viewed once without a price before viewing in again with a price (half prices were above market average values and the other half prices were below market average values). This contributed to isolate the possible influence of the specific characteristics of each product from the analysis.

Each trial began with a short (1-3 s) fixation cross display followed by a random viewing of a product for 3 seconds accompanied (or not) by its price. The fMRI stimuli, about 8 minutes long, were displayed via E-Prime Professional 2.0. The timing of each trial was adapted from previous fMRI experiments. The structure of the fMRI task is depicted in Figure 1.

[Insert Figure 1 here]

The participants, following the fMRI session, filled out a questionnaire serving to double check the role price played in their decision. They were likewise consulted as to the relevance they assigned to the different individual and collective costs and benefits in a purchase context identical to that of the fMRI exam. This was carried by another questionnaire made up of 14

items measured on a 7-point scale (1=not important; 7=very important). This tool can be consulted on the Appendix D.

3.3. fMRI data acquisition and analysis

MRI scanning was carried out in a 3 Tesla Trio Siemens Scanner equipped with a 32-channel head coil. Functional scans were acquired by a T2*-weighted echo-planar imaging (EPI) sequence (TR = 2000 ms, TE = 25 ms, FA = 90°, slices = 35, thickness = 3.5 mm, slice order = descending). The distance factor was 20% and the slice matrix was 64 x 64 mm.

The functional images were preprocessed and analyzed by a Statistical Parametric Mapping program (SPM12) run with MATLAB R2012a software. Statistical maps were generated for each participant by fitting a boxcar function to the time series convolved with the canonical hemodynamic response function. This resulted in the estimation of a general linear model (GLM) for each participant with the following regressors of interest: (i) onset picture in products accompanied by price (PP), and (ii) onset picture in products with no price information (PNP). Furthermore, each GLM included a constant session term, six covariates to capture residual movement-related artifacts, and fixation crosses as regressors of no interest. Images were realigned to correct for motion, normalized into standard stereotactic space, and smoothed with a 7 mm Gaussian kernel full-width half-maximum. The task was modeled for participants at the single subject level, comparing activity while viewing products accompanied by price to those including price information. A random effects model was constructed, averaging the single results at the group level.

To ascertain the differences of activations of the brain when viewing products with and without price, two contrasts were calculated: PP vs. PNP, and vice versa. To identify the differences in brain activation between prosocial and non-prosocial consumers during the price or no price processing, the intra-subject contrast images for each of the previous contrasts were subject to two-sample t-tests.

Random effect statistical analyses were run using small volume correction (SVC) as implemented in the SPM. The use of SVC allows researchers to conduct corrections by means of the Gaussian Random Field Theory within a predefined region of interest (ROI) (Bennett et al. 2009). Specifically, the authors created a mask containing spheres measuring 10 mm in radius based on a priori anatomical coordinates gleaned from previous studies analyzing the processing of valuation, preference and choice. To be more precise, the MPFC ROI was defined by the MNI coordinates [x = 0, y = 51, z = 23] reported by Levy et al. (2011) in a study that found that this region can predict subsequent choices between the same items secured outside the scanner. The bilateral anterior insula (x = -32, y = 26, z = 0; x = 32, y = 20, z = -6), anterior cingulate cortex (x = -2, y = 28, z = 28) and striatum (x = -14, y = 10, z = -6) are reported by a meta-analysis for reward and subjective value-related brain activation (Bartra et al. 2013).

4. Results

4.1. Self-reported results

The study found that prosocial participants (vs. non-prosocial) placed much more value during the purchase decision-making process on collective costs (environment, animals and society: $p < .01$) and on collective benefits (environment, animals and society: $p < .01$). The Mann-Whitney U test revealed a quasi-significant difference on the import placed on price for both groups ($p = .06$). In fact, it is the non-prosocial group that reports higher values for this individual cost (see Table 1).

No significant differences were identified in terms of the relevance placed on the other individual costs (search $p = .21$, negotiation $p = .73$, monitoring $p = .67$, learning $p = .72$). There were also no significant differences in the relevance given to the individual benefits (functional $p = .40$; hedonic $p = .42$; symbolic $p = .30$) (see Table 1).

Table 1. Differences of the relevance attributed to the costs and benefits.

Types of costs	Non-prosocial consumer		Prosocial consumer		U	p-value
	Media	DS	Media	DS		
Individual costs						
Price	6.11	1.05	5.13	0.99	17.50	0.06
Search	6.00	0.71	5.25	1.39	23.50	0.21
Negotiation	1.33	0.50	1.50	0.76	33.00	0.73
Monitoring	1.67	0.71	1.50	0.53	32.00	0.67
Adaptation and learning	2.00	0.71	2.13	0.99	32.50	0.72
Individual benefits						
Functional	6.44	0.73	6.13	0.83	28.00	0.40
Hedonic	5.67	1.58	5.50	0.93	28.00	0.42
Symbolic	3.67	1.73	3.13	0.99	25.50	0.30
Collective costs						
Environment	3.44	1.13	5.88	1.13	5.00	<0.01
Animals	3.00	0.71	5.75	1.28	2.00	<0.01
Society	3.56	1.01	6.13	1.36	6.00	<0.01
Collective benefits						
Environment	3.22	0.97	5.75	0.71	1.50	<0.01
Animals	3.22	0.67	5.38	0.74	1.50	<0.01
Society	3.33	1.00	5.25	0.71	4.50	<0.01

4.2. fMRI results

Two sample t-tests revealed significant differences in the brain processing mechanisms of products among prosocial and non-prosocial consumers when accompanied or not by price cues. Whole brain analyses ($p_{\text{uncorrected}} < .001$, $k > 5$ voxels) indicate stronger activations in the clusters in the anterior cingulate cortex, cerebellum and inferior frontal gyrus among non-prosocial consumers when processing products accompanied by price information. When restricting this analysis to the ROIs (at the FWE-corrected threshold of $p < .05$) indicated by Bartra et al. (2013) and Levy et al. (2011), the hypothesized MPFC and the bilateral anterior insula fell in line. Table 2 and Figures 2 and 3 offer details at to these activations and their coordinates. The opposite contrast (product with no price vs. product with price) also did not yield supra-threshold activations either at the whole brain or the ROI level.

Table 2. Brain regions resulting from the Small Volume Correction (e.g., SVC, whole-brain with mask) and whole-brain (without mask) analyses carried out in the contrast of product + price vs. product in non-prosocial and prosocial consumers.

Contrasts and regions	Peak MNI coordinates (mm)			Cluster size	T	Publication
	X	Y	Z			
Product+Price > Product						
Non-prosocial vs. prosocial						
<i>SVC analysis</i>						
Medial Prefrontal Cortex	0	51	23	2	3.23	Levy et al. 2011
Anterior insula	-32	26	0	4	3.58	Bartra et al. 2013
Anterior insula	32	20	-6	2	3.12	Bartra et al. 2013
<i>Whole-brain analysis</i>						
Anterior cingulate cortex	6	42	9	11	3.81	
Cerebellum	-22	-49	-27	25	3.79	
Insula/inferior frontal gyrus	-36	28	5	5	3.58	

[Insert Figure 2 here]

[Insert Figure 3 here]

5. Discussion and conclusions

The development of means to encourage adopting sustainable consumption patterns requires a deep understanding of the everyday purchasing decision process and its variations by each type of consumer. In this sense, the present study seeks to contribute to a better understanding of the role of price in daily decision-making processes. To attain this goal, it evaluated how this variable is processed by prosocial and non-prosocial consumers, that is, individuals who either embrace or not reject sustainable habits. The self-reports and neural findings confirm the existence of differences on how price affects each of these profiles.

The findings of the self-reports identify differences when evaluating price at the conscious level among each consumer type thus bolstering *Hypothesis 1*. Prosocial participants place a greater relevance on collective costs and benefits when carrying out their daily purchases. Non-prosocial consumers, by contrast, place a greater weight on individual costs, especially price. These results are in line with earlier studies that confirm differences in the nature of consumer profiles (Sunderer and Rössel 2012; Ladhari and Tchegna 2017), that is, that prosocial consumers tend more toward personal and collective welfare while non-prosocials focus only on the personal. The low scores obtained for most of individual costs among each group may reflect that the purchasing habits of the participants and the purchasing context serving for this study reduce their presence. One of the selection criteria was that the participants must reside independently and be household decision-makers. The product categories presented in the study are acquired and consumed by them, which minimizes the adaptation and learning costs. The results therefore are in line with those of Chatzidakis et al. (2016) and Nguyen et al. (2016) indicating that habitual behavior implies the acquisition of experience. Moreover, a supermarket is not a space of commerce offering the opportunity to negotiate or where it is usual to carry out exhaustive monitoring of the interchange compliance. North (1992), in fact, notes that in contexts where the exchange is guided by institutionalized norms, transaction costs tend to be lower.

Neither was it possible to distinguish in the relevance afforded by each group to individual benefits. These scores remained nonetheless high among both groups which reflects that regardless of the type of consumer, purchasing decisions are always intended to achieve personal welfare (Pelozo and Shang 2011).

The measurements of neural activation carried out with the fMRI reveal the psychological roots of the differences between prosocial and non-prosocial consumers when evaluating price. Non-prosocial consumers experienced higher activations in the MPFC, bilateral anterior insula, ACC, cerebellum and inferior frontal gyrus which corroborate *Hypothesis 2*. The MPFC is largely involved in contexts of reward and value and is known to be activated, for example, when processing preferred versus non-preferred drinks (McClure et al. 2004), aesthetic packages (Reimann et al. 2010) and desired, high calorie foods (Siep et al. 2009). The MPFC is equally associated with choice across a wide range of contexts. Social cognitive neuroscience literature not only links its activation to predicting health campaign choices (Falk et al. 2016; Falk and Scholz 2018), but also found that it can serve to predict choices made outside of the scanner about items evaluated during fMRI scanning (Levy et al. 2011). Non-prosocial consumers also experienced stronger activation in the bilateral anterior insula, ACC, cerebellum and inferior frontal gyrus. The specialized literature indicates that such areas encode the subjective value of a decision (Bartra et al. 2013) and are key in trustworthy purchase environments (Dimoka 2010; Riedl and Javor 2012).

This may well indicate that non-prosocial consumers (vs. their prosocial counterparts) reveal a higher inclination toward choosing products accompanied by the price (vs. products with no price information). They may even experience a greater sense of reward and value toward products marked with a price. While this notion must be regarded with caution due to potential of reverse inference (Weber et al. 2015), the results align with the Equity Theory (Adams 1963, 1965) and suggest that non-prosocial consumers are able to come a purchase decision when they know the product's price. Their orientation toward personal welfare encourages attaining an evaluation of equity of the exchange at the individual level (Peloza and Shang 2011; Ladhari and Tchetgna 2017). Information as to the price is enough to carry out this evaluation because this variable can offer data on the individual costs and benefits of the product, especially in contexts of scant information or lack of knowledge as to the brand, company and/or product (Hoffman et al. 2002; De Langhe et al. 2014). Prosocial consumers, by contrast, are less prone to make their purchase decision under the same conditions. Their objective to achieve both personal welfare and that of others fosters an evaluation of the equity of the exchange at the collective level. Therefore, these consumers require additional information as to the price that allows them to carry out this level of the evaluation. These results relate to previous research that prosocial consumers come to their decisions not only based on price information, but through other factors such as sustainability or concern for others (Lee 2016).

The findings of this study yield implications for academia, business and social fields. In the case of academia, the results offer a deeper understanding of the importance among different consumer profiles of the price in decision-making processes (Umashankar et al. 2017; Hasanzade et al. 2018). Depending on the profile, the price may be sufficient to go ahead with the purchase (non-prosocial) or must be accompanied by additional information about collective costs and benefits (prosocial). Earlier empirical studies prove that the perception of equity in an exchange contributes to generating favorable consumer responses such as trust, satisfaction, WOM and purchase (Konuk 2018; Casaló and Romero 2019). However, the way price affects the perception of equity and the differences between prosocial and non-prosocial consumers remains unclear. Traditional self-report techniques only resolve part of this research niche and suffer severe limitations when analyzing consumer decisions beyond the scope of self-awareness (Lee et al. 2014). Resorting to neuroimaging techniques is therefore valuable as they reveal how and why price-related information is processed among consumers of diverse profiles. The current paper thus makes headway in this field as it is the first to reveal that the greater value placed by non-prosocial consumers on individual costs derives from elicitation of brain areas linked to reward, valuable expectancies and choice.

This study's findings also offer input to business that can serve brand managers to develop segmentation strategies focusing on promoting the purchase of sustainable products. In this sense it is more attractive for non-prosocial consumers to bolster the perception of fair/equitable exchange at the individual level through the price and its relationship with individual benefits. Thus, non-prosocial consumers should experience reward and a greater neuronal predisposition toward campaigns that communicate the price of sustainable products as a guarantee of higher performance (functional benefit), satisfactory experience (emotional benefit) and status (symbolic benefit). For prosocial consumers, in turn, it is necessary to incorporate additional information that promotes the perception of fair exchange. This last consumer profile will thus respond more efficiently to sustainable product campaigns that highlight collective benefits such a positive impact on the environment or on vulnerable sectors.

This study's findings at the social level can serve public and non-governmental organizations to encouraging sustainable consumption habits such as recycling. Resorting to incentives (e.g., tax reduction, discounts on products) and messages focusing on its benefits (e.g., recycling implies saving money) will have a greater impact on non-prosocial consumers. On the other hand, the development of incentives directed at third parties (e.g., raising funds through recycling for vulnerable populations) and of messages communicating the collective benefits of carrying out

these activities (e.g., recycling reduces pollution) will have a greater repercussion on prosocial consumer participation.

It is nonetheless necessary to recognize that this study's participants were exposed to a restricted purchase scenario involving little basic information as to a series of low involvement, low-cost products of unknown brands and companies. A task vital to future research is to attain a fuller understanding of price processing among prosocial and non-prosocial consumers by adding the influence of contextual variables that include characteristics of the product (e.g., utilitarian, hedonic or symbolic benefits), price (e.g., high, average or low), purchase (e.g., habitual, sporadic, impulsive), company (e.g., size, visibility, line of business) and consumer (brand preference, third party opinions, prior experience with the product). It would likewise be of interest that future research includes information as to the different collective costs and benefits as well as the altruistic behavior of companies in order to evaluate how these are processed with the price by each consumer type. In this sense, it would be compelling, for example, to assess to what extent prosocial consumers during purchases are able to sacrifice individual for collective benefits. Moreover, this study focuses on evaluating price exclusively in the context of purchase. However, the array of decisions confronting consumers on a daily basis is much broader (e.g., recommendations, interaction with a company through different channels, participation in company initiatives or in boycotts against companies) is poorly explored field worth examining through the neuromarketing perspective.

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Figures legends

Figure 1. Structure of the trials of the fMRI sessions.

Figure 2. Illustration of the brain regions revealing a higher degree of activation among non-prosocial consumers (compared to prosocial consumers) while visualizing products accompanied or not by price. T-map thresholded at $p < .001$ uncorrected for multiple comparisons ($2 < T < 5$) superimposed on the mean anatomical image of all subjects (MNI-space).

Figure 3. Non-prosocial consumers exhibit a greater activation of the MPFC (MNI: 0, 51, 23) and the anterior insula (-32, 26, 0) than prosocial consumers when visualizing products accompanied by price. Error bars indicate standard error.

Appendices

Appendix A Scales for the selection of participants

Socially Responsible Purchase and Disposal scale

When deciding to purchase the products of daily consumption, how true are each of the following statements? Please respond according to your current behavior and not what you think you should do.

- SRPD1. I try to buy from companies that help the needy.
SRPD 2. I try to buy from companies that hire people with disabilities.
SRPD 3. I avoid buying products or services from companies that discriminate against minorities.
SRPD 4. When given a chance to switch to a retailer that supports local schools, I take it.
SRPD 5. I try to buy from companies that make donations to medical research.
SRPD 6. I make an effort to buy from companies that sponsor food drives.
SRPD 7. When given a chance to switch to a brand that gives back to the community, I take it.
SRPD 8. I avoid buying products made using child labor.
SRPD 9. When given a chance, I switch to brands where a portion of the price is donated to charity.
SRPD 10. I avoid buying products or services from companies that discriminate against women.
SRPD 11. When I am shopping, I try to buy from companies that are working to improve conditions for employees in their factories.
SRPD 12. I try to buy from companies that support victims of natural disasters.
SRPD 13. I make an effort to buy products and services from companies that pay all of their employees a living wage.

Socially responsible consumer behavior

Please take a moment to think about the part played by one or both of the following issues when you are in the process of deciding what to buy: (1) how companies behave toward their employees, the community, and the environment and (2) the environmental impact of the products themselves. Please select one of the following statements that most closely describes, overall, the extent to which you take them into account.

- SRCB 1. Pre-contemplation: I base my purchase decisions on product and service quality, price, and convenience. I am not concerned with these issues and I don't think about them when deciding what to buy.
SRCB 2. Contemplation: I believe that these issues are important, but it is too difficult and time-consuming to base my purchase decisions on them.
SRCB 3. Action: When it is easy, I use information on these issues in my purchase decisions.
SRCB 4. Maintenance: I make an effort to learn about these issues, and I am willing to pay more or sacrifice product quality in order to heed to these issues in my purchase decisions.

Appendix B. Characteristics of the sample

Characteristics	Prosocial	Non-prosocial
N	8	10
Gender (M/F)	4/4	5/5
Age (years)	18 to 25	18 to 25
Education level	Undergraduate	Undergraduate

Appendix C. Description of the purchase scenario

“Imagine that you just arrived in the city where you are going to begin your university studies. It is the first time that you are in this city and you arrived with a suitcase that contains mainly clothes and a laptop. You have already leased a furnished apartment and have just moved into it. During the months that you are in the city you will be solely responsible for what you consume and for the care of your apartment.

One of your first activities will be to shop at the supermarket. Remember that you arrived with a suitcase containing mainly clothes, so you need to buy products to eat, to follow your university classes and to keep your apartment clean.

Walking through the aisles of the supermarket you come across different types of products. Certain, although of different brands, resemble each other. They are produced by different companies, and their prices may vary. You will need to select the products to purchase as you normally do, that is, taking into account the criteria, preferences and priorities that you normally apply in your decision of which to buy and which not to buy.”

Appendix D. Items of the post-experiment survey

How important is it for you when coming to a purchasing decision that the production, distribution and/or consumption of the product does NOT generate a negative impact on...?

- CC1. The environment
- CC2. Animals
- CC3. Society

How important is it for you when coming to a purchasing decision that the production, distribution and/or consumption of the product benefits ...?

- CB1. The environment
- CB2. Animals
- CB3. Society

How important is it for you when coming to a purchasing decision the time, money and other resources that must be used...?

- IC 2. To find the ideal product
- IC 3. To reach an acceptable agreement with the seller
- IC 4. To ensure that the other party delivers the product to you as you requested
- IC 5. To learn to use the product

How important is it for you when coming to a purchasing decision...?

- IC1. The price
- IB 1. That the product facilitates completion of your tasks
- IB 2. That the product offers you pleasant sensations
- IB 3. That the product helps you reflect the image you want to offer to others