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NEW PERSPECTIVES AND INSIGHTS ON THE DETERMINANTS OF
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COMPORTAMENTO PRÓ-AMBIENTAL

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PRO-ENVIRONMENTAL BEHAVIOR

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Aos 29 dias do mês de maio do ano de 2024, às 09:00 horas, por meio de Videoconferência, realizou-se a defesa de TESE DE DOUTORADO de PEDRO AUGUSTO BERTUCCI LIMA, intitulada **NEW PERSPECTIVES AND INSIGHTS ON THE DETERMINANTS OF PROENVIRONMENTAL BEHAVIOR**. A Comissão Examinadora foi constituída pelos seguintes membros: Prof. Dr. ENZO BARBERIO MARIANO (Orientador(a) - Participação Virtual) do(a) Departamento de Engenharia de Produção / Unesp - Faculdade de Engenharia - Câmpus Bauru, Prof.^a Dr.^a JANINE FLEITH DE MEDEIROS (Participação Virtual) do(a) Departamento de Engenharia de Produção e Transportes / Universidade de Passo Fundo, Prof.^a Dr.^a JUDITH IRENE MARIA DE GROOT (Participação Virtual) do(a) Department of Marketing / Faculty of Economics and Business, University of Groningen, Prof.^a Dr.^a LEILA ELGAAIED-GAMBIER (Participação Virtual) do(a) Marketing Department / TBS Education, Prof.^a Dr.^a SARA MARGARIDA MORENO PIRES (Participação Virtual) do(a) Departamento de Ciências Sociais, Políticas e do Território / Universidade de Aveiro. Após a exposição pelo doutorando e arguição pelos membros da Comissão Examinadora que participaram do ato, de forma presencial e/ou virtual, o discente recebeu o conceito final: aprovado. Nada mais havendo, foi lavrada a presente ata, que após lida e aprovada, foi assinada pelo(a) Presidente(a) da Comissão Examinadora.

Prof. Dr. ENZO BARBERIO MARIANO

Enzo B. Mariano

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*“What do you say we become two
Leonardo da Vincis?”*

Richard Feynman

ABSTRACT

Behaviors that minimize or improve the quality of the environment, that is, environmental behaviors (PEBs), are relevant to mitigate environmental problems that affect the planet and people's quality of life. Because of this, it is essential to understand the determinants of these behaviors, so that they can be encouraged. Among the factors used to analyze the PEB, the value-belief-norm theory (VBN) is one of the most used because it was developed especially for the analysis of PEBs through the incorporation of different theories and existing concepts. Although it is widely used, there are still new opportunities and research possibilities regarding this theory, including integrating it with other theories and constructs. Thus, the general objective of this thesis is to propose new perspectives for the VBN theory through its application in different contexts, and to explain different types of PEBs. In order to achieve this objective, this thesis is divided into four articles, each with a specific objective. The first article, through a systematic literature review, set out to map the relationship between the VBN theory and environmental advertisements. As a result, a theoretical framework was proposed that combines the stages of cognitive processes of persuasive messages with the VBN theory, also including contextual factors and personal capabilities as moderators. The second article aimed to analyze how different values used in messages about biological conservation interact with the individual values of the audience. The study was applied in two contexts: the interaction between humans and marmosets in the city of Bauru, Brazil, and the presence of wild boars in the metropolitan region of Barcelona, Spain. The research points out that in the case of Brazil, altruistic and biospheric messages moderate the relationship between individual altruistic and biospheric values and message performance, while in the context of Spain, control messages, that is, informative ones, presented a moderating effect. The third article, which also included Brazilian and Spanish data, analyzed, using 40 structural equation models, how reported recycling behaviors and purchases of recycled products interact with the intention to purchase specific products produced with recycled material. The study also aimed to analyze the role of beliefs, personal and social norms, and attitudes on behavioral intention in the interaction between reported behavior and behavioral intention. The results indicate that the reported behavior of purchasing recycled products is the main predictor of the intention to purchase specific products made with recycled material, with few relationships being found between recycling behavior and purchase intention, which is a barrier to achieving circular economy, see the need to close the cycle of materials and energy in the production and consumption cycles. The psychological variables used showed a

relationship with behavioral intention, but few moderation relationships. Finally, the fourth study, which also used structural equation modeling, aimed to analyze how human capabilities, analyzed in aggregate and by separate dimensions, relate to PEB and what their role is in the interaction between personal norms and intention to behavior. The results indicate that the relationship between human capabilities and PEB is not strong, depending on the dimensions of capabilities and specific categories of PEB. Furthermore, the results indicate that human agency capabilities negatively moderate the relationship between personal norms and environmental behaviors. Thus, the results of this thesis offer new possibilities for VBN theory, in particular the role of the interaction between VBN variables and other variables such as persuasive messages, past behaviors and human capabilities, to explain environmental behaviors. The thesis also presents results that go beyond VBN, presenting one of the few literature reviews in the area of green advertisements, awareness of ecological conservation issues in Bauru and Barcelona, the relationship between past behaviors and behavioral intention in the context of the economy circular, and the development of a reduced instrument to apply capabilities theory in survey studies.

Keywords: environmental behavior; value-belief-norm theory; sustainability; structural equation modeling; green marketing; environmental conservation; circular economy; human development.

RESUMO

Comportamentos que minimizem ou melhorem a qualidade do meio ambiente, isto é, comportamentos ambientais (PEBs), são relevantes para mitigar os problemas ambientais que afetam o planeta e a qualidade de vida das pessoas. Devido a isso, é fundamental compreender os determinantes desses comportamentos, para que eles possam ser estimulados. Dentre os fatores empregados para analisar o PEB, a teoria do valor-crença-norma (VBN, do inglês value-belief-norm) é uma das mais utilizadas por ter sido desenvolvida especialmente para a análise de PEBs através da incorporação de diferentes teorias e conceitos já existentes. Embora seja muito utilizada, ainda existem novas oportunidades e possibilidades de pesquisa com relação a esta teoria, inclusive integrando-a com outras teorias e constructos. Assim, o objetivo geral desta tese é propor novas perspectivas para a teoria VBN mediante a sua aplicação em diferentes contextos, e para explicar diferentes tipos de PEBs. De modo a alcançar este objetivo, esta tese é dividida em quatro artigos, cada um com um objetivo específico. O primeiro artigo, por meio de uma revisão sistemática da literatura, se propôs a mapear a relação entre a teoria VBN e anúncios ambientais. Como resultado, foi proposto um framework teórico que combina os estágios dos processos cognitivos de mensagens persuasivas com a teoria VBN, incluindo também fatores contextuais e de capacidades pessoais como moderadores. O segundo artigo teve como objetivo analisar como diferentes valores utilizados em mensagens sobre conservação biológica interagem com os valores individuais da audiência. O estudo foi aplicado em dois contextos: a interação entre humanos e saguis na cidade de Bauru, Brasil, e a presença de javalis selvagens na região metropolitana de Barcelona, Espanha. A pesquisa aponta que no caso do Brasil, mensagens altruístas e biosféricas moderam a relação entre valores individuais altruístas e biosféricos e a performance da mensagem, enquanto no contexto da Espanha as mensagens de controle, isto é, informativas, apresentaram efeito moderador. O terceiro artigo, que também contou com dados brasileiros e espanhóis, analisou por meio de 40 modelos de equações estruturais como comportamentos reportados de reciclagem e compra de produtos reciclados interagem com a intenção de compra de produtos específicos produzidos com material reciclado. O estudo também teve como objetivo analisar o papel das crenças, normas pessoais e sociais, e atitudes na intenção de comportamento na interação entre comportamento reportado e intenção de comportamento. Os resultados apontam que o comportamento reportado de comprar produtos reciclados é o principal preditor da intenção de comprar produtos específicos feitos com material reciclado, tendo sido encontradas poucas relações entre comportamento de

reciclagem e a intenção de compra, o que é uma barreira para o alcance da economia circular, vide a necessidade de se fechar o ciclo de materiais e energia nos ciclos de produção e consumo. As variáveis psicológicas empregadas apresentaram relação com intenção de comportamento, mas poucas relações de moderação. Por fim, o quarto estudo, que também utilizou modelagem por equações estruturais, teve como objetivo analisar como as capacidades humanas, analisadas de forma agregada e por dimensões separadas, se relacionam com PEB e qual o seu papel na interação entre normas pessoais e intenção de comportamento. Os resultados apontam que a relação entre capacidades humanas e PEB não é forte, dependendo das dimensões das capacidades e de categorias específicas de PEB. Além disso, os resultados indicam que as capacidades de agência humana moderam negativamente a relação entre normas pessoais e comportamentos ambientais. Desse modo, os resultados dessa tese oferecem novas possibilidades para a teoria VBN, em especial o papel da interação entre variáveis da VBN e outras variáveis como mensagens persuasivas, comportamentos passados e capacidades humanas, para explicar comportamentos ambientais. A tese também apresenta resultados que vão além da VBN, apresentando uma das poucas revisões de literatura na área de anúncios verdes, a sensibilização quanto a questões de conservação ecológica em Bauru e Barcelona, a relação entre comportamentos passados e intenção de comportamento no contexto da economia circular, e o desenvolvimento de um instrumento reduzido para aplicar a teoria das capacidades em estudos surveys.

Palavras-chave: comportamento ambiental, teoria valor, crença e norma; sustentabilidade; modelagem de equações estruturais; marketing verde; conservação ambiental; economia circular; desenvolvimento humano.

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*“go, go without drama
without fear of making mistakes,
go without guilt,
and if you want to come back,
come in no hurry
without fear of finding your
place”*

Duca Leindecker and Humberto
Gessinger

1. INTRODUCTION

The world faces severe environmental problems related to climate change, waste generation, biodiversity loss and the pollution of natural ecosystems (UNEP, 2023). The urgency of improving the environmental condition is not only about preserving the planet for its own sake, but also about preserving human beings (SEN, 2013). A degraded environment negatively affects human well-being across different dimensions. It can be the source of different physical and mental problems (GILES-CORTI; LOWE; ARUNDEL, 2020), hinder individuals' capabilities (LIMA et al., 2021), and even impact human happiness (LIMA; MARIANO, 2022). One way to mitigate environmental problems and improve environmental conditions is by adopting pro-environmental behaviors (CLAYTON et al., 2015).

A pro-environmental behavior (PEB) can be defined as “any behavior that harms the environment as little as possible, or even benefits the environment” (STEG; VLEK, 2009, p. 309). Stern (2000) pointed out four types of pro-environmental behavior: environmental activism, non-activist public sphere, private sphere, and other pro-environmental behaviors. Thus, supporting environmental policies (FRIEDRICH; JEFFERSON; GLEGG, 2014), getting involved in environmental volunteering (MCDOUGLE.; GREENSPAN; HANDY, 2011), talking to others about environmental issues (SELINSKE et al., 2020.), choosing more sustainable products and services (SHARMA; ASWAL; PAUL, 2023), recycling (ELGAAIED, 2012), saving water (PARKER et al., 2018) and energy (VAN DER WERFF; STEG, 2015), among many other behaviors, can be considered PEB.

PEBs differ in terms of the cognitive, physical, or financial efforts necessary for their adoption (KNEEBONE et al., 2020). For example, installing a rainwater tank to supply water for use inside your home is a much more expensive, time-consuming, and complex behavior than turning off the tap when brushing your teeth. Despite these differences, it is generally acknowledged that all kinds of PEBs can contribute to mitigating environmental problems (NIELSEN et al. 2021). A better understanding of the elements that influence the process of forming a PEB can support the development of strategies to increase PEB in general (NIELSEN et al., 2021)

Different conceptual frameworks have been applied to predict PEB (REZVANI; JANSSON; BODIN, 2015). Prior research has adopted many different theories of behavioral change, including the theory of reasoned action (FISHBEIN; AJZEN, 1975), the theory of planned behavior (AJZEN, 1991), self-efficacy theory (BANDURA, 1977) and value-belief-norm (VBN) theory (STERN et al., 1999; STERN, 2000). The present thesis has

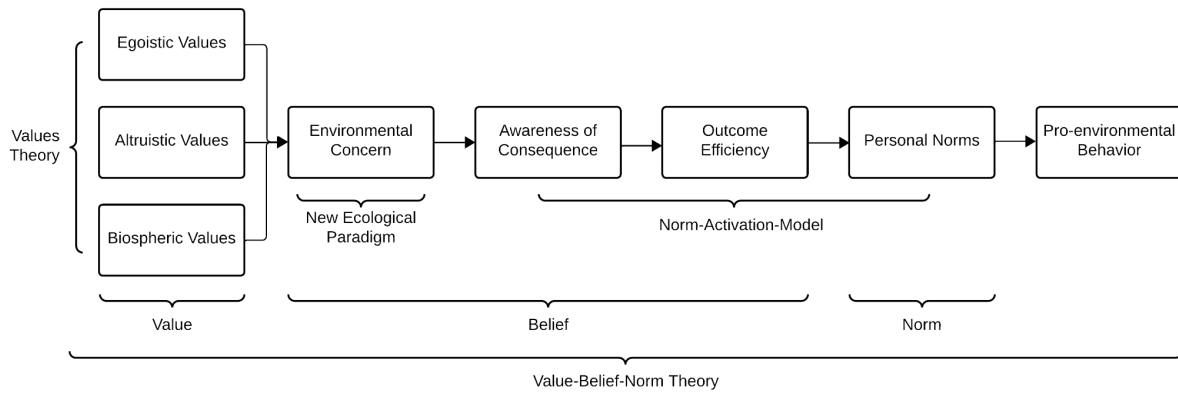
adopted VBN as its focal theoretical framework for two main reasons: (1) unlike other theories, it was designed specifically to understand the antecedents of PEB; and (2) it is inclusive and combines elements of other conceptual frameworks, i.e., values theory (SCHWARTZ, 1992), norm-activation (NAM) theory (SCHWARTZ, 1977) and the new ecological paradigm (NEP) (DUNLAP et al., 2000). A summary of each concept of the VBN theory is presented as follows:

- 1) Values: values theory conceptualizes individual values as criteria used to select and justify the behaviors and evaluations of other individuals and events (SCHWARTZ, 1992). Individual values influence how individuals evaluate costs and benefits involved in behavior (STEG, 2016). Within the scope of the individuals' values investigated by Schwartz (1992), three have been employed more frequently in the PEB literature (DE GROOT; STEG, 2010a; STEG; DE GROOT, 2012):
 - a) Egoistic: the individual perceives a behavior as beneficial to themselves, that is, the personal benefits of the behavior outweigh the personal costs of adopting the behavior. For example, an individual might opt for saving water to reduce their water bill;
 - b) Altruistic: the individual perceives that a behavior benefits the community or society, that is, the societal benefits of the behavior outweigh the personal costs of adopting the behavior. For example, an individual reduces their water consumption to avoid a lack of water for other individuals;
 - c) Biospheric: the individual perceives that a behavior will benefit the ecosystem as a whole, that is, the ecosystem benefits of the behavior outweigh the personal costs of adopting the behavior. For example, an individual decreases their water consumption to avoid water stress on the environment.
- 2) Beliefs: are beliefs that an individual has about environmental concern and the relationships of human beings and nature, beliefs about the consequences of environmental impact, and beliefs about their role in mitigating these environmental issues (DE GROOT; STEG, 2009; DUNLAP et al., 2000; STERN, 2000). In the VBN theory, belief can be divided into the following concepts:
 - a) New Ecological Paradigm: is related to ecological worldviews and environmental concern that an individual might possess, under three main themes: balance of nature, limits of growth, and human domination over nature;

- b) Awareness of Consequence: is the awareness that an individual has about negative consequences that might affect them, other individuals, or other things, if actions are not taken to resolve or mitigate some ongoing event.
 - c) Ascription of Responsibility: is the feeling of responsibility for the negative consequences that might happen if an individual does not act in a determined way. Recent studies have employed the concept of outcome efficiency, i.e., the feeling that an individual can help to mitigate or solve a problem (VAN DER WERFF; STEG, 2015), due to the strong correlation with and difficulty to empirically distinguish between ascription of responsibility and personal norms (STEG & DE GROOT, 2010).
- 3) Norms: the NAM framework asserts that being aware of environmental problems (awareness of consequence) and the perception of the possibility to improve the environmental state (outcome efficacy) activate personal norms which will encourage PEB (Van der Werff & Steg, 2015). Personal norms (or moral norms) are feelings of moral obligation that an individual perceives in terms of a behavior, which in turn can increase or decrease the propensity that the individual will adopt the behavior (SCHWARTZ, 1977). Thus, the stronger the feeling of moral obligation to adopt a behavior, the stronger the probability of engaging in that behavior.

The VBN theory was first proposed by Stern et al. (1999) to explain environmentalism and PEB. VBN posits that pro-environmental action is the result of specific individual values, beliefs and personal norms. The model is based on a causal chain that moves from relatively stable and central elements of personality (individual values) to more focused beliefs about human-environment relationships (beliefs that environmental conditions threaten things valuable to an individual and that an individual can act on to reduce the threat), to personal norms (feelings of a moral obligation to perform a certain behavior) (STERN, 2000). Each variable of the causal chain has a direct impact on the next, but may also have a direct influence on other variables further downstream (STERN, 2000) (Figure 1).

Figure 1 - The Value-Belief-Norm Theory



Source: Adapted from Stern (2000)

There are several PEB determinant categories (e.g., sociodemographic aspects, habits, external elements, social norms, and attitudes), the intrinsic motivation factors covered by the VBN theory being one of these determinants (BLANKENBERG; ALHUSEN, 2019). Thus, by considering other factors, such as external stimulus, theories and concepts, it is possible to increase the explanatory power of VBN and the efficient stimulation of the adoption of further PEB (HAN et al., 2015). Considering the relevance of these aforementioned determinants, the present thesis prioritized an analysis of their interaction with VBN variables and PEB. More especially, the thesis considered the one external factor that has been regarded as a means of stimulating behavioral change, namely persuasive messages, such as green advertisements (BULLOCK et al., 2017; DE GROOT et al., 2013; ELGAAIED-GAMBIER et al., 2018). Green advertisements can be defined as messages that “promote an awareness of environmental issues and/or suggests behaviors useful in minimizing or correcting these environmental issues” (FOWLER III; CLOSE, 2012). Moreover, some researchers have found that social norms (i.e., an individual’s expectation of what the majority of the population does and what other individuals believe should or should not be done) and attitudes (i.e., evaluations that an individual has about something) can increase the explanatory power of moral based models, such as the NAM framework (HAN et al., 2015; KLOCKNER, 2013). Thus, these two variables (social norms and attitudes) were also included in the analysis here presented. Finally, considering that the literature has mainly considered socio demographic aspects as personal capabilities (e.g., BLANKENBERG; ALHUSEN, 2019), which are variables that have been consistently related to different types

of PEB, the present thesis includes the concept of human capabilities, from the capability approach perspective, considering that they might present new insights for this group of determinants. There are two main concepts in the capability approach: functionings and capabilities. Functionings are an individual's being and doing, such as choosing to follow an ecological career or buying a sustainable product. Capabilities, on the other hand, are the opportunities that individuals have to be and have whatever they value (SEN, 2010).

1.1 Research Question and Objectives

The main research question guiding this research is: How can VBN theory affect, fully or partially, directly or indirectly, different types and aspects of pro-environmental behavior? Based on this research question, the main goal of the research is to propose new forms and perspectives by which VBN theory may be used, in association with other theories and concepts (such as persuasive messages, past behaviors, social norms and attitudes, and human capabilities), in order to explain the different types of PEB. To this end, the research:

- 1) Extensively examined the relationship between VBN and green advertising which, despite being an important field of green marketing, has received little attention from the VBN theory;
- 2) Analyzed the relationship of individual values and messages framed within values in order to further the development of more persuasive messages regarding conservation behavior;
- 3) Analyzed the role of an extended version of the NAM framework, considering the relationship between the reported recycling and purchasing behavior of recycled products and the behavioral intention to purchase specific products made of recycled materials; and
- 4) Assessed the direct effect of human capabilities on PEB, and the moderating effect of human capabilities on the relationship between personal norms and PEB.

Thus, the present research sought to investigate those fields that had previously given little attention to the intersection of VBN and PEB, offering new possibilities for their study (i.e., green advertising, conservation ecology, circular economy, and human development). The approach applied in this research is aligned to the necessary multidisciplinary appeal to tackle environmental challenges, as presented by several researchers (CLAYTON et al., 2015; POLYPORTIS; MAGNIER; MUGGE, 2022; SAUVÉ; BERNARD; SLOAN, 2016; VERSCHOOR et al., 2020).

The present thesis has been divided into four articles, each focused on one of the specific objectives of the thesis. While the first article focused on the VBN theory as a whole, the second article focused on the concept of values, the third article on an extended version of the NAM framework (i.e., beliefs and personal norms), and the fourth article focused on personal norms (Table 1).

Table 1 - Specific objectives and corresponding article

Article	VBN variable	PEB type	Objectives
1	Value, Belief, and Personal Norms	Diverse	Review all published research at the intersection of green advertising and pro-environmental motivation (from the VBN theory perspective) and identify the major themes and potential areas of deficit in this work.
2	Values	Conservation PEB	Analyze how values framed in messages interact in the relationship between individual values and attitudes toward such messages and PEB intention related to conservation issues.
3	Awareness of Consequence, Outcome Efficiency, and Personal Norms	Circular PEB	Analyze if reported recycling behaviors and the purchase of recycled products are related to the behavioral intention to buy specific recycled products. Additionally, assess the direct and moderating effect of extended NAM variables on the relationship between reported behavior and behavioral intention.
4	Personal Norms	General, Recycling, and citizenship PEB	Assess the direct relationship of capabilities and their specific dimensions on the adoption of three different kinds of PEB: General PEB, household waste and recycling, and environmental citizenship; and identify the moderating role of these dimensions on the relationship between personal norms and the three types of PEB.

Source: Developed by the author

1.2 Description of the articles and stage of development

A brief description of each article comprising this thesis and their current stage of development (Table 2) is next presented.

1. **Article 1.** Green advertising can be an impactful ally for fostering sustainability, as persuasive messages can positively impact the adoption of PEB (DE GROOT; ABRAHAMSE; JONES, 2013; ELGAAIED-GAMBIER; MONNOT; RENIOU, 2018). However, the adoption of the VBN, which is one of the most used theories from the environmental psychology field to explain PEB (STEG, 2016), have been

sparsely employed. Thus, the present study proposed a holistic mapping of the literature, through the systematic literature review method, of a final sample of 60 articles drawn from the Scopus and Web of Science databases, to gather together the knowledge about VBN applied in green advertising. This article expanded the notion of values to other perspectives rather than only relying on the one proposed by Schwartz (1992), as this increased the number of papers found in the literature search and presented a better picture of what researchers have considered as values in green marketing. Moreover, there has been a lack of systematic investigation of green advertising in general in the literature, the exceptions being a bibliometric study (AGARWAL; KUMAR, 2021) and a recent study about green advertising in social media (KTISTI; HATZITHOMAS; BOUTSOUKI, 2022). Thus, the present study also contributes to the more general perspective of green advertising.

2. **Article 2.** Several studies have already considered the role of VBN variables in conservation behavior (FORNARA et al., 2020; GOLEBIE; VAN RIPER, 2023; VAN RIPER; KYLE, 2014). However, few studies have considered how to translate these ideas into conservation communication (BATAVIA et al., 2018). Therefore, the present article aims to analyze the relationship between individual values, value framed messages, attitudes toward messages and behavioral intention. To achieve this goal, the article collected data from Brazil and Spain in order to carry out two case studies: (1) the interaction between humans and marmosets in Bauru, Brazil and (2) the presence of wild boars in the metropolitan region of Barcelona, Spain. The findings presented are not only important for the conservation ecology field, but also for the sustainability literature in general, as the relationships between values held by individuals and values in messages have not been studied extensively.
3. **Article 3.** Consumers play a vital role in the circular economy, as their waste management practices - such as recycling and buying behavior - are necessary if organizations closing material and energy loops are to be supported (KIRCHHERR; REIKE; HEKKERT, 2017). Although there are studies analyzing circular economy related behavior (GOMES et al., 2022a), there are claims that consumer behavior is less studied than other aspects of the circular economy (ARIAS et al., 2022). Moreover, there is a lack of understanding regarding the relationship between recycling behavior and buying behavior. Therefore, this research aims to analyze if reported recycling behaviors and the purchase of recycled products are related to the behavioral intention to buy specific recycled products over a traditional option. To

achieve this goal, the research collected data from Brazilian and Spanish undergraduate students and employed structural equation modeling to assess the direct effect of reported recycling and purchasing behavior on the intention to purchase recycled products. The research also assessed the direct and moderating effect of an extended NAM framework (i.e., awareness of consequence, outcome efficiency, personal norms, social norms, and attitudes) in the relationship between reported behavior and behavioral intention. The study included an extended version of the NAM framework in order to increase the explanatory power of the model, thereby including social norms and attitudinal elements that have already been regarded as useful for achieving this goal (HAN et al., 2015; KLOCKNER, 2013).

4. **Article 4.** Human development is closely related to sustainability issues, with several studies analyzing their relationship from a macro perspective (LIMA et al., 2022). The capability approach assumes that the development of a region should be seen according to the expansion of individuals' freedoms to be and have wherever they value (SEN, 2010). Recently, empirical investigations have been conducted in order to assess human capabilities at an individual level (LUIZ, 2022). However, little is known about the role of human capabilities from the point of view of PEB (LEßMANN; MASSON, 2015). Therefore, the present study analyzed the direct relationships between human capabilities and three of its dimensions (i.e., Capabilities related to biological and physical human needs; Capabilities related to the fundamental interests of a human agent; and Capabilities related to the fundamental interests of a social being) and PEB. The study also analyzed the moderating effect of human capabilities and these three dimensions on the relationship between personal norms and PEB.

Table 2 - The current stage of development of each article

Article	Title	Stage	Journal	Impact Factor
1	From green advertising to sustainable behavior: a systematic literature review through the lens of the value-belief-norm framework	Published (2023)	<i>International Journal of Advertising</i>	6.7 (2022)
2	Matching conservation messages with individual values: Promoting social conservation behavior through value-framed messages	To be submitted	-	-
3	Like the windmills of your mind: The role of psychological variables on the spillover effect in circular behavior	To be submitted	-	-
4	More than moral motivations: The moderating role of human capabilities on the relationship between personal norms and pro-environmental behavior	Published (2023)	<i>Journal of Cleaner Production</i>	11.1 (2022)

Source: Developed by the author

“Here, there, and everywhere”
John Lennon and Paul McCartney

2. ARTICLE 1 - SYSTEMATIC LITERATURE REVIEW ABOUT GREEN ADVERTISING, VALUE-BELIEF-NORM THEORY AND PRO-ENVIRONMENTAL BEHAVIOR

2.1 INTRODUCTION

Environmental issues are more than ever a global priority, with experts calling for immediate and meaningful action (UNEP 2021). Even though they are only a cog in a complex system, consumers are part of this necessary collective effort (SEN, 2013; STEG; VLEK, 2009). The role of consumers may involve buying products that are less harmful to the environment or choosing a lifestyle that mitigates negative impacts on nature (ATKINSON; KIM 2015; STERN, 2000). Pro-environmental behavior, also referred to as sustainable behavior, can be understood as “any behavior that harms the environment as little as possible, or even benefits the environment” (STEG; VLEK, 2009, p.309). Pro-environmental behavior encompasses a wide array of individual actions, which can be classified into four categories (STERN, 2000): activism, non-activist public sphere behaviors, private sphere behaviors and behaviors in organizations. Although scholars in marketing and consumer studies focused mainly on green consumption practices such as purchasing green products (e.g. SCHLEGELMILCH; BOHLEN; DIAMANTOPOULOS, 1996; YAN; KEH; CHEN, 2021) and recycling (BISWAS et al., 2000; LI et al., 2021), prior research in marketing also addressed other types of behaviors, such as green customer citizenship, i.e. advocacy and feedback behaviors (e.g. VAN TONDER; FULLERTON; DE BEER, 2020), and green activism, i.e. participating in events organized by environmental groups, donating to environmental groups, circulating environment-related petitions etc. (e.g. LEONIDOU; GRUBER; SCHLEGELMILCH, 2022).

One way to raise awareness and encourage individuals to adopt greener choices is through advertising and communication (e.g., ELGAAIED-GAMBIER; MONNOT; RENIOU, 2018; HARTMANN et al., 2014; YOON; KIM, 2016). Green advertising is “any advertising that explicitly or implicitly promotes an awareness of environmental issues and/or suggests behaviors useful in minimizing or correcting these environmental issues. Green advertising may be associated with either commercial for-profit enterprises or not-for-profit initiatives.” (FOWLER III; CLOSE 2012, p. 121). To be effective, these strategies must embrace relevant values (FREIRE; LOUSSAÏEF, 2018). Previous research suggests that

promoting green activities by appealing to individual nature-based values can encourage the adoption of sustainable behavior (PETERSON et al., 2021).

Although it is recognized that some advertising techniques are likely to stimulate the adoption of more sustainable behavior by activating individual predispositions and values (BULLOCK; JOHNSON; SOUTHWELL, 2017), it is still uncertain how marketers are considering these individual predispositions in the green advertising domain. Moreover, several factors have been identified as key determinants for sustainable action (ELHAFFAR; DURIF; DUBÉ, 2020; GROENING; SARKIS; ZHU, 2018) and several theories were used to predict the likelihood of consumers adopting greener choices. In particular, value-belief-norm (VBN) theory (STERN et al., 1999; STERN, 2000) is a widely used framework to understand how people act in relation to the environment. It posits that people's beliefs and perceived responsibility to preserve the environment are based on their values, which are important principles that guide their actions (SCHWARTZ, 1992; STERN et al., 1999). These values, beliefs and personal norms are expected to influence whether or not people engage in behavior that is good for the environment (STERN et al., 1999). Yet, it is unclear how such theories are positioned in perspective with the persuasion process activated as a result of exposure to sustainability-related messages. If consumers have no prior pro-environmental predisposition, it is quite unlikely that green advertising alone will make them adopt sustainable behavior. Moreover, if green advertising fails to activate the right psychological levers, it may be less effective. In this research, we argue that green advertising effectiveness cannot be addressed independently from environment-related intrinsic motivations.

Given the stakes for practitioners and for society as a whole, it is crucial to better understand how environmental communication interacts with pre-existing psychological predispositions towards the environment. To the best of our knowledge, there are still no systematic investigations on how the intrinsic pro-environmental motivation of consumers is related to green advertising. Thus, in parallel to addressing new research questions in this area, it seems necessary to take a step back, summarize what we already know on the effectiveness of green advertising and identify potential gaps in the literature. Our research questions, therefore, are: (RQ1) What is the current state of knowledge regarding the impacts of green advertising on sustainable consumer behavior? (RQ2) How do the psychological factors that influence pro-environmental behavior interact with green advertising to shape consumer behavior? To answer these questions, this research aims to understand the state of the art on how green advertising influences individuals' pro-environmental motivations in order to foster the adoption of more sustainable behavior. From a theoretical perspective, our

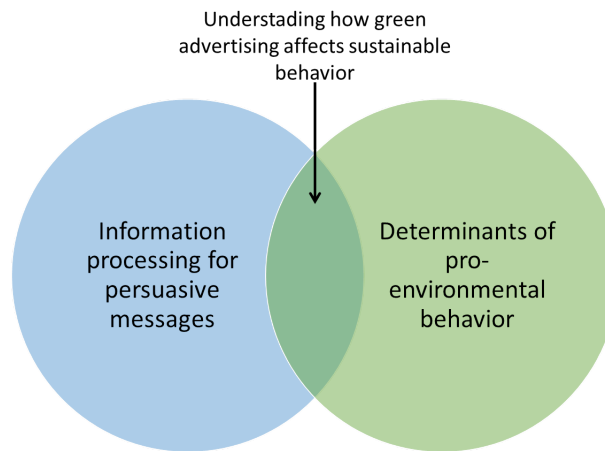
objective is to link the persuasion process underlying environmental communication to existing theories of sustainable behavior. We focus on the well-established VBN theory to determine the role of individual values, beliefs, and personal norms in shaping consumer pro-environmental behavior in response to green advertising.

Several studies have highlighted the relevance of literature reviews in the field of advertising, including research on gender stereotypes in advertising (GRAU; ZOTOS, 2016), mobile advertising (GREWAL et al., 2016), online advertising (HA, 2008), online behavioral advertising (BOERMAN; KRUIKEMEIER; BORGESIOUS, 2017), political advertising (VAN STEENBURG, 2015), and advertising to preschoolers (LOOSE et al., 2022). These papers review the current state of the literature in the field and propose frameworks and research agendas (HAYES; HOLIDAY; PARK, 2022; KNOLL, 2016; LOOSE et al., 2022; WILSON, 2022). Until very recently, there was a significant lack of literature review studies on environmental issues in advertising. However, three different reviews (e.g., GOLOB; PODNAR; ZABKAR, 2023; RATHEE; MILFELD, 2023; SANTA; DREWS, 2023) have recently been published in this area, emphasizing the dynamic evolution of the field. The review developed by Golob, Podnar, and Zabkar (2023) is not specific to green advertising per se but covers sustainable communication in general. It describes the different manifestations and functions of sustainable communication. Rathee and Milfeld (2023), on the other hand, developed a framework for assessing the effectiveness of sustainability advertising, with a focus on advertising context, source characteristics, and message design. Finally, Santa and Drews (2023) focused on the role of heuristics in processing green advertising information. Although our research shares some common ground with these recent review papers, it also differs on many levels and offers a complementary perspective. The present article aims to review all published research at the intersection of green advertising and pro-environmental motivation and to identify the major themes and potential areas of deficit in this work. The originality of our proposed framework lies in its integrative nature and its incorporation of environmental intrinsic motivations as central predictors through VBN theory.

2.2 DELINEATING THE SCOPE OF THE RESEARCH: A FOCUS ON VALUE-BELIEF-NORM FRAMEWORK

Booth, Sutton, and Papaioannou (2016) insist on the place of theory in systematic literature reviews. There are several ways in which literature reviews can involve and interact with theory. For example, a literature review may identify and describe relevant theories related to a particular issue, or it may aim to integrate and synthesize existing theories to create a "meta-model." Additionally, literature reviews can be used to generate new, overarching theories and interpretations (BOOTH; SUTTON; PAPAIOANNOU, 2016; CAMPBELL et al., 2014). Finally, the literature itself may provide a set of data that can be used to test and modify existing theories. To understand how consumers process green advertisements and how these messages affect the likelihood of consumers to engage in sustainable behavior, it is necessary to connect two bodies of research pertaining, respectively, to information processing and the determinants of pro-environmental behavior (Figure 1). This approach aligns with previous research that has emphasized the value of conducting systematic reviews at the intersection of two fields (e.g., ROBSON, 2020). Although this double perspective is essential to grasp the process of behavior change and the effects of green advertisements, previous studies have somewhat overlooked this interaction between the cognitive process and social values. By bridging this gap, our contribution will be to develop a persuasion framework that is specific to green advertising and sustainability issues. With this objective in mind, we chose to narrow down the scope of our systematic review by addressing green advertising and its impact on behavior in the light of a specific theoretical perspective. We argue that green advertising effectiveness should be assessed through the lens of theories of pro-environmental action.

Figure 2 - Green advertising's effect on behavior: at the intersection of two bodies of research



(Developed by the authors)

Among the different conceptual frameworks that have been used to predict pro-environmental behavior, prior research relied on many different theories of behavioral change, including the theory of reasoned action (FISHBEIN; AJZEN, 1975), the theory of planned behavior (AJZEN, 1991), self-efficacy theory (BANDURA, 1977) and value-belief-norm theory (STERN et al., 1999; STERN, 2000). The present research uses the latter as the focal framework for two main reasons: (1) unlike other theories, it was designed specifically to understand the antecedents of pro-environmental behavior; (2) it is inclusive and combines elements of other conceptual frameworks, i.e. value theory (SCHWARTZ, 1992), norm-activation theory (SCHWARTZ, 1977) and the new ecological paradigm (DUNLAP et al., 2000).

Value-belief-norm (VBN) theory posits that pro-environmental action is the result of specific individual values, beliefs and personal norms. The model proposed is based on a causal chain that moves from relatively stable and central elements of personality (individual values) to more focused beliefs about human-environment relations (beliefs that environmental conditions threaten things valuable to an individual and that an individual can act on to reduce the threat), to personal norms (feelings of a moral obligation to perform a certain behavior) (STERN, 2000). According to Stern (2000), each variable of the causal chain has a direct impact on the next, but may also have a direct influence on other variables further downstream.

The focus of this review is on studies that have integrated green advertising with at least one of the VBN concepts.

2.3 METHOD

A systematic literature review is a structured and rigorous process for reviewing, synthesizing, and critically evaluating existing research on a particular topic (BOOTH; SUTTON; PAPAIOANNOU, 2016). One of the main goals of systematic literature reviews is to establish connections across a wide body of research, to identify research gaps and to develop an agenda for future research (BAUMEISTER; LEARY, 1997). In this way, reviews are often multidisciplinary with a research team composed of experts in different fields (BOOTH; SUTTON; PAPAIOANNOU, 2016). The systematic literature review method applied in this paper followed the recommendations of Paul and Criado (2020) and Booth, Sutton, and Papaioannou (2016).

In order to be systematic, a literature review must follow a research protocol involving several stages (BOOTH; SUTTON; PAPAIOANNOU, 2016; CAJAL et al., 2020). The protocol used in this review followed, with some adaptation, the same steps used by other review papers published in renowned journals on advertising and environmental sciences (e.g., ALVES; MARIANO, 2018; HAYES; HOLIDAY; PARK, 2022; LOOSE et al., 2022; WILSON, 2022) and also the PRISMA protocol (Preferred Reporting Items For Systematic Reviews And Meta Analysis) (MOHER et al., 2009).

2.3.1 Selection process

The first step was the selection of the databases. When conducting systematic reviews, rather than selecting a sample of journals, using academic databases to run keyword searches is generally recommended (MOHER et al., 2009). Academic databases tend to be more comprehensive and cover a wider range of journals, making it more likely to identify all of the relevant studies for the review. Searching more than one database is also recommended, as each database indexes a different set of journals (NEWMAN; GOUGH, 2020), with most reviews typically searching at least two electronic databases (NIHR, 2011). We chose Scopus and Web of Science (WoS), as they are identified as a reference (PAUL;

CRIADO, 2020) and are used in many review papers in the field (e.g. ALVES; MARIANO, 2018; HAYES; HOLIDAY; PARK, 2022; LOOSE et al., 2022; WILSON, 2022).

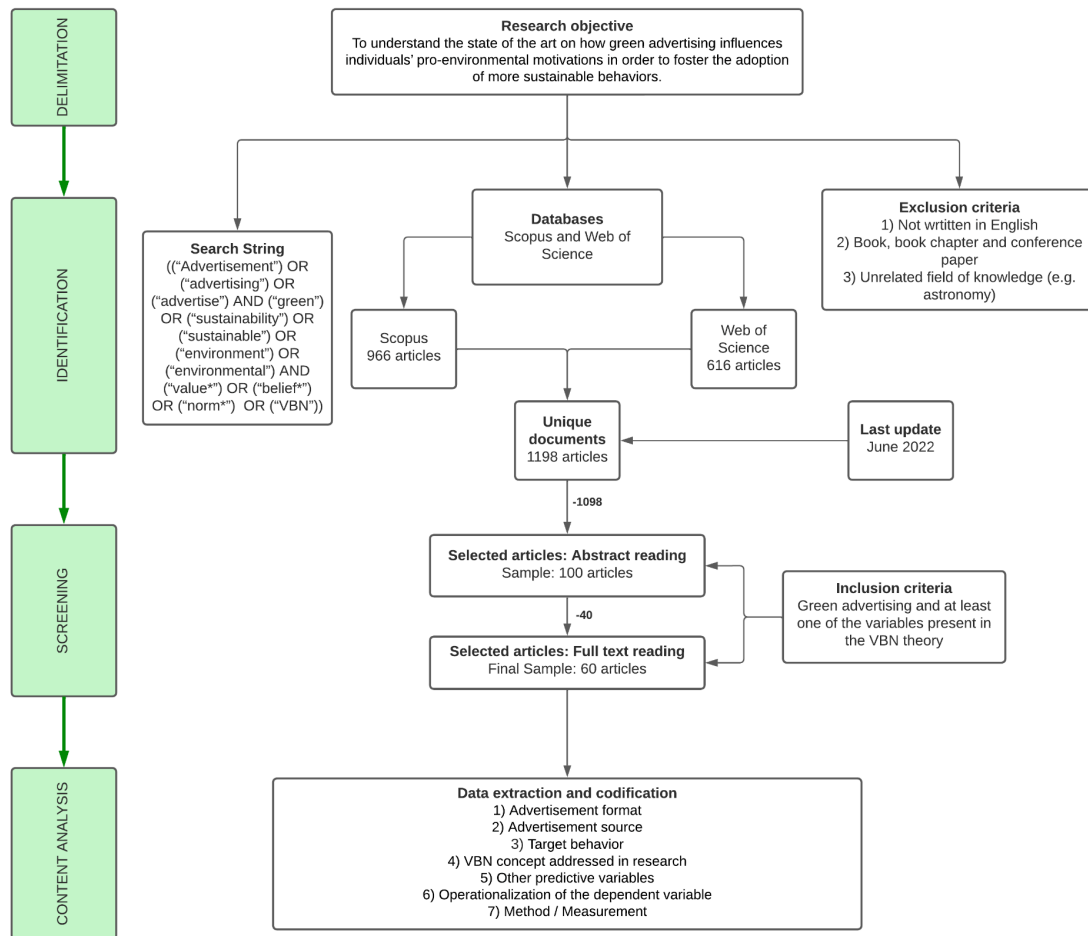
The second step consisted in selecting the appropriate keywords to use for the database search. Since the fundamental structure of this article relates to green advertisements and the VBN framework, we used keywords related to these areas in both databases. Words in the same column of the table were applied with an OR conjunction and were combined with the other columns using an AND conjunction. The keywords were sought in the titles, abstracts, and keywords of articles. The asterisk (*) serves as a wildcard operator. It indicates that any variation of that root word would be included in the search. In this way, the following string was used: ((“Advertisement”) OR (“advertising”) OR (“advertise”) AND (“green”) OR (“sustainability”) OR (“sustainable”) OR (“environment”) OR (“environmental”) AND (“value*”) OR (“belief*”) OR (“norm*”) OR (“VBN”)). The final search update was performed in June 2022.

To increase the integrity of the sample, we selected only articles written in English and which had been through a peer-review process. Furthermore, we applied filters related to subject areas of knowledge to find articles that fit better with the scope of our research (FERRAZ et al., 2021), such as business, communication, management, and economics. We found 966 articles in Scopus and 619 in WoS. After merging the samples and excluding the duplicates, we were left with a total of 1,198 articles.

The next step was reading the abstract of each article and selecting those related to the subject. In order to pass through this first filter, a given article should analyze at least one of the VBN concepts (individual values, belief, or personal norm) and be related to green advertising or another aspect of communication related to environmental sustainability. No restrictions were placed on the publication year or research method in the search. The articles ranged in publication date from 1968 to 2022; the oldest article that passed all the screening processes was published in 2006.

A total of 100 articles met the requirements of the aforementioned step and were subjected to a complete reading to analyze their content. This process dispensed with a further 39 articles, since they did not cover green advertising or one of the variables from the VBN as expected; the main reasons for exclusion were the consideration of social norms rather personal norms and using the word “value” with a different meaning than the psychological characteristic. The analysis later led to one further article, which was not clear about the methodology used, being discarded. This process resulted in a final sample of 60 articles. The review steps are represented in Figure 2.

Figure 3 - Systematic literature review flowchart



(Developed by the authors)

2.3.2 Coding scheme

Having thus obtained the articles for the final sample, we created a coding scheme (see Table 1). This classification is based on previous systematic reviews in advertising research (e.g., KNOLL, 2016) but was adapted to fit the dimensions of interest for this study. The categories were selected and discussed among the authors after initially reviewing the articles in the final sample. These categories include: the format of the advertisement, the source of the advertisement, the behavior targeted in the advertisement, the VBN concept addressed, other predictive variables, the operationalization of the dependent variable, the method of data collection, the country where the data was collected, and the main results of the study. Detailed subcategories can be found in Table 1.

Table 3 - Coding scheme

Coded dimensions	Categories
Advertisement format	Image
	Video
	Audio
	Text
	Other/ N/A
Advertisement source	Company
	Public agency
	NGO
	Other / N/A
Type of behavior promoted	Product choice/purchasing behaviors
	Non-purchasing behaviors (<i>recycling etc.</i>)
VBN concept addressed in research	Value (<i>individual or personal - not cultural</i>)
	Belief
	Norm (<i>personal or moral - not social</i>)
	VBN (<i>full model</i>)
Other predictive variables	Personal Capabilities
	Contextual Factors
	Information processing variables
	Affective variables

	Habits and past behavior
	Attitudes/preferences
	Behavior intention
Operationalization of the dependent variable	Actual observed behavior
	Simulated choice
	Self-declared behavior
	Questionnaire (<i>survey, experiment etc.</i>)
	Qualitative interviews (<i>individual interviews, focus groups</i>)
Method / Measurement	fMRI
	Observation
	Secondary data

Source: Developed by the authors

It should be noted that in the VBN classification we sometimes coded as beliefs variables that were not necessarily labeled as such in the papers mentioning them but that still referred to consumer perceptions rather than factual aspects (e.g. perceived barriers). The same is true for values when the authors refer to well-established value orientations such as altruism or materialism. The “other predictive variables” category was coded as contextual factors, social norms, cultural aspects, supportive policies, facilitating conditions (e.g. access to recycling bin) etc. The information processing variable was coded as any variable related to attention, understanding or acceptance of the message including attitude towards advertising and skepticism. Personal capabilities include individual variables such as personality traits, knowledge, green products familiarity, education, and income. This category was also checked if the authors mentioned, for instance, that data collection took place among young and educated consumers.

2.3.3 Intercoder reliability

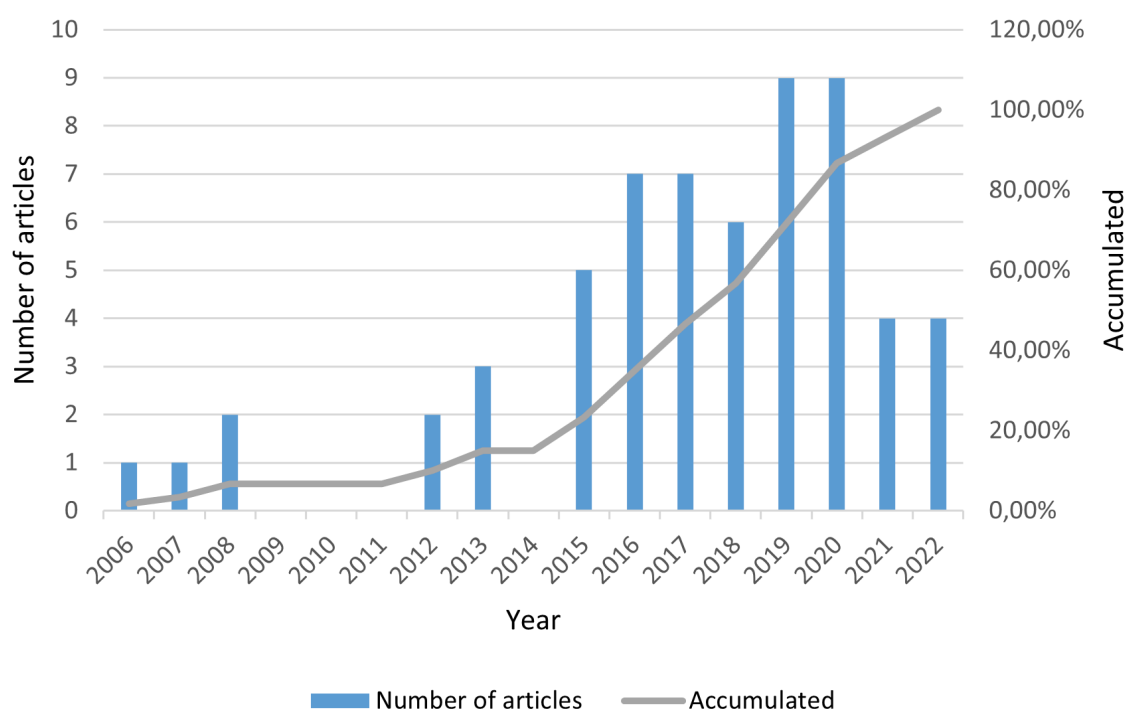
Based on this classification, the first author coded all the articles of the sample. In parallel, an external coder was trained for the purpose of the study. Previous research highlights the importance of using external coders who are not involved in the study as they tend to increase the objectivity of ratings and improve the validity of the results (e.g., COFIE; BRAUND; DALGARNO, 2022). It is usually considered acceptable to compute reliability coefficients either on a subset of the sample (e.g. a random 10%) or on a subset of the variables (MCHUGH, 2012). In this case, the external coder classified the whole sample based on the central characteristics of the studies including: target behavior promoted in the advertisement, VBN concept addressed in the research, and methodology used in the paper. The intercoder reliability test was conducted with the help of ReCal, an open-source tool (FREELON, 2010) and led to a mean Krippendorff's alpha of .643, with an average percentage agreement of 92% and an average number of disagreements of 4.7 out of 60. Since a coefficient of 0.60 or higher is generally considered to be a strong level of agreement (CICCHETTI, 1994; MCHUGH, 2012), these results are acceptable. Cases of disagreement or doubts were discussed with other co-authors leading to the final coding table.

2.4 RESULTS

2.4.1 Descriptive statistics

All of the articles selected were published between 2006 and 2022 (see figure 3) and the majority were published after 2015, reflecting an increase in research at the intersection of advertising and pro-environmental motivations.

Figure 4 - Number articles published per year at the intersection of green advertising and at least one of the VBN concepts



(Developed by the authors)

Looking at the journals where the articles were published (Table 2), one can note the diversity of disciplines involved. The topic of this systematic review being intrinsically multidisciplinary, this diversity is not surprising. Four categories of journals emerge. (1) Several of the articles in our sample are from advertising and communication journals, such as: *International Journal of Advertising*, *Journal of Advertising*, and *Journal of Current Issues & Research in Advertising*. (2) Other papers were published in consumer behavior and/or business studies journals, such as *Journal of Business Research*, *Journal of Consumer Marketing*, *Psychology & Marketing*, etc. (3) Another major category of journals specializes in sustainability issues, such as *Journal of Cleaner Production*, *Sustainability*, *Ecological Economics*, and *Waste management*. (4) Finally, A number of journal outlets are from other fields, such as psychology (e.g. *Journal of Experimental Psychology: Applied*), human resource management (e.g. *Personnel Psychology*); food studies (e.g. *British Food Journal*), Tourism & hospitality management (e.g. *International Journal of Contemporary Hospitality Management*) or neuroscience (e.g. *Social Neuroscience*).

Table 4 - Journal outlets ranked by number of articles published

Journal	Number of articles
<i>Journal of Consumer Marketing</i>	4
<i>Journal of Promotion Management</i>	4
<i>Environmental Communication</i>	3
<i>Journal of Cleaner Production</i>	3
<i>Marketing Intelligence & Planning</i>	3
<i>Sustainability</i>	3
<i>British Food Journal</i>	2
<i>International Journal of Advertising</i>	2
<i>International Journal of Contemporary Hospitality Management</i>	2
<i>Journal of Advertising</i>	2
<i>Journal of Marketing Communications</i>	2
<i>Social Responsibility Journal</i>	2
<i>Ecological Economics</i>	1
<i>Journal of Experimental Psychology: Applied</i>	1
<i>Journal of Brand Management</i>	1
<i>Journal of Business Research</i>	1
<i>Personnel Psychology</i>	1
<i>Psychology & Marketing</i>	1
<i>Waste Management</i>	1
Other	21

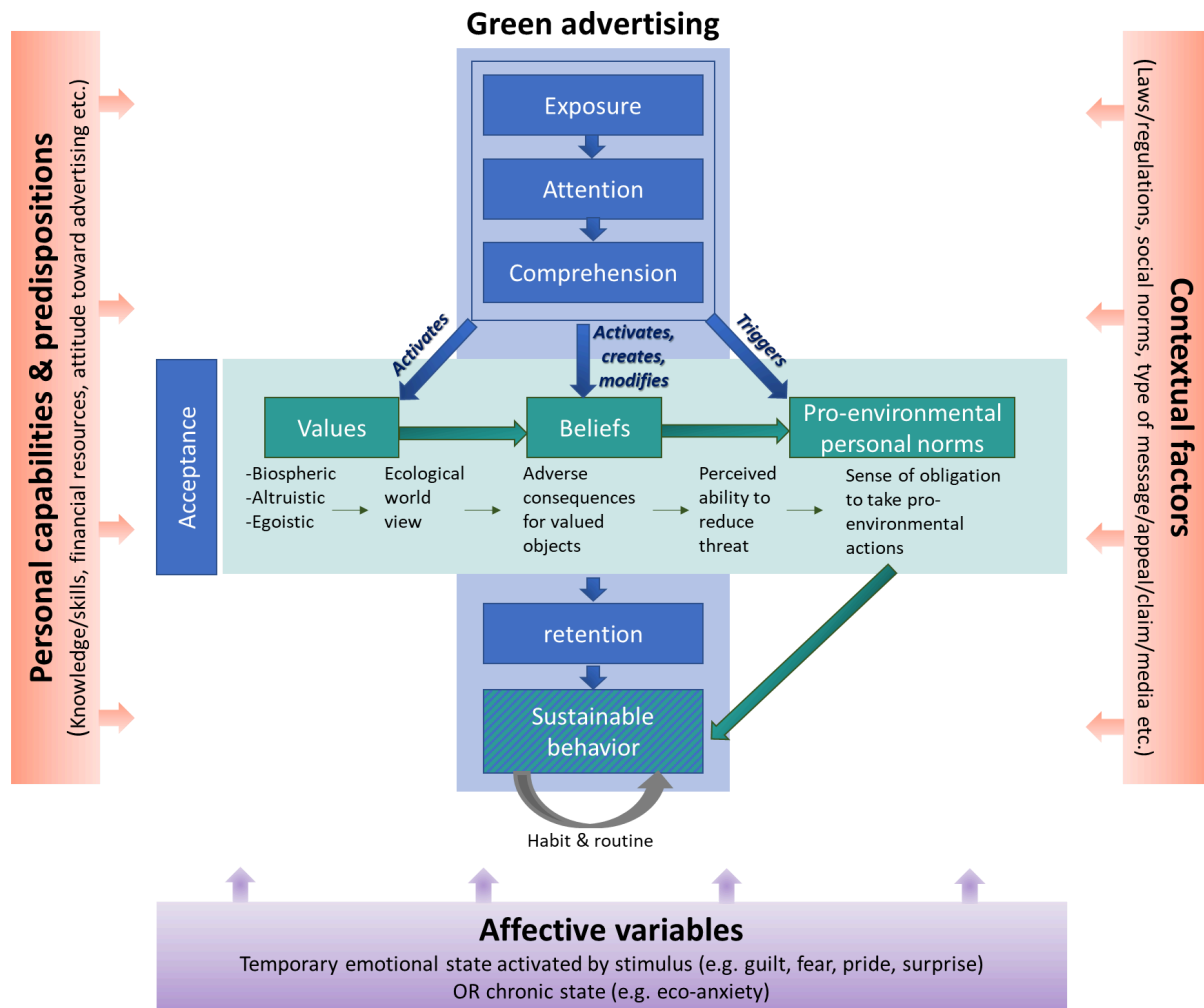
Source: Developed by the authors

Finally, it is interesting to note that 29 out the 60 papers reviewed are based on data collected in the United States. Of the others, 6 are based on data collected in India and 5 in China, the rest is split among various countries. Only three papers are based on cross-cultural data.

2.4.2 Organizing framework

In order to synthesize the processes relating green advertisements to sustainable behavior, we developed the conceptual framework presented in Figure 4. This integrative framework was designed based on a mixed deductive and inductive approach. The central core is a combination of VBN theory and information processing models for persuasive messages, which was established prior to data collection as a scheme for organizing our findings. All the other categories of variables emerged inductively from the reviewed literature.

Figure 5 - Suggested integrative framework for green advertising effectiveness combining information processing steps, VBN model, affective variables and potential moderators



Source: Developed by the authors

Considering that a predisposition to pro-environmental action can be influenced by information, green advertisements are likely to activate people's intrinsic motivations - individual values, beliefs, and personal norms - with the intention of promoting certain pro-environmental behavior. Figure 4 highlights different types of variables and paths. The steps in blue (center column) refer to the model of information processing for persuasive messages adapted from McGuire (1985). The variables in green (center row) refer to the value-belief-norm theory of environmentalism (STERN, 2000). In orange (left and right columns) are included potential moderators (internal and external factors) such as social norms (ELGAAIED-GAMBIER; MONNOT; RENIOU, 2018), personal capabilities (SAUNDERS; BARRINGTON; SRIDHARAN, 2015), and habits and past behaviors

(OUELLETTE; WOOD, 1998); while affective variables (HARTMANN; APAOLAZA-IBÁÑEZ, 2010) appear in purple (bottom row).

Other literature reviews on green advertising that have been published recently (e.g., RATHEE; MILFELD, 2023; SANTA; DREWS, 2023) have taken a perspective that is specific to advertising research, as they focus on predictors that are strictly related to the ad or message, such as ad context, source characteristics, message design, and verbal and nonverbal cues. While our framework includes these elements of the persuasion process, it also includes factors of intrinsic motivation as core elements of the framework. In fact, in the other reviews, individuals' intrinsic motivations are not central; they are considered as potential moderators, just like any other individual characteristics. Our perspective is different. Although we agree that some individual factors (which we here call individual capabilities) may play a moderator role and enhance or attenuate the effectiveness of the persuasion process, we also argue that intrinsic pro-environmental motivations, including values, beliefs, and personal norms, are more than conditional variables; they are central predictors of pro-environmental behavior. We suggest that the persuasion process of green advertising can only be effective if these intrinsic pro-environmental motivations are appropriately activated. As a result, researchers and practitioners in the field of sustainability advertising should consider these aspects more thoroughly.

Providing information to individuals has already been regarded as a way to increase PEB through the VBN perspective (STEG, 2016), which is regarded as one of the main theories to analyze PEB (STEG; VLEK, 2009). However, this topic was still not systematically reviewed in the green advertising literature. Moreover, recent reviews in advertising (GOLOB; PODNAR; ZABKAR, 2023; RATHEE; MILFELD, 2023) have reinforced the importance of increasing the number of different perspectives applied into green advertising, including the intersection with other areas of knowledge. Considering that one of the main goals of green advertising is to stimulate PEB through persuasive messages (GOLOB; PODNAR; ZABKAR, 2023), it seems reasonable to rely on one of the most important theories related to PEB to achieve this goal. Thus, the proposed framework contributes to the green advertising field by adapting a traditional model of information processing for persuasive messages (MCGUIRE, 1985) with specific elements related to PEB and the VBN perspective.

Next, we present how the constructs of the framework were conceptualized and how they are addressed in the literature. We also present research opportunities for each construct.

2.4.3 Exposure to green messages and type of green advertising

The sample studies addressed exposure to green advertising through different approaches. We distinguish between (a) those that presented a specific advertisement in the study, either to be shown to the target audience or to be analyzed by the authors; and (b) those which analyzed public receptivity, which usually measures past experience and the frequency of exposure to green advertising (e.g., YOON; KIM, 2016).

A precise assessment of the kind of advertisement used was not possible, since not all the sample papers were clear about the media assessed. We recommend that this aspect should be addressed in future studies of this type. Notwithstanding this observation, we are able to state that the majority of studies opted for images and texts, with a smaller number using videos or textual content without pictures. Casado-Aranda, Sánchez-Fernández, and Montoro-Ríos (2017) combined images with audio and found that male and female voices have different implications in relation to the gain or loss of frame in advertisements. The importance of this paper, and that of Vezich, Gunter and Lieberman (2017), lies in the use of fMRI images as a scientific method, which is a more objective information source than questionnaires. 50 of the papers from the sample used questionnaires as the instrument of research including surveys and experiments, while two of these also used fMRI brain images (CASADO-ARANDA; SÁNCHEZ-FERNÁNDEZ; MONTORO-RÍOS, 2017; VEZICH; GUNTER; LIEBERMAN, 2017) and one actually collected behavioral data (COZZIO; TOKARCHUK; MAURER, 2021) to present the results. The 10 remaining comprise three qualitative qualitative research papers including focus groups and individual interviews (ATKINSON; KIM, 2015; MILLER; LELLIS, 2016; OYEDELE; DEJONG, 2013), and eight content or semiotic analysis of advertisements (some papers used two methods). Future studies using fMRI images - or similar technologies - should be implemented, since brain images may reveal an opposite response to the results of questionnaires (VEZICH; GUNTER; LIEBERMAN, 2017).

Regardless of the type and purpose of an advertisement, in order to decipher or decode, and understand the message(s) contained, the interlocutor and receiver must share the same code. This is why some advertisements need to be adapted when they are targeted at a foreign audience: not only to respect societal, cultural, or religious aspects, but also to facilitate accessibility to the decoding of implicit advertising messages (FREIRE; LOUSSAÏEF, 2018; MINTON et al., 2012). Cross-cultural differences in consumer response

to green advertising have been noted in the literature, with significant variations in consumer motives and media habits observed across countries (MINTON et al., 2012).

The attention aspect has been little studied in the literature. Shen et al. (2020) measured ‘attentional blink’ in individuals watching green advertising. They found that more creative advertising led to higher attention, and that environment-related altruism orientation was related to attention level. Gotlieb (2019) included recognition of an advertisement but used it as a control variable. Future research should analyze how intrinsic green motivation is related to attention to and comprehension of the message.

Finally, although there is a growing literature on greenwashing (e.g., JOG; SINGHAL, 2020; NEUREITER; MATTHES, 2022), future research should further address this thorny issue in order to better identify the operationalization techniques that lead to an increased perception of greenwashing, and how it interacts with the intrinsic motivations of consumers with respect to environmental preservation.

2.4.4 Values, beliefs, norms and general pro-environmental motivations

The intrinsic motivation approach used in this research focuses on the concepts of individual values, beliefs, and personal norms which VBN theory identifies as the main antecedents of pro-environmental behaviors. According to VBN theory, pro-environmental behavior can be influenced by new information that modifies individual beliefs (STERN, 2000). This is convergent with the level of interest that this theory has received from the green marketing literature (GROENING; SARKIS; ZHU, 2018). Table 3 describes how the different studies addressed the VBN concepts and their connection to green advertising: 37 articles analyzed individual values, 24 analyzed beliefs, 5 analyzed personal norms, and only one article (JAHARI et al., 2022) considered the whole VBN framework.

Table 5 - Systematic summary of the articles reviewed

Article	Advertisement format	Advertisement source	Type of green behavior promoted	VBN concept addressed in the research	Other predictive variables	Operationalization of the dependent variable	Method / Measurement	Country	Main results
Atkinson and Kim (2015)	Image, Text, Video	Company	Product Choice/Purchasing Behavior	Beliefs, Norms	Information Processing Variable, Habits and Past Behavior, Personal Capabilities, Contextual Factors	Self-declared Behavior, Attitude/Preferences	Focus Group, Secondary Data	USA	Green-ad frames are common in certain sectors, but claims are often ambiguous and unsubstantiated. Green consumers are skeptical of these ads but ultimately accepting of the claims; they rationalize by amplifying the non-green claims.
Bailey, Mishra, and Tiamiyu (2016)	Image, Text	Company	Product Choice/Purchasing Behavior	Values	Information Processing Variable, Personal Capabilities, Habits and Past Behavior	Attitude/Preferences, Behavior Intention	Questionnaire	India	Green consumption values have a positive impact on attitude towards green advertising and its trustworthiness.
Bailey, Mishra, and Tiamiyu (2018)	Image, Text	Company	Non-purchasing Behavior (recycling)	Values	Information Processing Variable, Personal Capabilities, Habits and Past Behavior	Attitude/Preferences, Behavior Intention	Questionnaire	USA	Green consumption values influence the perceptions of trustworthiness in green communication, as well as attitude and behavior intention.

Bellman, Rask, and Varan (2019)	Video	Company	Product Choice/Purchasing Behavior	Beliefs	Information Processing Variable, Personal Capabilities	Attitude/Preferences, Behavior Intention	Questionnaire	USA	An unbranded entertainment campaign changed consumers' belief about the environment, nutrition, and gene technology.
Brushkova et al. (2018)	Video	Public Agency	Non-purchasing Behavior	Values	Contextual Factors	N/A	Secondary Data, Questionnaire (expert survey)	Russia	Social advertising videos promoting ecological values in Russia were found to be insufficient in number, in their coverage of ecological problems, and in quality. Their effectiveness can be improved by focusing on local issues.
Bullock et al. (2017)	Image, Text	Company	Product Choice/Purchasing Behavior	Values	Personal Capabilities	Simulated Choice	Questionnaire	USA	The higher influence of green advertising was on values more related to individuals and the well-being of their families.
Casado-Aranda et al. (2017)	Audio, Image	Company	Product Choice/Purchasing Behavior	Values	Affective Variable, Information Processing Variable	Attitude/Preferences, Behavior Intention	fMRI, Questionnaire	Spain	The same region of the brain related to personal values is more influenced by green advertising using a female voice and presenting a loss frame appeal.
Cheng et al. (2020)	N/A	Company	Product Choice/Purchasing Behavior	Values	Information Processing Variable, Habits and Past Behavior, Personal Capabilities	Self-declared Behavior	Questionnaire	Taiwan	Hedonic values influence green advertising involvement positively while utilitarian values influence it negatively.
Cozzio, Tokarchuk	Text	Company	Non-purchasing Private Sphere	Values	N/A	Actual Observed Behavior	Observation	Italy	Messages conveying altruistic values increase the adoption of

and Maurer (2021)			Behavior (Food waste)						sustainable behavior in an all you can eat buffet.
do Paço, Shiel, and Alves (2019)	N/A	Company	Product Choice/Purchasing Behavior	Values	Information Processing Variable, Habits and Past Behavior, Contextual Factors, Personal Capabilities	Self-declared Behavior	Questionnaire	UK & Portugal	Green values are positively related to the receptivity of green advertising and buying behavior.
Fernando, Sivakumaran, and Suganthi (2016)	Text	Company	Product Choice/Purchasing Behavior	Belief	Affective Variable, Information Processing Variable, Personal Capabilities	Attitude/Preferences	Questionnaire	India	Fear and response efficacy increase message involvement which in turn predicts attitudes toward an advertisement.
Freire and Loussaïef (2018)	Image, Text	Company	Product Choice/Purchasing Behavior	Values	Contextual Factors	N/A	Secondary Data	France	Brands use green advertising to promote their corporate social responsibility indirectly
Gaither and Gaither (2016)	Audio, Image, Text, Video	Company	N/A	Norms	Contextual Factors	N/A	Secondary Data	USA	Industry trade groups (coal and petroleum) use the narratives of distraction and appropriation of US cultural values in order to enhance support for their industries and reduce concern for climate initiatives

Gaither and Synclair (2018)	Video	Company	Product Choice/Purchasing Behavior	Values, Beliefs	Personal Capabilities, Information Processing Variables, Affective Variables	Attitude/Preferences	Questionnaire	USA	Contrary to expectations, environmental concern increases the effectiveness of environmental advocacy campaigns sponsored by companies in polluting industries by strengthening audience identification with the values portrayed in an ad and their perceptions of shared values with the advertiser.
Gotlieb (2019)	Image, Text	Other (university)	Product Choice / Purchasing Behavior	Values	Contextual Factor, Information Processing Variable, Personal Capabilities	Behavior Intention	Questionnaire	USA	Targeting value-expressive needs increases desire and action for eco-friendly products, while targeting less internalized sources only increases desire.
Gully et al. (2013)	Text	Company	Non-purchasing Behavior (Applying for a job)	Values	Contextual Factors	Attitude/Preferences, Behavior Intention	Questionnaire	USA	Recruitment information about an organization's values can affect job seekers' intentions to pursue a job with the organization, depending on the job seekers' desire for impact through work.
Jahari et al. (2022)	N/A	Other (university)	Product Choice/Purchasing Behavior & Non-purchasing Behavior	VBN (full model)	Information Processing Variable, Personal Capabilities, Habits and Past Behavior	Self-declared Behavior, Attitude/Preferences	Questionnaire	Malaysia	Personal norms alone and also following attribution of responsibility mediate the influence of campus advertising on pro-environmental behavior intention.

Jaiswal et al. (2020)	N/A	Company	Product Choice/Purchasing Behavior	Belief	Habits and Past Behavior, Personal Capabilities, Information Processing Variable	Behavior Intention, Self-declared Behavior	Questionnaire	India	Higher levels of these beliefs were related to higher levels of attitudes toward green advertising.
Jog and Shingal (2020)	N/A	Company	Product Choice/Purchasing Behavior	Norms, Beliefs	Information Processing Variable, Personal Capabilities	Self-declared Behavior, Attitude/Preferences	Questionnaire	India	An understanding of Greenwashing moderates the relationship between receptivity to green advertising and green purchase behavior.
Kim and Yoon (2017)	N/A	Company	Product Choice/Purchasing Behavior	Belief	Information Processing Variable, Contextual Factors, Habits and Past Behavior, Personal Capabilities, Affective Variables	Self-declared Behavior, Attitude/Preferences, Behavior Intention	Questionnaire	South Korea	Perceived benefit was positively related to attitude toward green advertising.
Kurisu et al. (2019)	Video	Public Agency	Non-purchasing Behavior	Belief	Affective Variables, Contextual Factors, Information Processing Variable, Personal Capabilities	Behavior Intention	Questionnaire	Japan	Videos with simple communication modes are more effective to enhance people's attitudes and intention to adopt green behavior. Beliefs about the effectiveness and feasibility of the solutions to fight global warming predict behavioral intentions.

Lawson (2013)	Image, Text	Company	Product Choice/Purchasing Behavior	Values	Contextual Factor, Personal Capabilities	N/A	Secondary Data	China	Real estate advertisements in China reflect economic expansion rather than sustainability; it may take time for demand to shift in response to representations of eco-cities.
Lee and Haley (2022)	N/A	Company	Product Choice/Purchasing Behavior & Non-purchasing Behavior	Values	Information Processing Variable, Habits and Past Behavior, Personal Capabilities, Contextual Factors	Attitude/Preferences, Reported Behavior	Questionnaire	USA	Consumers with strong environmental motivations have express knowledge of pro-environmental products, use more of them, tend to have less skepticism, and more positive attitudes toward green advertising.
Lee, Haley, and Yang (2019)	Image, Text	Company	Non-purchasing Private Sphere Behavior (recycling)	Values, Beliefs	Personal Capabilities, Contextual Factors	Attitude/Preferences, Behavior Intention	Questionnaire	USA	Consumer perceptions of the sponsoring organization, self-efficacy, and perceived effectiveness in complying with the advocated issue (recycling) impact advocacy advertising goals (attitude and intention).
Li and Cui (2021)	Image, Text	Company	Product Choice/Purchasing Behavior	Values, Beliefs	Affective Variables, Contextual Factors	Behavior Intention	Questionnaire	China	Consumers with high face consciousness (desire to enhance/maintain facial appearance) are more willing to buy organic food, especially in a group situation and when the advertising appeal is altruistic (vs. egoistic).
Li, Yang and Liu (2021)	Image, Text	Company	Product Choice/Purchasing Behavior	Norms	Personal Capabilities	Behavior Intention	Questionnaire	China	Negative frames are more effective in convincing consumers to purchase

recycling-aiding products than positive frames.

Social marketing campaigns that address global warming and climate change are transformed into commercial messages through the use of parody.

Advertising for home-sharing services that emphasizes environmental benefits can effectively encourage its adoption, with utilitarian-oriented consumers responding well to hard-sell appeals and hedonic-oriented consumers to soft-sell appeals.

Consumer persuasion, knowledge, and environmental worldview influence their attribution of firm motives in ambiguous ads, which impact attitudes towards the ad and brand and information-seeking intentions.

Addressing consumers' worldview beliefs in brand CSR communications can offset the influence of trait skepticism and impact brand attitudes.

Linder (2006)	Audio, Image, Text, Video	Company, Public Agency, NGO	Product Choice/Purchasing Behavior & Non-purchasing Behavior	Values	Affective Variables, Personal Capabilities, Contextual Factors	N/A	Secondary Data	N/A	
Liu et al. (2019)	Image, Text	Company	Product Choice/Purchasing Behavior	Values	Information Processing Variable, Habits and Past Behavior, Personal Capabilities, Affective Variables	Behavior Intention	Questionnaire	USA	
Magee (2019)	Image, Text	Company	Non-purchasing behavior (visit website and WoM)	Belief	Information Processing Variable, Personal Capabilities	Attitude/Preferences, Behavior Intention	Questionnaire	USA	
Magee (2022)	Text	Company	Non-purchasing behavior (visit website and WoM)	Belief	Information Processing Variable, Personal Capabilities	Attitude/Preferences, Behavior Intention	Questionnaire	USA	

Mandliya, Varyani, Hassan, Akhouri and Pandey (2020)	N/A	Company	Product Choice/Purchasing Behavior	Values	Information Processing Variable, Personal Capabilities	Behavior Intention	Questionnaire	India	Individualistic materialism moderates the mediation role of green advertising between consumer attitude toward sustainability and purchase intention.
Miller and Lellis (2016)	Video	Company	N/A	Values	Personal Capabilities, Contextual Factors	Attitude/Preferences	Focus Group	USA	Impact of values-based environmental advocacy messages by the fossil fuel industry on audience response and identification with instrumental and terminal values.
Minton et al. (2012)	Other	Company	Product Choice / Purchasing Behavior, Activism/ Donations/ Volunteering, Non-purchasing Private Sphere Behavior	Values	Information Processing Variable, Contextual Factors, Habits and Behavior	Attitude/Preferences, Reported Behavior	Questionnaire	USA, Germany & South Korea	There are cross-cultural differences in consumer responses to green advertising, with significant variations in consumer motives and media habits observed across countries.
Muralidharan and Sheehan (2017)	Image, Text	Public Agency	Non-purchasing Behavior (bringing reusable bags for shopping)	Values	Information Processing Variable, Personal Capabilities, Contextual Factors	Attitude/Preferences, Behavior Intention	Questionnaire	USA	High self-transcendent individuals are more environmentally conscious and, overall, a penalty framed as a tax (vs. fee) is more effective.
Mydock III et al. (2018)	Image, Text	Company	Product Choice / Purchasing Behavior	Belief	Information Processing Variable, Personal Capabilities,	Attitude/Preferences, Behavior Intention	Questionnaire	Australia	Consumers have a positive attitude toward products promoted as made using renewable energy. Future temporal orientation is a central predictor.

Nekmahmud and Fekete-Farkas (2020)	N/A	Company	Product Choice / Purchasing Behavior	Belief	Contextual Factors Information Processing Variable, Personal Capabilities, Habits and Past Behaviors	Reported Behavior, Behavior Intention	Questionnaire	Bangladesh	Both the belief about the benefits and the future evaluation of green marketing are related to green behavior consumption.
Osburg et al. (2019)	N/A (ethical advertising in general)	Company	Product Choice / Purchasing Behavior	Values	Information Processing Variable, Personal Capabilities	Behavior Intention	Questionnaire	USA	Altruistic and biospheric values are positively related to higher trust in ethical advertising and in behavior intention, while egoistic value is negatively related.
Oyedele and Dejong (2013)	Video	Company	Product Choice / Purchasing Behavior	Values	Personal Capabilities, Information Processing Variable, Affective Variables, Contextual Factors	Attitude/Preferences	Qualitative Interviews	USA	Consumers interpret green advertisements as focusing on convenient, minor green activities rather than sustainable ones, and they often reflect anthropocentric rather than eco-centric values.
Pickett-Baker and Ozaki (2008)	N/A	Company	Product Choice / Purchasing Behavior	Belief	Information Processing Variable, Personal Capabilities, Habits and Past Behaviors, Contextual Factors	Reported Behavior	Questionnaire	UK	Female consumer confidence in the performance of green products is correlated with their general pro-environmental beliefs. However, consumers cannot easily identify greener products (apart from cleaning products).

Pudaruth, Juwaheer, Seewoo (2015)	N/A	Company	Product Choice / Purchasing Behavior	Belief	Information Processing Variable, Personal Capabilities, Contextual Factors, Habits and Past Behaviors	Reported Behavior	Questionnaire	Mauritius	The purchasing of eco-friendly cosmetics is influenced by a combination of factors, with the behavioral intention and referral of female customers primarily driven by "women's lifestyles, self-image, health and economic conditions".
Rahman, Park, and Chi (2015)	Text, Other	Company	Product Choice/Purchasing Behavior & Non-purchasing Behavior	Norms	Personal Capabilities, Information Processing Variable	Behavior Intention	Questionnaire	USA	Hotel environmental claims that have an ulterior motive lead to consumer skepticism, which negatively affects the intention to participate in a linen reuse program and the intention to revisit the hotel, with skepticism partially mediating these relationships.
Raska, Nichols, and Shaw (2015)	Text	Company	Product Choice / Purchasing Behavior	Belief	Personal Capabilities, Contextual Factors, Information Processing Variable	Attitude/Preferences, Behavior Intention	Questionnaire	USA	Descriptive norm cues in green advertising for large grocery chains can activate consumer perceptions of deceptive intent, leading to negative attitudes and lower green buying intentions.
Reich and Soule (2016)	Image, Text	Company	Product Choice / Purchasing Behavior	Values	Information Processing Variable, Habits and Past Behavior, Personal Capabilities	Attitude/Preferences	Questionnaire	USA	In the context of product advertising, consumer attitudes to green ads are more favorable than those for green demarketing ads ('buy less'), mediated by greater inferences of genuine environmental concern. In the context of institutional ads, demarketing ads are preferred.

Rizzi, Gusmerotti and Frey (2020)	Image, Text	Company (cooperative)	Product Choice / Purchasing Behavior	Values	Affective Variables, Information Processing Variable, Personal Capabilities, Habits and Past Behavior	Self-declared Behavior, Behavior Intention	Questionnaire	Italy	The effect of communitarian values disclosed on green advertising on perceived brand attitudes.
Schwartz et al. (2015)	Text	Company	Non-purchasing Behavior	Belief	Contextual Factors, Personal Capabilities, Information Processing Variable	Behavior Intention	Questionnaire	USA	Emphasizing monetary benefits in advertisements for energy-saving programs reduces willingness to enroll and shifts attention away from environmental concerns, even when environmental benefits are also emphasized.
Sethi, Tandon, and Dutta (2018)	N/A	Company	Product Choice / Purchasing Behavior	Belief	Information Processing Variable, Contextual Factors, Habits and Past Behavior, Personal Capabilities	Self-declared Behavior, Behavior Intention	Questionnaire	India	Environmental concern, green advertising and perceived quality positively affect attitude towards green products, which leads to purchase intention.
Shen et al. (2020)	Video	Not mentioned	Non-purchasing Behavior	Values, Beliefs	Information Processing Variable, Personal Capabilities, Affective Variables,	Self-declared Behavior	Questionnaire, Other (Rapid serial visual presentation)	China	Environmental advertising elicits a significant attentional blink effect, indicating a higher level of selective attention. This effect is stronger for creative advertisements and for individuals with high

					Habits and Past Behavior				environment-related altruistic values.
Sheoran and Kumar (2020)	N/A	Company	Product Choice / Purchasing Behavior	Values	Information Processing Variable, Contextual Factors, Habits and Past Behavior, Personal Capabilities	Self-declared Behavior	Secondary data (literature review), Questionnaire	N/A	Fourteen key enablers of sustainable consumer behavior were identified (e.g. green advertising, eco-labeling, moral values, education etc.).
Silva et al. (2020)	N/A	Company	Product Choice / Purchasing Behavior	Values	Information Processing Variable, Personal Capabilities, Contextual Factors	Attitude/Preferences, Behavior Intention	Questionnaire	France & Brazil	In France, green skepticism is associated with greater intentions to make green purchases, while in Brazil green skepticism is associated with greater suspicion and distance from companies' claims.
Song and Kim (2019)	Image, Video	Company	Product Choice / Purchasing Behavior	Values	Affective Variables, Habits and Past Behavior, Personal Capabilities	Attitude/Preferences, Behavior Intention	Questionnaire	USA	Impure altruism (duality of altruistic and egoistic warmth) leads to the intention to purchase green products and can be promoted through "feel-good" marketing strategies.
Spears and Germain (2007)	Image, Text	Company	N/A	Values	Affective Variables, Contextual Factors	N/A	Secondary Data	USA	Advertising changed from self-focused values to values more focused on society.

Stadlthanner et al. (2022)	Image, Text	Company	Product Choice / Purchasing Behavior	Values	Habits and Past Behavior, Information Processing Variable, Personal Capabilities	Attitude Towards the Cause and the Brand, Behavior Intention	Questionnaire	USA	Gain-framed messages are more effective at increasing cause involvement in consumers, with CSR skepticism and biospheric values moderating the relationship. In turn cause involvement improves consumer attitudes towards the cause and the company promoting it.
Vermeir and Verbeke (2008)	Image, Text	Company	Product Choice / Purchasing Behavior	Values, Beliefs	Contextual Factors, Personal Capabilities	Behavior Intention	Questionnaire	Belgium	Attitudes, perceived social influences, perceived consumer effectiveness, and perceived availability are key determinants of sustainable food consumption among young adults in Belgium, with the strength of these determinants varying based on levels of confidence and value orientation.
Vezich et al. (2017)	Image, Text	Company	Product Choice / Purchasing Behavior	Values	Personal Capabilities	Attitude/Preferences	fMRI, Questionnaire	USA	Consumers show greater activation in brain regions associated with personal value and reward in response to standard ads compared to green ads, and this activity is correlated with reported liking of the ads, while self-reported evaluations of green ads may be influenced by social desirability concerns and not reflect actual purchase behavior.
Wang et al. (2017)	Audio, Video	Company	Product Choice / Purchasing Behavior	Values	Affective Variables, Contextual Factors,	Attitude/Preferences, Behavior Intention	Questionnaire	China	Attitude toward the ad and perceived value mediate the relationship between emotional

					Information Processing Variable, Personal Capabilities				green appeals and purchase intention.
Wei et al. (2017)	N/A	Company	Product Choice / Purchasing Behavior	Values	Information Processing Variable, Habits and Past Behavior, Personal Capabilities	Self-declared Behavior, Attitude/Preferences, Behavior Intention	Questionnaire	Taiwan	The influence of environmental involvement (based on individuals' needs and values), green advertising skepticism and other variables on behavior intention.
Wilson et al. (2021)	Image, Text	NGO	Non-purchasing behavior (visitation to an NGO campaign's website)	Belief	Information Processing Variable, Contextual Factors, Personal Capabilities, Affective Variables	Self-declared Behavior, Attitude/Preferences	Questionnaire, observation	USA	Transit advertising campaign to educate commuters about climate change changed people's beliefs, increasing optimism about climate change mitigation, and driving commuters to the website.
Yan, Hyllegard, and Blaesi (2012)	Image, Text	Company	Product Choice / Purchasing Behavior	Belief	Information Processing Variables, Personal Capabilities, Contextual Factors, Habits and Past Behavior	Attitude/Preferences, Behavior Intention	Questionnaire	USA	Consumers form positive attitudes toward clothing brands when the ad contains explicit environmental cues. Attitude towards brand, subjective norm, attitude toward ad, eco-fashion involvement and environmental commitment predict intention to purchase an environmentally friendly apparel brand.

Yoon and Kim (2016)	N/A	Company	Product Choice / Purchasing Behavior	Belief	Information Processing Variable, Personal Capabilities, Contextual Factors, Affective Variables, Habits and Past Behavior	Self-declared Behavior, Attitude/Preferences, Behavior Intention	Questionnaire	USA	Response-efficacy, eco-centric/anthropocentric attitudes, green product purchase frequency, and past green product attitude significantly predict green advertising attitude and behavioral intention.
Zanon and Teichmann (2016)	Text	Other (Expert vs. Blogger)	Product Choice / Purchasing Behavior	Values	Contextual Factors, Affective Variables, Habits and Past Behavior, Personal Capabilities	Behavior Intention	Questionnaire	N/A	Advertising appeals, message source and social norms predict the effectiveness of eco-accommodation advertisements.

Source: Developed by the authors

Looking at the decision-making process of individuals, De Groot and Steg (2007) proposed that making values more salient affects the way people prioritize their values in specific situations and consequently the extent to which different values influence beliefs, intentions, and behavior. The introduction of new information might indeed change the cognitive base of the factors influencing behavior (AJZEN, 1991; BAMBERG; AJZEN; SCHMIDT, 2003). This is why researchers have begun to focus on the role of value activation in the context of purchasing products with environmental attributes (BULLOCK; JOHNSON; SOUTHWELL, 2017) and why the association between pro-environmental behavior and value orientation is a growing field, especially in green advertisements (HE et al., 2019).

In general, the findings of our sample papers point to the importance of considering intrinsic motivation in green advertising strategies. Osburg et al. (2019) emphasize that consumer values determine the level of receptiveness to ethical advertising which in turn affects consumer willingness to purchase ethical products. Companies which succeed in reaching target audience values through their communication may thus influence target audience action or inaction (MILLER; LELLIS, 2016).

In particular, Yoon and Kim (2016) found that egocentric and anthropocenic views have a positive relationship with green attitude. Pickett-Baker and Ozaki (2008) also suggest that consumers with pro-environmental values are more likely to believe that green products will perform as advertised, whilst the majority of consumers tend to be skeptical toward the performance of green products.

Among other values, researchers addressed self-transcendence and self-enhancement orientations. Individuals with high self-transcendence values have a more positive attitude toward green advertising (MURALIDHARAN; SHEEHAN, 2017). However, according to Bullock, Johnson and Southwell (2017) advertisements designed to activate self-transcendent biospheric or altruistic values were not significantly more effective than conservation-related values. The authors conclude that self-transcendent values may already be naturally activated in the decision-making process of choosing green products, and suggest that advertisements should stimulate other value types to reach a wider audience, such as conservation and self-enhancement values, in particular related to health preservation (BULLOCK; JOHNSON; SOUTHWELL, 2017). This is in line with Song and Kim (2019) who highlight the importance of including egoistic values in sustainable messages. However, this is inconsistent with Gotlieb's (2019) findings, which suggest that when a product is advertised

through self-enhancement, social-approval needs motivate greater purchase intention but not willingness to pay.

Overall, it appears that intrinsic pro-environmental motivations (captured here through VBN constructs) play a central role in the persuasive process from exposure to the green message to pro-environmental intention and action. Li, Yang and Liu (2021) found that values and personal norms mediate the effect of green advertising on pro-environmental behavior.

Future studies should more adequately consider what constitutes consumer values, since this term has sometimes been vaguely presented or expressed in a general way. Since advertising aims to encourage intrinsic consumer motivation, such as individual values, understanding what kind of value theory is being considered in a research study is fundamental. The majority of the studies relied on values followed by beliefs, with a lower presence of personal norms, and therefore should be further explored considering that, according to the VBN framework, personal norms are the closest, most direct antecedent to pro-environmental behavior.

2.4.5 THE ROLE OF INDIVIDUAL CAPABILITIES

In order to increase a message's effectiveness, the desired behavior must be perceived as feasible, since people engage more in practices which are demonstrably easy to perform (KURISU; KIMURA; HANAKI, 2019). In this context, personal capabilities are usually an explicative variable of pro-environmental behavior, but can also interact with values, beliefs and norms. These capabilities include the knowledge and skills required for particular actions, the availability of time to act, and general abilities and resources such as literacy, money, and social status. Therefore, socio-demographic variables such as age, education, gender and income are generally used as indicators or proxies for personal capabilities (BLANKENBERG; ALHUSEN, 2019; OYEDELE; DEJONG, 2013).

Younger people appear to be more favorable to information presented in advertising while older people are more skeptical. On the other hand, young people generally have fewer financial resources (YOON; KIM, 2016). Wilson et al. (2021) found that people with lower levels of education more frequently accessed a website presented in climate change advertising, which indicates that these individuals were seeking more information on the issue. The authors recognized the importance of this, in that seeing advertisements more often could affect beliefs about climate change. Bullock, Johnson and Southwell (2017) also found

that their stimulus activation was more effective for individuals over 40 years old who lacked a college education and did not identify as liberals. Different target audiences, therefore, require different advertising approaches. These findings indicate that personal capabilities, such as age, education and political ideals need to be considered together with value orientation.

Beyond socio-demographics, other internal variables include perceived consumer effectiveness and self-efficacy. Both are positively related to behavior intention and attitudes toward advertising. Thus, it is not only the feeling of the capability to execute an action, but also the belief that a given personal action will make a difference (CHENG; CHANG; LEE, 2020; KIM; YOON, 2017; VERMEIR; VERBEKE 2008). Without appropriate education and scientific knowledge, merely advocating environmental concern may in fact jeopardize pro-environmental efforts, since individuals lacking fundamental and critical knowledge may be influenced by greenwashing, which may be the result of ‘wanting to believe’ in an environmental improvement (GAITHER; SINCLAIR, 2018).

Although 50 papers out of 60 included aspects related to personal capabilities, not all of them analyzed the topic in depth in their results and discussions. Socio-demographic elements seem to be the most controversial factors. Therefore, we propose the inclusion of the capability approach in order to expand the socio-demographic factors within the freedom scope. The capability approach was proposed by Sen (2010) as an alternative means to evaluate development, considering individuals’ freedoms rather than only economic aspects. According to Sen, capabilities are the set of choices and opportunities an individual has and functionings are their materialization (SEN, 2010). Sen (2013) posits the agency aspect of the capability approach in which individuals, once provided with essential capabilities, can act as agents of change, in such a way that they can improve their lives and the environment around them. Past research has already related the capability approach to sustainable behavior (LESSMANN; MASSON, 2015; SEN, 2013). More studies from this perspective are needed to assess the role of consumer autonomy. Of particular interest here is how personal capability affects the whole central flow of our framework, and how it interacts with green advertising and intrinsic motivation to lead eventually to sustainable behavior and habits.

2.4.6 The role of contextual factors

In the proposed framework, contextual factors refer to external factors such as social norms (CIALDINI; RENO; KALLGREN, 1990; ELGAAIED-GAMBIER; MONNOT; RENIOU, 2018), cultural context and cultural values (SCHWARTZ, 1992; SCHWARTZ et al., 2012), and more broadly environment, infrastructure, and regulations (STERN, 2000). Considering intrinsic motivation together with these extrinsic aspects may be a way to improve green advertising effectiveness (FOWLER III; CLOSE, 2012).

Contextual factors, both in favor of or against a given promoted behavior, play a crucial role (STERN, 2000) and are even identified as one of the reasons for the intention-behavior gap (ELHAFFAR, DURIF; DUBÉ, 2020), as some factors influencing pro-environmental behavior are external to an individual, for example, physical infrastructure and product availability (STEG; VLEK, 2009). However, as explained by Stern (2000), contextual factors can affect individuals in different ways, according to their values and beliefs. A higher price, for example, may be considered either a barrier or a premium product. In this way, the mix of products offered in the market affects pro-environmental behavior, since consumers compare different product attributes.

Social contextual factors are another common aspect addressed in the literature (ELHAFFAR; DURIF; DUBÉ, 2020). It is acknowledged that social norms have a strong influence on pro-environmental behavior (STEG; VLEK, 2009). Consistently, social norm appeals were shown to positively influence pro-environmental behavior (ELGAAIED-GAMBIER; MONNOT; RENIOU, 2018; HE et al., 2019; RIZZI, GUSMEROTTI; FREY, 2020).

Conversely, when a society does not encourage a sustainable lifestyle, it acts as a barrier to the adoption of pro-environmental behavior (ELHAFFAR; DURIF; DUBÉ, 2020). Contextual elements, such as normative orientations toward the self (more egoistic) or others (more altruistic) influence the receptivity and effectiveness of advertisements (WHITE; PELOZA, 2009). In this way, cultural values (e.g. individualistic and collectivist) also have an influence on pro-environmental behavior. Therefore, contextual factors might affect the whole central flow of the framework (Figure 4).

Contextual factors were less covered than personal capabilities in the studies sampled (31 papers). Cultural background was an important element in this regard. Yoon and Kim (2016) and Kim and Yoon (2017), for example, carried out similar studies in two different cultures (United States and South Korea), and found a common relationship between attitudes

to green advertisements as a predictor of green behavior. Other predictive factors, however, were different. While North Americans were more influenced by perceived severity, efficacy and social norms, South-Koreans were more influenced by improved health, and financial and social benefits related to behavior. Moreover, based on the differences found in Germany, South-Korea and the United States, Minton et al. (2012) suggests that marketing communication needs to apply its strategies according to location: in a more collectivistic culture, there is a higher intention to act in a sustainable fashion. Since performing research in different countries and cultures may be more demanding, approximations regarding collectivistic and individualistic cultures may be useful.

The topic of social norms was the most prevailing aspect, which can be explained by its high influence in converting information into behavioral intention. Some papers identified a relationship between types of social norms and advertising appeal. Zanon and Teichmann (2016) identified that descriptive norms fit better with rational appeals framed by an expert source, while injunctive norms are more effective with emotional appeals framed by a blogger and have a greater effect on individuals with greener values. The former demonstrates higher behavior intention and the latter higher perceived emotional value. Injunctive norm messages perform better with high green consumption values, while descriptive norms fit better with low green consumption values. That is, for individuals with higher environmental intrinsic motivations, the presence of the right thing to do (e.g. injunctive norm) has a greater influence, while for individuals with lower environmental intrinsic motivations, what the majority of people (e.g. descriptive norm) are doing has more influence (ZANON; TEICHMANN, 2016). Raska, Nichols, and Shaw (2015) found that green advertising without descriptive norms led to higher behavior intentions than advertising with descriptive norms. The authors suggest that this happens because the descriptive norm might activate consumers' beliefs about the intention of advertisers to enhance consumers' skepticism about green advertising. This can happen, for example, by combining the two existing types of social norms with different types of message appeal, whether they be rational or emotional (HE et al., 2019).

2.4.7 The role of affective variables

The studies of our sample that include the role of affective variables usually involve emotional appeals as stimuli. Only one study (YOON; KIM, 2016) focusing on public receptivity - as independent from emotional appeals - found that the positive evaluations of

an advertisement (e.g. enjoyable, pleasing, not irritating) are relevant to fostering behavioral intention.

The use of emotional appeals is common in green advertising (GAITHER; GAITHER, 2016; LINDER, 2006; OYEDELE; DEJONG, 2013). Wang et al. (2017) discovered, for instance, that guilt appeals are related to higher pro-environmental behavior intention than pride appeals. However, as Oyedele and Dejong (2013) found, such appeals should be used cautiously in anthropocentric-based advertisements where consumers may not like the suggestion that they are responsible for environmental problems - guilt appeals - nor being overwhelmed by fear appeals, where they are made to feel bad about their actions when they already know that their behavior is not perfect.

It is interesting to note that individuals react differently to emotional appeals in green advertising depending on their profile and predisposition. Liu, Yuen, and Jiang (2019) found that communication with emotional elements works better for individuals with higher hedonic values, while more rational elements work better for individuals with higher utilitarian values. A strategy of shifting appeals (e.g. rational to hope) and including humorous and creative elements can help increase interest in an advertisement, which can lead to changes in beliefs and behaviors about a certain issue (SHEN et al., 2020; WILSON et al., 2021). Although these are important contributions, we still lack insights on the relationship between affective variables and intrinsic pro-environmental motivation factors in the green advertising domain.

Intrinsic pro-environmental motivation might require rational rather than emotional appeals in advertising, as individuals rely on the information transmitted to make their assessment of a message (RIZZI; GUSMEROTTI; FREY, 2020). Therefore, even emotionally-driven advertising needs to provide information which is sufficient enough for consumers to analyze it according to their values, beliefs, and norms. When these advertisements meet individual intrinsic motivations while also transmitting altruistic emotional feelings to consumers, there is an increase in pro-environmental behavior intention (SONG; KIM, 2019).

Given the potential reactions to negative emotional appeals in green advertising (i.e. guilt, fear, shame, and sadness), future research should rigorously address the ethical issues underlying this communication approach. While a growing multi-disciplinary literature is now focusing on the concept of eco-anxiety or climate change anxiety (e.g., CLAYTON; KARAZSIA, 2020), advertisers should be careful not to fuel this phenomenon and risk degrading individuals' mental health. Future studies should assess ways to raise awareness

about environmental problems without generating anxiety that could backfire and inhibit effective action.

2.4.8 Pro-environmental behavior and advertising effectiveness

As an outcome of green advertising, the literature reviewed in this study considered different types of dependent variables: behavior intention, current self-reported behavior, actual observed behavior, self-reported past behavior, or simply attitude towards a brand. The behaviors studied mainly address the purchasing of goods and services, but other pro-environmental actions are also addressed, such as recycling.

Not surprisingly, studies using real behavioral data are very scarce (only two papers). Wilson et al. (2021) collected data about access to a website with information about climate change. Cozzio, Tokarchuk and Maurer (2021) found that messages conveying an altruistic (vs. egoistic) appeal had a stronger influence on pro-environmental behavior regarding food waste (measured through a field study in a hotel). However, the lack of real behavioral data is a major issue for two main reasons. First, there might be inconsistencies between self-reports and actual behavior. Previous research suggests that consumer self-reports account for very few of the purchases actually made (BLANKENBERG; ALHUSEN 2019; VEZICH; GUNTER; LIEBERMAN, 2017). Second, there is often a gap between intention and behavior. Efforts to increase green purchasing by activating relevant consumer values may face major obstacles and, therefore, not always be effective (BULLOCK; JOHNSON; SOUTHWELL, 2017). One of the main challenges is to find ways to reduce this intention-behavior gap (ELHAFFAR, DURIF; DUBÉ, 2020).

Considering the kind of behavior that each study analyzed, the majority, 45, related to the purchase or overall acceptability of the products or services being advertised. 32 articles focused on the effect of green advertising on attitude towards a given brand. Sustainable action (excluding purchasing behavior) featured in 18 papers, with advertisements promoting intention toward new behavior, such as actions to prevent climate change (KURISU; KIMURA; HANAKI, 2019). Future research should further address topics related to general sustainable action and how it differs from purchasing and consumption behavior.

Another important aspect is the role played by habit and routine. Many pro-environmental behaviors are matters of personal habit or already established household routines. Dahlstrand and Biel (1997) assert that old habits can be broken and new habits created and established. This is more likely to occur when a given behavior is positive and

generates a sense of well-being associated with preserving a connection with nature (VERMEIR; VERBEKE, 2008; YOON; KIM, 2016).

Pickett-Baker and Ozaki (2008) and Kim and Yoon (2017) found that previous consumer experiences with green advertisements and sustainable products are related to new experiences. In this way, a new context, if repeated regularly, can disengage old unwanted habits and stimulate the new (DAHLSTRAND; BIEL, 1997), as long as the circumstances are kept constant and favorable for the development of such habits (OUELLETTE; WOOD, 1998). Since none of the papers in the review process covered the formal concept of habit as acknowledged by the specialized literature (e.g., OUELLETTE; WOOD, 1998), we adopted past and recurrent behavior as proxies of habit. 24 papers included questions about past sustainable behavior in their studies, but none attempted to understand whether and how an advertisement may help implement new habits.

Overall, the literature is embedded in the past-present timeline (past behavior influencing green advertising receptivity), but more research should address the present-future timeline (green advertising influencing long term behavior). Longitudinal designs are needed to better understand the process of sustainable habit formation. Technological tools (e.g. smartphone apps, geolocalization) offer interesting opportunities for collecting data about consumer behavior and habits (e.g., MACKERRON; MOURATO, 2013). Further studies are also needed to identify how past behavior influences the adoption of new behavior related to intrinsic motivation factors.

2.5 DISCUSSION

2.5.1 Contribution and research agenda

The main contribution of this article is the development of an integrative persuasion framework that is specific to green advertising (Figure 4).

The framework suggests that in order to be effective, a green advertisement should be seen, retain attention and be decoded correctly (i.e. the target individual understands and interprets the message accurately). This decoding process triggers a set of pre-existing individual values, beliefs and personal norms that are in favor of pro-environmental action. This process facilitates the memorization of the message and eventually leads to a higher propensity to engage in pro-environmental behavior. Since a sustainable lifestyle rarely requires a single, one-time activity, the challenge with green advertising is to foster repeated

pro-environmental behavior. Thus, we have included habit and routine at the very end of the process. However, several factors might attenuate/reinforce the effects described or interrupt the chain of steps. Potential moderators or boundary conditions include internal and external variables. Internal variables refer to an individual's personal capabilities (e.g. level of environmental literacy, financial resources) and general stable predispositions (e.g. anti-advertising bias) while external variables refer to the general context (e.g. laws/regulations, cultural context) or to social aspects (e.g. social norms). Finally, affective variables may intervene at any stage of the process. They include temporary emotional states activated as a result of exposure to the message (e.g. guilt, fear) or more chronic affective states (e.g. eco-anxiety).

Overall, we believe that our integrative model applies to any type of green advertisement. Whether the source of the message is a company, an NGO, or a government agency, exposure to pro-environmental stimuli will lead individuals through the stages of persuasive information processing and activate their own environment-related values, beliefs, and norms to potentially influence their behavior. Greenwashing claims will also trigger this process. However, based on their personal capabilities and predispositions (i.e. knowledge, expertise, familiarity, trust in the source), consumers might or might not be able to detect that these claims are misleading. Beliefs play a central role in the VBN framework. Perceived credibility of the environmental claim is typically the type of belief that could either lead to accepting or rejecting the message. Consumer skepticism, which was addressed in 8 papers of our sample, is a key factor to consider. However, the literature suggests that it is easy for advertisers to get away with greenwashing, even among environmentally concerned consumers (GAITHER; SINCLAIR, 2018). There is a significant amount of existing research on greenwashing, but further research is needed to understand the factors that contribute to greenwashing literacy and to explore the effectiveness of interventions aimed at empowering consumers to identify different forms of greenwashing narratives.

Our systematic review provides interesting insights that help answer our research questions. In response to RQ1 (what is the current state of knowledge regarding the impacts of green advertising on sustainable consumer behavior?), overall, it appears that green advertising tends to activate appropriate persuasive response and positive attitudes among consumers, leading to higher intentions to adopt sustainable behavior. However, this process varies depending on (1) the nature of the message (framing, source, execution, type of promoted green behavior), (2) the profile of the consumer (values, beliefs, norms as well as other predispositions related to advertising, purchasing or the environment, and also

socio-demographic characteristics), (3) and the context (including social norms, culture, government intervention etc.). In response to RQ2 (How do the psychological factors that influence pro-environmental behavior interact with green advertising to shape consumer behavior?) we can conclude that environment-related intrinsic motivations and psychological predispositions (e.g. pro-environmental values) are activated upon message exposure and affect the persuasion process. They influence the perception of the message and predict attitude toward the ad and intention to adopt pro-environmental behavior.

With our systematic review, we unite two literatures pertaining respectively to the effectiveness of green advertising and the determinants of pro-environmental behavior. We argue that green advertising effectiveness cannot be studied without considering consumers' intrinsic motivations to act sustainably. This double perspective is critical to understand the process through which advertisements affect sustainable decisions. For this reason, we combined relevant keywords to make sure we cover both perspectives. This original approach based on a combined search led us to focus on a specific conceptual approach. We used VBN theory, a reference model in the pro-environmental behavior literature, to define the scope of intrinsic pro-environmental motivations. Our approach is inherently multidisciplinary, in line with previous calls to address environmental issues through interdisciplinarity (e.g., SAUVÉ; BERNARD; SLOAN, 2016).

As suggested in our model, green advertising can activate an individual's intrinsic motivation, which in turn will affect the adoption of sustainable behavior. Internal variables (i.e. an individual's profile and personal capabilities) are likely to affect this process. Most of the studies, however, are focused on socio-demographic factors such as age, gender and education. Contextual factors also play a crucial role and are captured mainly through social norms and cultural aspects. Real behavioral data was only assessed in two studies, which suggests that there is a significant literature gap. The formation of sustainable habits is incipient in this literature. Therefore, future studies should consider these aspects in their analyses.

From the literature review, several research gap opportunities were identified. Table 4 summarizes these gaps according to each of the conceptual framework constructs.

Table 6 - Research opportunities

Constructs of the framework	Research opportunities
Exposure to green messages and assessment of the persuasion process	Promote studies mixing different methods, combining secondary data (e.g. analysis of existing advertisements) and primary data (e.g. questionnaire post stimulus with measures of intrinsic motivations).
	Test the effect of different channels of communication (such as television, social media, radio etc.) on intrinsic motivations.
	Encourage the use of non-self-reported data including brain imagery (e.g. fMRI) and other techniques based on eye tracking and measurement of physiological responses to ad exposure, as they provide less subjective insights than questionnaire-based surveys and experiments.
	Promote studies using visual and audio advertisement as a stimulus, in order to better understand the role played by each kind of media in the activation of intrinsic motivations.
	Identify ad content and operationalization techniques that could lead to increased perception of greenwashing and assess how this perception interacts with consumers' intrinsic motivations towards environmental preservation.
Values, beliefs, norms & general pro-environmental motivations	Assess how different types of ads and appeals affect the early stages of the persuasion process, including aspects related to attention and comprehension.
	Considering the different value orientations and their relationship with sustainable behavior, investigate whether there are a set of values which have positive results for specific target audiences and cultures.
	Identify if there is a relationship between green marketing, intrinsic motivation and environmental education.
Individual capabilities and contextual factors	Promote studies analyzing the role of personal norms in the relationship between green advertising and sustainable behavior.
	Describe how socio-demographic factors affect response to green advertising and test potential moderator effects in the relationship between ad exposure / intrinsic motivations / sustainable behavior.
	Incorporate the capability approach in future research, considering human agency as a promoter or moderator of sustainable behavior from the intrinsic motivation and green advertising perspective.
	Integrate national social development indicators in a multilevel analysis, such as the components/dimensions of the Human Development Index, in order to analyze whether they can help explain sustainable behavior from the intrinsic motivation perspective.
	Promote research from different cultural backgrounds, such as Hofstede, Inglehart and/or Schwartz's cultural values, or consider different regions within the same cultures to understand the different effects of green advertising on intrinsic motivation.
	Investigate the factors that contribute to greenwashing literacy and potential interventions to empower consumers to recognize different forms and narratives of greenwashing.
	Assess the effects of a combination of social norms and advertising appeals from an intrinsic motivation perspective. Identify the reactions to paradoxical injunctions (group

	norm in favor of sustainable behavior vs. communication promoting unsustainable behavior and vice versa).
Affective variables	Beyond traditional emotional appeals, identify whether there are specific emotions to be considered when dealing with green advertising and nature-related appeals (e.g. awe) and how they affect intrinsic motivations.
	Assess the effect of negative emotional appeals on the tendency to experience eco-anxiety and test different ways of raising awareness about environmental problems without generating paralyzing anxiety.
	Analyze if advertising in online environments (e.g. YouTube videos) - and other real environments - reduce the positive evaluations that consumers may have toward the advertising (e.g. positive emotions).
Pro-environmental behavior & sustainable habits	Promote the measurement and comparison between lab and field studies to measure pro-environmental behavior.
	Investigate how intrinsic motivation related to pro-environmental behavior varies depending on whether the promoted behavior is related to consumption or not and whether the behavior occurs in the private vs. public sphere.
	Understand the role that intrinsic motivation has on the development of new habits that can be developed starting from pro-environmental behavior activated from green advertising.
	Improve knowledge about the influence of habits and past behavior on increasing new sustainable behaviors and how these habits can be encouraged.

Source: Developed by the authors

We highlight that the gaps identified should be understood within the VBN context, that is, these are research opportunities when the idea of green advertising and the predisposition towards pro-environmental behavior are integrated. These research opportunities embrace several perspectives. Researchers can explore communication aspects that have been little studied in the field, such as ‘Attention’ and ‘Comprehension’; different methodological approaches, with fMRI, other advertising media, and secondary data; the inclusion of new concepts, such as the capability approach; and the intensification of topics, such as personal norms, habits and the effect of green advertising in a real context, e.g. individual daily lives.

2.5.2 Limitations

Although this study was based on the steps of previous literature reviews (using curated bibliographic databases, selecting articles that had been through a peer-review process, using peer validation among authors), the inherent subjectivity of the selection and classification processes needs to be considered. Another factor is that as a review study is built upon previous literature, it will be subject to previous publication biases, such as positive-results bias (sometimes called the file-drawer effect, or the file-drawer problem) in

which confirmed hypotheses are more likely to be submitted and published. Finally, our choices regarding the keywords, databases and type of publication are intrinsically related to the objective proposed in this study, but relevant articles may have been excluded because of the strict selection criteria. That being said, it is important to mention that the first filter (based on the abstract) and the second (based on the complete reading) went through a peer-validation process, involving multiple authors, in all doubtful cases. The process of building the classification profile of each article (coding in the defined topics) was done in each case in order to avoid, as much as possible, a subjective or biased approach in the selection and classification steps.

2.6 CONCLUSION

The literature review and research agenda proposed highlight significant gaps that must be addressed if a comprehensive understanding of how green advertising interacts with pro-environmental predispositions to encourage sustainable behavior is to be achieved. The paper contributes to the literature by consolidating the knowledge that links green advertising and intrinsic motivation through a systematic literature review. Other relevant contributions are the framework developed, which explains how green advertisements work as stimuli toward sustainable behavior through intrinsic motivations, and the research opportunities identified. Overall, we call for more studies addressing green advertising effectiveness through the lens of intrinsic motivation and theories of pro-environmental action.

2.7 ARTICLE

This article was published in the *International Journal of Advertising* under the title “From green advertising to sustainable behavior: A systematic literature review through the lens of value-belief-norm framework” with the following authorship:

1. **Pedro Augusto Bertucci Lima:** Leading author, Conceptualization, Methodology, Data Curation, Formal analysis, Writing - Original Draft, Writing - Review and Editing
2. **Fernanda Pereira Sartori Falguera:** Conceptualization, Methodology, Data Curation, Formal analysis, Writing - Review and Editing
3. **Hermes Moretti Ribeiro da Silva:** Validation, Writing - Review and Editing.
4. **Suely Maciel:** Validation, Writing - Review and Editing.
5. **Enzo Barberio Mariano:** Supervision, Writing - Review and Editing
6. **Leila Elgaaied-Gambier:** Data Curation, Validation, Formal analysis, Writing - Review and Editing.

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*“If I had the strength you think I
have
I would engrave your drawing on
the metal of my skin.
Made for each other, made to last,
a light that does not produce shadows.”*
Humberto Gessinger

3. ARTICLE 2 - PROMOTING ENVIRONMENTAL CONSERVATION BEHAVIOR IN BAURU (BRAZIL) AND BARCELONA (SPAIN)

3.1 INTRODUCTION

Human activities have led to several environmental issues such as climate change, degradation and pollution of the natural environment, and biodiversity loss (UNEP, 2021). Urban areas concentrate the majority of the population, with this number being expected to increase even more (UNITED NATIONS, 2019), and are responsible for several of these environmental issues (BITHAS; CHRISTOFAKIS, 2006). Urban areas are biodiversity hotspots, composed of different kinds of animals and plants who are also affected by human behavior (BUTT et al., 2018; HERNANDEZ-SANTIN et al., 2023). Inappropriate behaviors toward this urban biodiversity can also be harmful for human health (CASTILLO-CONTRERAS et al., 2022). Therefore, more conservation efforts are necessary to benefit human well-being and biodiversity in urban areas (HERNANDEZ-SANTIN et al., 2023).

Conservation messages can motivate the community in taking an active role in supporting urban biodiversity conservation (DEAN et al., 2019; LANGE et al., 2022). Conservation messages aim to “inform, change attitudes or trigger behavior change for the benefit of biodiversity, including communication that forms part of stakeholder or public engagement programs, or advocacy campaigns” (GREGG et al. 2022, p. 1100). Studies on conservation messages have gained traction during the years (KIDD et al., 2019a), however, there are unanswered questions. For example, few empirical studies explore behavioral outcomes in response to positive or negative framings in conservation (KIDD et al. 2019b). There is also a lack of studies exploring the message effectivity in response to the recipients characteristics, resulting in a knowledge gap about the best strategy to stimulate conservation behaviors (FORNARA et al., 2020). The inclusion of contextual elements, such as individual values, might increase the performance of persuasive conservation messages (STEG, 2016, LIMA et al., 2024). Values have been regarded as “the criteria that people use to select and justify actions and to evaluate people (including the self) and events” (SCHWARTZ, 1992, p.1). Thus, values affect how individuals evaluate costs and benefits of engaging in different types of pro-environmental behaviors (PEB) (STEG; DE GROOT, 2012, STEG, 2016), such as conservation behavior.

The present research aims to analyze the relationship of values in individuals and in messages and attitude toward the message and PEB intention related to conservation issues. This research is composed of two studies exploring the effects of loss appeal messages on human-wildlife interactions in urban settings: the first focused on the interaction between human and marmosets in green urban areas in Brazil and the second on the presence of wild boars in urban areas of Spain. Both studies assessed the extent to which each message affects behavior intention (i.e., talking about the information presented in the message with others) and attitude toward the message, which are fundamental drivers for conservation outcomes and can be used to measure support for conservation (BATAVIA et al., 2018).

3.2. CONCEPTUAL MODEL AND RESEARCH HYPOTHESES

The PEB literature emphasizes three main values: egoistic, altruistic, and biospheric (DE GROOT; STEG, 2007, 2008; STERN, 2000). The stronger an egoistic orientation, the stronger people are motivated to perform a certain PEB when the personal benefits outweigh the personal costs (e.g., financial costs) that the individual may have from the behavior. When people act from a strong altruistic orientation, they will be more prone to engage in the behavior when it is perceived to provide a net benefit for the community or society (e.g., better water quality). Finally, when individuals are motivated to act from their biospheric orientation, they will consider the benefits and costs of the PEB in relation to the ecosystem and biosphere as a whole (e.g., lower levels of environmental degradation) (DE GROOT; STEG, 2010; STEG; DE GROOT, 2012). Although individuals possess all three value orientations, the degree to which each of these value orientations is important differs across individuals and within different contexts (STEG; DE GROOT, 2012; BOUMAN et al., 2021).

Studies have found that people with dominating altruistic and biospheric value orientations are more likely to engage in PEB, while individuals with strong egoistic value orientation are more likely to show less PEB (JANSSON et al., 2011; STEG; DE GROOT, 2012). This might happen because PEB involves a conflict between immediate individual costs, which are often relatively certain, while the altruistic and biospheric benefits of performing PEB are often long-term, uncertain and only feasible when others will perform the behavior as well (STEG; DE GROOT, 2012; VAN LANGE et al., 2013). Altruistic and biospheric are both self-transcendent value orientations while egoistic value orientations are

grounded in self-enhancement (SCHWARTZ et al., 2012). Considering that conservation behaviors are a kind of PEB, the following hypotheses are tested in this research (Figure 6):

H1. Individual values are related to attitude toward the conservation message:

H1a. Altruistic values present positive relationship with attitude toward the conservation message

H1b. Biospheric values present positive relationship with attitude toward the conservation message

H1c. Egoistic values present negative relationships with attitude toward the conservation message

H2. Individual values are related to intention to talk to others about the conservation topic presented in the conservation message:

H2a. Altruistic values present positive relationship with the intention to talk to others about the conservation topic presented in the conservation message

H2b. Biospheric values present positive relationship with the intention to talk to others about the conservation topic presented in the conservation message

H2c. Egoistic values present negative relationship with the intention to talk to others about the conservation topic presented in the conservation message

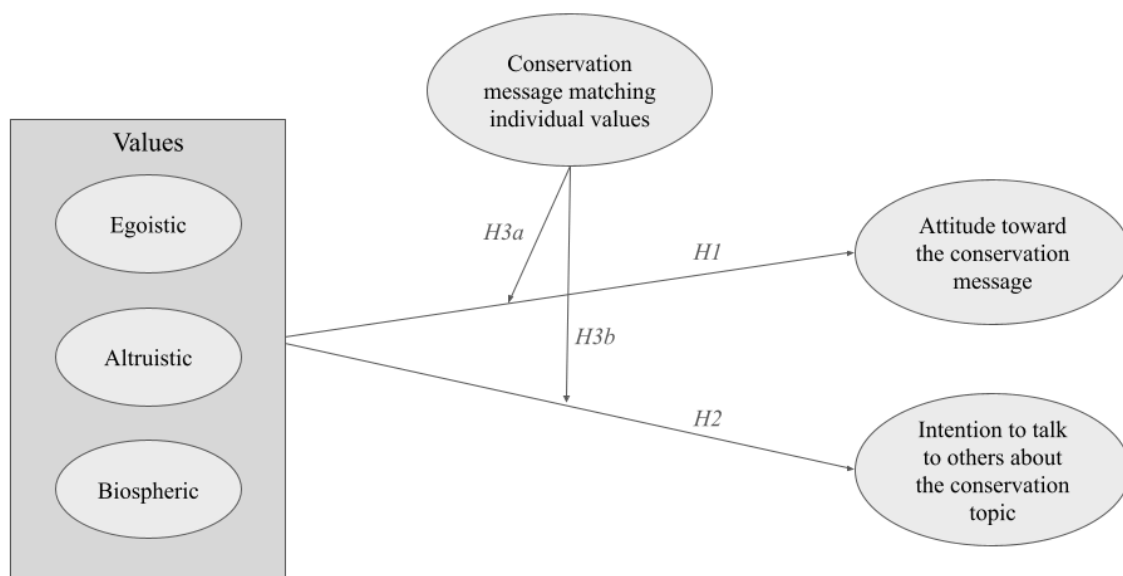
Strengthening biospheric and altruistic values might be a way to increase PEB (STEG, 2016). Incorporating value orientation cues in conservation messaging might help activate these values (BULLOCK et al., 2017). Messages conveying a non-anthropogenic appeal have been found to present higher conservation outcomes from the audience (BATAVIA et al., 2018). Golebie and van Riper (2023) suggest that altruistic and biospheric messages might be more aligned to conservation issues. Furthermore, the success of messaging depends upon context (KIDD et al. 2019b). Although these studies provide relevant information to develop better conservation campaigns, gaining knowledge about the extent in which different behavior related variables are affecting specific conservational challenges (FRIEDRICH et al., 2014). Moreover, considering that biospheric and altruistic values are usually more related to conservation behavior (CHEN; WU, 2023) it is useful to understand manners to increase attitude and PEB among egoistic values. Thus, the following hypotheses were developed (Figure 6):

H3: Individuals will be more responsive to environmental messages that match their individual value orientations

H3a. Individuals will present higher attitudes toward the message in messages that match their individual values orientation

H3b. Individuals will present higher intentions to talk to others about the message's content in messages that match their individual values orientation

Figure 6 - Research hypotheses



Source: Developed by the authors

3.2 Study 1: Contact avoidance with marmosets in Bauru, Brazil.

Study 1 addresses the interaction between individuals and marmoset in Bauru. Bauru is a municipality located in São Paulo State, in the Southeastern region of Brazil. The 2022 census indicates that Bauru has a population of 379.146 inhabitants and GDP per capita of R\$43,806.93 (position 1230 among 5570 Brazilian municipalities). Bauru is located in the Cerrado and Atlantic Forest biome (IBGE, 2022) and presents a Dry-winter humid subtropical climate (Cwa).

Marmosets are a small primate that lives in forest environments and is highly adapted to urbanized areas, actively using parks and other areas with trees as their habitat (LEITE et al., 2021; RODRIGUES; MARTINEZ, 2014). There are two species of marmoset in Bauru, the Common marmoset (*Callithrix jacchus*) and the Black-tufted marmoset (*Callithrix*

penicillata). There are also cases of hybridization (SANTOS, 2021). It is common to witness people interacting with marmosets, giving them food, and/or petting the marmoset, which might be due to the friendly appearance and perceived behavior of the animal (LEITE et al., 2011) or the affinity between humans and marmosets (RODRIGUES; MARTINEZ, 2014). However, this interaction leads to serious problems for the animal and it is also dangerous for individuals. Local issues include marmoset deaths resulting from “human herpes” (CARDOSO, 2021), and marmosets attacking people and spreading diseases (RODRIGUES; MARTINEZ, 2014). This has led local authorities to create several campaigns to sensitize individuals to not interact with the marmoset. For example, Bauru’s Botanic Garden launched the “*I like marmoset, it there and me here*” (literal translation from “Eu curto sagui, ele lá e eu aqui”) (JARDIM BOTÂNICO BAURU, 2024).

The first authors’ university campus has also engaged in campaigns to prevent people from interacting with the marmoset. The university offers ample green spaces and is in close proximity to the marmoset’s habitat. Despite existing campaigns, students and academic staff frequently engage in undesirable behaviors, giving food and taking pictures petting the marmoset. Thus, an online survey study presenting three possible framings to conservation messages was developed to assess the effectiveness of said messages in response to individual value orientations and the value cues embedded in each framing.

3.2.1 Method

3.2.1.1 Sample

In total, 179 students from a university located at Bauru answered the questionnaire of the study 1. After removing answers that failed to provide the correct attention answer ($n = 2$), the final sample was composed of 177 respondents. Considering that the sample size and power analysis calculation using the G*Power software (FAUL et al., 2009) pointed out that the study would need at least 92 individuals for an effect size of 0.15, power of 0.80, and five predictors, the final sample size of this study was adequate. The final sample was composed of 91 women (51.41%), 77 men (43.50%), 7 individuals who did not identify as women or men (3.95%), and 2 individuals who preferred not to answer (1.13%). The sample’s age ranged from 18 to 26 years old ($M = 22.08$, $SD = 3.94$).

3.2.1.2 Conservation messaging

Three conservation messages about marmosets were developed by the first and second authors. The first author works professionally in a digital marketing agency while the second is a professor of graphic design in advertising with 15 years of experience. One advertisement disclosed an egoistic appeal, other a biospheric appeal, and the last was a control advertisement without a particular appeal. The three advertisements had the same images (of two marmoset) with a text asking for individuals to not interact with the animal and “just to leave them alone”. The egoistic appeal emphasized that interacting with the animal could be harmful for individuals, while the biospheric appeal stated that the interaction could be harmful for the animal. The control variable just asked for individuals to avoid the marmoset (Figures A1-3). The text of the messages were inspired by previous research employing Schwartz’s values theory or a similar approach in persuasive conservation communication (BATAVIA et al., 2018; BULLOCK et al., 2017; GOLEBIE; VAN RIPER, 2023) and the recommendations to not pet or give food to the marmoset (JARDIM BOTÂNICO BAURU, 2024; RODRIGUES; MARTINEZ, 2014). All advertisements had the call to action *“For more information, click in the link below”*.

3.2.1.3 Survey Design

An online questionnaire was developed on “free online questionnaire”. The questionnaire began by presenting the research aims and the ethical statements of anonymity, confidentiality, exclusively scientific purposes of the usage of the data collected, including the assured right to withdraw from the study at any moment without any type of loss. The consent to participate could be given by individuals if they agree with the ethical statement and were 18 years old or older. The referee number “73010223.9.0000.5398” of the approval from a Brazilian Ethic Committee of the Faculty of Sciences - São Paulo State University, to conduct the present research in Brazil, was also presented. In order to stimulate a higher number of answers respondents could participate, if they want, in a prize draw of a gift card of R\$150.00 (approximately €30.00) in a food delivery app.

Participants answered questions about their individual values and were randomly assigned to one of the versions of the conservation message through the A/B test question type available in the questionnaire platform. After seeing the message, participants were asked if they have already given food to a marmoset, or have had or heard of any issues

related to the animal. Participants were then asked to answer questions about the credibility, attitude toward the message and behavior intention related to talking to others about the issue. All questions used a Likert-type scale from 1 (strongly disagree/not important) to 7 (strongly agree/extremely important). The final part of the questionnaire was composed of socio demographic questions. The full questionnaire is available at the supplementary material (Table A1). The questionnaire also interrogated participants' recycling behavior and personal norms for a different research project.

Individual values were assessed by De Groot and Steg's (2007, 2008) scale. The scale is composed of 13 questions, being 5 for measuring egoistic values orientation (social power, wealth, authority, influential, and ambitious), 4 for measuring biospheric values orientation (preventing pollution, respecting the earth, unity with nature, and protecting the environment), and 4 for measuring altruistic values orientation (equality, a world of peace, social justice, and helpfulness). The respondents were asked not to consider more than two values as being extremely important. Cronbach's alpha was 0.71 for egoistic values ($M = 4.6$, $SD = 0.92$), 0.77 for altruistic values ($M = 6.4$, $SD = 0.74$), and 0.91 for biospheric values ($M = 6$, $SD = 1.1$).

Credibility of the advertisements was measured with three questions adapted from MacKenzie and Lutz (1989): "*The allegations presented in this ad are true*", "*This ad is unbiased*", and "*I believe the claims presented in this ad*". Cronbach's alpha was 0.52 ($M = 5.4$, $SD = 1.2$), after removing the first question, the alpha increased to 0.64 ($M = 5.8$, $SD = 1.2$).

Attitude toward the message was measured with three variables adapted from MacKenzie and Lutz (1989): "*On a scale of 1 (bad) to 7 (good) what do you think of the advertisement?*", "*On a scale of 1 (unpleasant) to 7 (pleasant) what do you think of the advertisement?*", and "*On a scale of 1 (unfavorable) to 7 (favorable) what do you think of the advertisement?*". Cronbach's alpha was 0.72 ($M = 5.2$, $SD = 1.5$).

Behavioral intention was measured with adapted questions (MARKLE, 2013; KAISER; WILSON, 2004) about the chance of talking to others about the issue disclosed in the advertisement (i.e., the interaction with the marmoset), which can be considered as a social conservation behavior (SELINSKE et al., 2020). This research used three questions "*In the future, how likely are you to talk to your college friends about how to properly interact with marmosets?*", "*In the future, how likely are you to talk to your friends outside university about how to properly interact with marmosets?*", and "*In the future, how likely are you to talk to your family about how to properly interact with marmosets?*", ranging from

1 (totally unlikely) to 7 (totally likely). Cronbach's alpha for behavior intention was 0.95 ($M = 4.8$, $SD = 1.9$).

To measure the engagement of participants with the advertisement (actual behavior), a different link was included for each advertisement. The three links lead to the same website, a blog at the first author's research group explaining about the risks of the human interacting with the marmoset in the University Campus. By collecting the data collected with Google Analytics, it was possible to measure how many individuals clicked on the link from each version of the conservation message.

3.2.1.4 Statistical Analysis

The Cronbach's alpha were calculated on R Studio with the package "Psych". Next, considering that the perceived credibility in messages (ELGAAIED-GAMBIER et al., 2018) can affect its performance, the three groups of advertisements had their perceived credibility and attitude toward the message compared to check for possible differences. Thus, considering that the Shapiro-Wilk test indicated that the data was not normally distributed, the Kruskal-Wallis test was employed to analyze the differences between the three groups of messages. This was also applied to check for differences for behavior intention and attitude toward the message among the 3 groups. These analyses used the packages "dplyr", "rstatix", "dunn.test", and "FSA" in R Studio. Sociodemographic data was not used as control in any analysis (GOLEBIE; VAN RIPER, 2023).

To analyze the effect of advertisements on behavior intention variables using linear regression models, we utilized exposure to different ads as dummy variables and the values as moderators. To check the feasibility of adopting the conventional linear regression model, assumptions were verified using *jamovi* software. As none of the tested models exhibited normality of residuals according to the Shapiro-Wilk test, we opted to adopt Generalized Linear Models (GLM) due to their non-parametric nature. The models were implemented using the *glm* function from the R *stats* package. Next, to specifically analyze the interaction effects in the models, slope analyses were performed with the support of the *sim_slopes* function from the *interactions* package. With the support of the *interact_plot* function from the *jtools* package, graphics were generated to visually explore the effect of ads on the relationship between behaviors and values. We considered a less stringent threshold for significant p values (i.e., $p < 0.10$) (DAHIRU, 2008).

3.2.2 Results

From the 177 complete answers, 66 individuals were assigned to the biospheric framed version of the message ($M = 4.74$, for behavior intention), 60 to the egoistic version ($M = 4.93$, for behavior intention), and 51 to the control version ($M = 4.66$, for behavior intention). Considering the initial questions, 159 (89.83%) individuals indicated that they have never given food to marmoset, 170 (96.04%) have never had any problem with the animal, and 113 (63.84%) have never heard of any issue related to the marmoset

The correlation analysis did not indicate any correlation between behavior intention and reporting have already heard issues related to the marmoset. The Kruskal-Wallis test did not identify differences among the behavior intentions between the groups ($\chi^2 = 1.123$, $df = 2$, $p = 0.571$). There were differences regarding attitude toward the message ($\chi^2 = 7.043$, $df = 2$, $p = 0.030$). However, applying the Dunn test with the Bonferroni correction did not present any significant differences for the groups (Table 7). Considering that there was no difference regarding the perceived credibility in any version of the message ($\chi^2 = 0.016$, $df = 2$, $p = 0.992$), no further analysis was deemed necessary for credibility.

Table 7 - Dunn test with Bonferroni correction

Comparison	Z	p unadjusted	p adjusted
Biospheric - Control	-2.232	0.025	0.077
Biospheric - Egoistic	-2.294	0.022	0.065
Control - Egoistic	0.036	0.971	1.000

Source: Developed by the authors

From the initial 179 answers received, 7 (3.91%) individuals accessed the link to search for more information. Considering that this data is from Google Analytics, it is not possible to distinguish between the answers that failed the attention mark testion, therefore all answers were considered. 3 individuals from the egoistic group accessed the link for more information, while 2 from the biospheric and control group accessed the link. The small number of accesses do not allow any statistical analysis and reinforces the difficulty in engaging individuals in getting more information about the issue.

The results from the regression models indicate that the altruistic value ($\beta = 0.289$, $p = 0.078$) was significantly positively correlated with attitudes toward the message, while the biospheric ($\beta = 0.062$, $p = 0.591$) and egoistic ($\beta = 0.119$, $p = 0.256$) values did no present significant relationship (Table 8). These results support Hypothesis 1a while it did not support

hypotheses 1b and 1c. A change from the control version of the message to the altruistic message presents a negative significant relationship ($\beta = -0.445$, $p = 0.061$), while a change for the egoistic version of the message did not present significant relationship ($\beta = -0.166$, $p = 0.493$).

Table 8 - Regression analysis for attitude and behavior intention from the marmoset case

Variable	Attitude		Behavior Intention (mean)	
	β	p-value	β	p-value
Egoistic Value	0.119	0.256	-0.125	0.418
Altruistic Value	0.289	0.078	0.380	0.115
Biospheric Value	0.061	0.591	0.265	0.118
Change from the control message to the biospheric message	-0.445	0.061	0.188	0.590
Change from the control message to the egoistic message	-0.166	0.492	0.176	0.619

Source: Developed by the authors

Considering the mean of the behavior intention variables, any of the three values presented significant relationships, the egoistic ($\beta = -0.125$, $p = 0.418$) value presented higher p while the altruistic ($\beta = 0.380$, $p = 0.115$) and biospheric ($\beta = 0.265$, $p = 0.118$) values presented p close to 0.1 (Table 2). These results did not support any of the Hypotheses 2.

The slope analysis presented information about the effect of each version of the message on the relationship between individual values and the dependent variables (i.e., attitude and behavior intention). The egoistic value presented 1 significant negative relationship with behavior intention for the biospheric version of the message ($\beta = -0.43$, $p = 0.07$) (Table 9). The altruistic value presented 3 positive significant relationships: being 2 with the biospheric version of the message, for attitude ($\beta = 0.402$, $p = 0.033$) and behavior intention ($\beta = 0.664$, $p = 0.018$), and 1 for the egoistic version with attitude ($\beta = 0.564$, $p = 0.067$). Finally, the biospheric value presented 3 positive significant relationships, being 2

for the biospheric message: attitude ($\beta = 0.307$, $p = 0.047$) and behavior intention ($\beta = 0.436$, $p = 0.054$), and 1 for the egoistic version with behavior intention ($\beta = 0.599$, $p = 0.010$) (Figures A4-9). The results partially support Hypotheses 3a and 3b, where altruistic and biospheric value orientations respond positively to altruistic and biospheric message framings, resulting in positive attitudes towards the message and behavior intentions. However, egoistic value orientations did not correlate to positive attitudes and behavior intent for egoistic message framing.

Table 9 - Slope analysis for the marmoset messages

Value orientation	Message version	Attitude		Behavior Intention (mean)	
		β	p-value	β	p-value
Egoistic	Biospheric	-0.064	0.685	-0.426	0.068
	Egoistic	0.288	0.155	0.346	0.248
	Control	0.167	0.388	-0.318	0.267
Altruistic	Biospheric	0.402	0.033	0.664	0.018
	Egoistic	0.564	0.067	0.641	0.160
	Control	0.127	0.568	0.534	0.105
Biospheric	Biospheric	0.307	0.047	0.436	0.054
	Egoistic	0.145	0.358	0.599	0.010
	Control	0.030	0.852	0.281	0.238

Source: Developed by the authors

3.2.3 DISCUSSION

The different versions of the message did not present differences regarding the perceived credibility, contradicting the expectation the biospheric-framed messages would present higher credibility in conservation communication (GOLEBIE; VAN RIPER, 2023). Considering that only the altruistic value presented significant relationships with the dependent variables, the glm results are partially aligned with the literature that indicates that altruistic and biospheric value orientation present positive relationships with conservation outcomes while the egoistic orientation presents negative relationships (FORNARA et al., 2020; OJEA; LOUREIRO, 2007; VAN RIPER; KYLE, 2014).

The results of the slope analysis suggest that the biospheric version of the message can increase the effectiveness of the conservation communication for altruistic and biospheric value orientation, however, it can decrease the effectiveness of the egoistic value orientation, this result might be related to the aversion to be perceived as an “environmentalist” (DEAN et al., 2019). This result differed from previous study that did not find relationships between egoistic values and conservation messages (GOLEBIE; VAN RIPER, 2023). Considering that altruistic and egoistic values are both self-transcendent values which have been analyzed as the same values in other studies (i.e., biospheric-altruistic values, VAN RIPER; KYLE, 2014), it was expected to have a positive relationship between altruistic values and biospheric messages and vice-versa. Surprisingly, the egoistic message stimulated positive responses for the altruistic and biospheric values. These results might be explained by the PEB analyzed: talking about the message with others, as the egoistic framed version of the message highlighted health dangers for individuals, the altruistic and biospheric orientation seemed worried with others and alerted them, while the egoistic motivation did not present this intention. The findings reinforce the notion that it is not only the message that affects the outcome, but how it interacts with the individuals’ values (GOLEBIE; VAN RIPER, 2023). The results indicate that, for the marmoset case in the Brazilian university, the control version of the message might be the most suitable option, as it presents a significant positive direct relationship on attitude towards the message while not negatively moderate any between individual values and attitude or behavior intention. Although the biospheric version of the message positively moderate the relationships between altruistic and biospheric values and the dependent variables, it presents a significant negative direct impact on attitudes towards the message and negatively moderate the relationship between egoistic values and behavior intention.

3.3. STUDY 2 - PROPER FOOD WASTE DISPOSAL TO AVOID WILD BOAR IN BARCELONA, SPAIN

Study 2 addresses the necessity of properly disposing of food waste in the metropolitan area of Barcelona, Spain, to avoid issues with the presence of wild boar in the urban environment. The urban area of Barcelona has a population of 3.2 million inhabitants and a GDP per capita of 30,700€ (Àrea Metropolitana de Barcelona, 2024). Barcelona is located in the east of the Iberian Peninsula, close to southern France, and has a mediterranean

climate, with moderate temperatures throughout its four seasons (ALGECIRAS; MATZARAKIS, 2016).

The presence of wild boar (*Sus scrofa*) in urban areas has increased in several European cities (CAHILL et al., 2012). In Barcelona, the wild boar mainly inhabit the Collserola Natural Park, but it spread to the Metropolitan region due to the urbanization process. Many wild boars become habituated to humans, becoming accustomed or indifferent to the presence of humans (CAHILL et al., 2012). The wild boar diet primarily consists of plant material, with a seasonal shift towards agricultural plants in summer and non-agricultural plants in winter (GIMÉNEZ-ANAYA, 2008). However, the presence of anthropogenic food attracts the wild boar to urban areas, especially in periods with scarce amounts of food in their natural habitat (CAHILL et al., 2003). Wild boar can find anthropogenic food by direct access (given by individuals) or indirectly by searching for food that had been discarded (CAHILL et al., 2012). Although these animals are most active at night, with feeding activity peaking between 00:00 and 05:00 (CAHILL et al., 2003), the presence of food during the day increases daytime activities and reduces their fear from humans, being common to spot wild boar rooting up grass in city parks and turning over domestic rubbish bins in search of food (CAHILL et al., 2012).

The presence of the wild boar in urban areas presents epidemiological risks, as the animal can spread different diseases (CARLOS et al., 2023). They can also damage private and public infrastructure and cause traffic accidents (CASTILLO-CONTRERAS et al., 2018a). Moreover, the population might also present the fear of being attacked by the animal or have their vehicles damaged (CAHILL et al., 2012). Several approaches have been discussed in order to control the population of wild boar (MASSEI et al., 2011) and also mitigate the presence of animals in urban areas, especially regarding limiting access to food waste (CASTILLO-CONTRERAS et al., 2018b). Considering actions that the general population can do, the main one is to properly manage food waste. Therefore, public awareness campaigns to individuals not to feed the wild boar and to make domestic rubbish bins inaccessible to the animal have been already employed in the Barcelona region (CAHILL et al., 2012; CASTILLO-CONTRERAS et al., 2018b). Thus, an online survey study presenting three random conservation messages was developed to assess the effectiveness of messages considering the relationship between individual values and the values framed in the message.

3.3.1 Method

3.3.1.1 Sample Size - Study 2

In total, 205 students from a university located in Barcelona answered the questionnaire. After removing answers that failed to provide the correct attention answer ($n = 9$), the final sample has 196 respondents. A priori analysis made on G*Power software (FAUL et al., 2009) indicated that 92 individuals were needed to meet the sample size of 0.15 and power of 0.80, and five predictors, thus the final sample of 196 answers were deemed as sufficient. The final sample was composed of 154 women (78.57%), 37 men (18.88%), 2 individuals who did not identify as women or men (1.02%), and 3 individuals who preferred not to answer (1.53%). The sample's age ranged from 18 to 54 years old ($M = 19.77$, $SD = 3.70$).

3.3.1.2 Conservation messaging

Three advertisements about how to properly manage food waste to mitigate the wild boar presence were developed by the same authors and emulating the messages of Study 1 (Figures A10-12). The messages raised awareness about properly disposing of food waste in closed bins (CAHILL et al., 2012; CASTILLO-CONTRERAS et al., 2018b). Three advertisements had the same images of a wild boar with a text encouraging individuals to properly discard their food waste in closed bins. The egoistic appeal emphasized that mitigating the presence of the wild boar in urban areas could increase the individual's own well-being, while the altruistic appeal stated that it could increase other individuals' well-being. The control advertisement encourages individuals to properly manage their food waste to mitigate the presence of the wild boar. Differently from study 1, in study 2, the control message's text contained a brief information (i.e., littering might attract wild boar) rather than just the call to action (DEAN et al., 2019). All advertisements had the call to action "For more information, click in the link below".

3.3.1.3 Survey Design and statistical analysis

An online questionnaire was developed in Google Forms. The sample of this study was composed by undergraduate students from Spain. The conduction of the study in Spain

was approved by a Spanish Ethical Committee from the Autonomous University of Barcelona under the code “6466”. Study 2 used the same questions for measuring individual values, previous behavior and knowledge about issues regarding the wild boar, advertisement credibility, attitude toward the message, and sociodemographic information as used in Study 1. The same strategy used in Study 1 to measure actual behavior was also applied in Study 2 as well as the same prize draw of a gift card of €30.00 on a food delivery app. Individuals were also randomly assigned to one of the versions of the message, however, in this case, this was made with the software linkly and not a native option such as done in Study 1.

Individual values were measured with the same questions as study 1. Egoistic values presented Cronbach’s alpha of 0.65 ($M = 4.7$, $SD = 0.8$), after removing the fifth question, the Cronbach’s alpha improved to 0.71 ($M = 4.3$, $SD = 0.94$), altruistic values presented Cronbach’s alpha of 0.81 ($M = 6.2$, $SD = 0.85$), and biospheric values presented Cronbach’s alpha of 0.89 ($M = 5.6$, $SD = 1.1$)

Credibility was measured with the same questions as study 1 and presented Cronbach’s alpha of 0.64 ($M = 4.6$, $SD = 1$). After removing the second question, Cronbach’s alpha increased to 0.81 ($M = 4.9$, $SD = 1.2$).

Attitude was measured with the same questions as study 1 and presented Cronbach’s alpha of 0.82 ($M = 4.3$, $SD = 1$).

Behavior intention was measured with adapted questions (MARKLE, 2013; KAISER; WILSON, 2004) about the chance of talking to others about the issue disclosed in the advertisement (i.e., dispose of food waste in close containers to avoid attracting wild boars): *“In the future, how likely are you to talk to your college friends about not feeding wild boars and to properly manage food waste?”*, *“In the future, how likely are you to talk to your friends outside university about not feeding wild boars and to properly manage food waste?”*, and *“In the future, how likely are you to talk to your family about not feeding wild boars and to properly manage food waste?”*, ranging from 1 (totally unlikely) to 7 (totally likely). The Cronbach’s alpha was 0.92 for behavior intention ($M = 2.8$, $SD = 1.5$)

The same statistical analysis made one study 1 was applied to study 2.

3.3.3 Results

From the initial 205 answers received, 9 (4.39%) individuals accessed the link to search for more information. 4 individuals from the altruistic and egoistic groups accessed the

link for more information, while only 1 from the control group accessed the link. The small number of accesses reinforces the difficulty in engaging individuals in getting more information about the issue.

From the valid 196 answers, 68 individuals were assigned to the altruistic framed version of the message ($M = 2.79$, for behavior intention), 72 to the egoistic version ($M = 2.85$, for behavior intention), and 56 to the control version ($M = 2.69$, for behavior intention). Considering the initial questions, 12 (6.12%) had already given food to the wild boar, 58 (29.59%) have already had problems with the animal, and 169 (86.22%) have already heard negative issues about the wild boar.

The correlation analysis did not indicate any correlation between behavior intention and have already heard issues related to the wild boars. The Kruskal-Wallis test did not identify differences among the behavior intentions ($\chi^2 = 1.085$, $df = 2$, $p = 0.581$) nor attitude toward the message ($\chi^2 = 0.232$, $df = 2$, $p = 0.890$). The results also did not point to any difference regarding the perceived credibility in any version of the message ($\chi^2 = 0.676$, $df = 2$, $p = 0.713$), therefore, no further analysis was deemed necessary for credibility in this study.

Any of the values presented significant relationships with attitude towards the message. Therefore, all Hypotheses 1 were rejected. Considering behavior intention, the biospheric value presented a significant relationship ($\beta = 0.327$, $p = 0.007$), while the egoistic ($\beta = -0.019$, $p = 0.808$) and altruistic ($\beta = 0.126$, $p = 0.237$) values did not (Table 10). Thus, Hypotheses 2b was supported, while 2a and 2c were not supported.

Table 10 - Regression analysis for Attitude and behavior intention from the wild boar case

Variable	Attitude		Behavior Intention (mean)	
	Estimate	p-value	Estimate	p-value
Egoistic Value	-0.019	0.808	-0.177	0.114
Altruistic Value	0.126	0.237	0.058	0.697

Biospheric Value	-0.039	0.653	0.327**	0.007
Change from the control message to the biospheric message	-0.042	0.825	0.016	0.951
Change from the control message to the egoistic message	0.009	0.959	0.171	0.508

Source: Developed by the authors

Considering the slope analysis (Figures A13-18), the egoistic value presented 2 negative relationships: with the altruistic value and attitude towards the message ($\beta = -0.220$, $p = 0.093$), and with the egoistic value and behavior intention ($\beta = -0.334$, $p = 0.057$). The altruistic value presented a significant positive relationship between the control version of the message and behavior intention. The biospheric version of the message presented 2 positive relationship with behavior intention, one related to the egoistic version of the message ($\beta = 0.431$, $p = 0.003$) and the other related to the control version of the message ($\beta = 0.337$, $p = 0.076$) (Table 11). Therefore, Hypotheses 3a and 3b were not supported, as no matching of values and messages moderate the relationship between values and the dependent variables.

Table 11 - Slope analysis for the wild boar messages

Value orientation	Message version	Attitude		Behavior Intention (mean)	
		Estimate	p-value	Estimate	p-value
Egoistic	Altruistic	-0.220	0.093	-0.094	0.623
	Egoistic	0.183	0.129	-0.334	0.057
	Control	-0.065	0.704	0.128	0.602
Altruistic	Altruistic	0.200	0.194	0.196	0.375
	Egoistic	-0.040	0.750	0.196	0.276
	Control	0.263	0.174	0.603	0.030
Biospheric	Altruistic	0.124	0.362	0.199	0.298
	Egoistic	-0.060	0.563	0.431	0.003
	Control	0.046	0.733	0.337	0.076

Source: Developed by the authors

3.3.4. Discussion

The lower behavior intention presented in case study 2 might be related to an issue more well known for the general population, as something that is more frequently showed on mass media, as 86.22% of respondents stated already hearing something negative about the wild boar, while only 36.16% of the respondents from the case study 1 reported hearing something negative about the marmoset. The glm results support Hypothesis 1b, by indicating that biospheric values are negatively related to behavior intention, being aligned with the literature (FORNARA et al., 2020; OJEA; LOUREIRO, 2007; VAN RIPER; KYLE, 2014).

The results of the slope analysis did not support Hypotheses 3a and 3b. The findings suggest that the egoistic and control version of the message can increase the effectiveness of the conservation communication for altruistic and biospheric value orientation, however, the egoistic message can decrease the effectiveness of the egoistic value orientation. Again, the results are contrary to the expectation, as the egoistic message stimulated the majority of positive responses for the altruistic and biospheric values, which might be explained by the perceived health risk for others and the necessity to talk to them about the issue for their safety. Moreover, individuals might not have the understanding that food waste attracts the wild boar, being the reason for the control message, that contained this piece of information, stimulating behavior intention for the altruistic and biospheric values orientation. Thus, the control version of the message seems to be the best option for this case. This result contradicts the expectation that only providing information is not usually enough to stimulate environmental behavior (KUSMANOFF et al., 2019) and might have happened because individuals already perceived the presence of the wild boar as dangerous for them. The fact that 86.22% of the sample have reported awareness about wild boar's problems, reinforces this idea.

3.4. DISCUSSIONS AND CONCLUSION

The present research examined the relationships between values-framed conservation messages, individual values, and attitude toward the message and behavior intention. To achieve this goal, two studies were conducted, one considering the human-marmoset

interaction in Brazil and the other about how to properly dispose of food waste to mitigate the presence of wild boars in the metropolitan region of Barcelona.

The glm model employed suggests that, in Brazil, altruistic values correlated with positive attitudes towards conservation messages. Meanwhile in Spain, biospheric values were related to spreading conservation messaging. Although both results are aligned with the literature, altruistic and biospheric values presenting positive outcomes for conservation attitude and behavior (FORNARA et al., 2020; OJEA; LOUREIRO, 2007; GOLEBIE; VAN RIPER, 2023), more significant relationships were expected (Table 12). This outcome might be related to the context of each study and the behavior intention analyzed.

Table 12 - Overview of studies' results

Hypothesis	Study 1 - Marmoset Brazil	Study 2 - Wild Boar Spain
H1a	Supported	Not supported
H1b	Not supported	Not supported
H1c	Not supported	Not supported
H2a	Not supported	Not supported
H2b	Not supported	Supported
H2c	Not supported	Not supported
H3	Partially supported	Not supported
H4	Partially supported	Not supported

Source: Developed by the authors

The findings of this research, especially considering study 1, present partial support for Hypotheses 3a and 3b (Table 12). The results indicate that biospheric messages negatively impact the relationship between egoistic value and behavior intention, while the relationships between altruistic and biospheric values, and behavior intention are positively affected by altruistic and biospheric messages. However, in study 2 the egoistic message presented the negative influence on egoistic values while presenting a positive impact on biospheric values. Moreover, the control version of the message, that presents more information in study 2 than in study 1, positively interacts with the relationship between altruistic and biospheric values, and behavior intention. This might have happened because of the behavior intention analyzed in this research: talking about the issue with other individuals, thus, messages that presented a possible for danger for the reader (egoistic appeal) might have translated as a danger for other

people, so biospheric values were more keen to talk about it with others, while this do not happened with the egoistic value. This result contradicts previous assumption that only showing information in persuasive messages present lower behavior intention (DEAN et al., 2019) and, at least in the contexts analyzed in this research, seems to be the best option to be employed. This aligns with the assumption that social behavior promoting tends to be more successful when starting by raising awareness about the subject (DE GROOT; STEG, 2009).

The number of individuals who accessed the website to check for more information about the marmoset (3.91%) and the wild boar (4.39%) were below the 7% reported by Wilson et al. (2021), which might be explained by 2 reasons: i) in their study, more exposition to the message were related to higher access to the page, in the present research individuals only saw the message during the response of the questionnaire, and ii) their study indicated that individuals with lower levels of education were more prone to visit the page, and in the present research all the sample were composed or undergraduate students, that is, an well educated sample with 36.16% of them reporting being aware about issues involved to the marmoset, and 88.22% about the wild boar.

3.4.1 Managerial and policy implications

Considering that public segmentation is one of the most important steps when developing conservation messages (KIDD et al., 2019a; KUSMANOFF et al., 2020) and that it is hardly possible to conceive a message that will positively influence everyone's behavior, conservation messages should frame their content based on the most desired group to be affected (KUSMANOFF et al., 2019). Thus, conservation campaigns aiming to reach undergraduate students, especially in the cases presented in this research (i.e., marmoset in Brazil and wild boar in Barcelona), could rely on the findings presented in this research, specially considering the messages with a neutral appeal and more information about the issue seems to present a better outcome. More specifically, this research points out that only about 36% of the study's one sample have heard issues related to the marmoset, far below the 88% of the second study. This suggests that undergraduate students in the first study are not aware of issues within their own university, requiring more efforts to sensibelize the academic population. Therefore, this research presents the practical implication of informing part of the academic community about these conservation issues on their campus. Universities can have an active role in mitigating conservational issues and fostering sustainability, especially the

ones that have natural elements in their surroundings, preserving nature while can transform the community perspective toward the environment (COLDING; BARTHEL, 2017).

3.4.2 Limitations and future research

The present research presents some limitations. First, it relied mostly on behavior intention questions, which did not always translate into actual behavior (LANGE; DEWITTE, 2019). The research included actual behavior of seeking for more information by presenting a call to action to individuals to access an online page presenting information about the topic disclosed, however, the low number of access in the page did not allow deeper analysis with the other information collected in the studies. Moreover, the conservation message was presented to individuals by an online survey questionnaire and not in a real environment where individuals could have their attention shifted for different reasons in their surroundings. Therefore, future studies could perform longitudinal analysis or experiments trying to access actual behavior. For example, research can be conducted in places that already present conservation campaigns and analyze the behavior presented by individuals.

A second limitation of the research relates to the homogenous sample of the studies, i.e., undergraduate students. Although external generalizability should be cautiously done because of this, the results presented in the studies can be useful for targeting these particular populations in conservation campaigns. Moreover, the studies were focused on testing internal validity between the relationships among the analyzed variables and not on external validity, which is something common in the PEB literature (DE GROOT et al., 2021; Lima et al., 2023). Therefore, it would be interesting to compare the results of these studies with other populations, such as with general individuals in Bauru and Barcelona.

3.5 ARTICLE

This article is intended to be submitted to a journal under the title “Matching conservation messages with individual values: Promoting social conservation behavior through values-framed messages” with the following authorship

1. **Pedro Augusto Bertucci Lima:** Leading author, Conceptualization, Methodology, Data Curation, Formal analysis, Writing - Original Draft.

2. **David Badajoz-Dávila:** Conceptualization, Methodology, Writing - Original Draft. Writing - Review and Editing.
3. **Octaviano Rojas Luiz:** Conceptualization, Methodology, Software, Formal analysis, Writing - Original Draft. Writing - Review and Editing.
4. **Cristina Hernandez-Santin:** Validation, Supervision, Writing - Original Draft. Writing - Review and Editing.
5. **Emily A. Gregg:** Methodology, Writing - Review and Editing.
6. **Enzo Barberio Mariano:** Supervision, Writing - Review and Editing.

*“Like the circles that you find
in the windmills of your mind”*
Alan and Marilyn Bergman

4. ARTICLE 3 - PAST BEHAVIOR AND BEHAVIOR INTENTION IN THE CIRCULAR ECONOMY CONTEXT

4.1. INTRODUCTION

The Circular Economy (CE) has been regarded as one way to achieve human and sustainable development (KIRCHHERR et al., 2017; LIMA et al., 2021) as it proposes a “regenerative system in which resources input and waste, emission and energy leakage are minimized by slowing, closing, and narrowing material and energy loops” (GEISSDOERFER et al., 2017, p. 759). Individuals are important for achieving these material and energy loops because of their consumption habits and behaviors (KIRCHHERR et al., 2017; STANGHERLIN et al., 2023). There are studies discussing the consumption aspect in the CE (CAMACHO-OTERO et al., 2018; GOMES et al., 2022a); however, there are missing topics in the literature, such as how different CE behaviors are related to themselves (e.g., WIESER; TROGER, 2018) and how past behavior can be related to behavior intention, which can be particularly important for understanding consumer patterns in the CE (STANGHERLIN et al., 2023). A better understanding of how consumers deal with different kinds of circular consumption can be useful for planning strategies to increase them (PENZ et al., 2019; THØGERSEN, 1999).

CE is considered an umbrella term, as it embraces several practices and approaches already existing in the sustainability literature, such as recycling, ecodesign, and energy recovery (KALMYKOVA et al., 2018). Some of its concepts, such as recycling, re-use, and sharing are well discussed and already adopted by many individuals (GARCIA et al., 2021); thus, a better understand about the relationships between these behaviors and new ones might offer new perspectives for achieving circularity (STANGHERLIN et al., 2023). Considering the environmental benefits derived from circular behaviors, they can be named as pro-environmental behaviors (PEBs), which are behaviors that mitigate environmental harm or even benefit the environment (STEG; VLEK, 2009). Individuals who already adopt one kind of PEB might be more prone to adopt the same behavior in the future or to adopt a new PEB, also referred to as positive spillover (NILSSON et al., 2017; THØGERSEN, 1999).

Spillover effect can be understood as the extent to which engaging in one behavior affects the probability of adopting a subsequent behavior (NILSSON et al., 2017). Theories, such as cognitive dissonance theory, that claims that individuals have the desire to act

consistently, supports that spillover effect might be more expected when analyzing similar behaviors (THØGERSEN, 2004). In this way, someone who recycles might be more prone to adopt a new behavior related to recycling rather than a different kind of behavior (e.g., avoiding using cars), even though both are considered PEB (TRUELOVE et al., 2014). However, there is also the chance of a negative spillover explained by “moral licensing”, that is, the individual perceives that they have already contributed to the environment with one behavior and act in a non-environmental manner in other cases (THØGERSEN, 1999). All this makes spillover effect important for the CE, as consumers play a vital role in closing the material and energy loops by properly disposing of end of life products (e.g., recycling) and buying products made of recovered materials (e.g., recycled products) (STANGHERLIN et al., 2023).

The spillover effect is well described in past reviews (NILSSON et al., 2017; TRUELOVE et al., 2014) and meta-analysis studies (MAKI et al., 2019), however, some questions remain open, such as what the role of social norms is (TRUELOVE et al., 2014). While some moderators for spillover effects are well described, such as the ones highlighted by Nilsson et al. (2017) in their review: similarity, personality, self-identity, and framing; other possible moderators should be investigated (TRUELOVE et al., 2014), such as other psychological variables commonly associated with PEB, e.g., environmental beliefs and norms.

Among the theories employed to understand PEB, intrinsic motivations, such as presenting at the norm-activation-model (NAM) (SCHWARTZ, 1977), are among the most important ones (STEG, 2016). The NAM asserts that being aware of environmental problems (awareness of consequence) and the perception of the possibility to improve the environmental state (outcome efficacy) activate personal norms which will encourage the PEB (VAN DER WERFF; STEG, 2015). Personal norms, thus, act as an internal compass for individuals to guide their PEB (DE GROOT et al., 2021). Although plenty of research has already relied on the NAM (DE GROOT; STEG, 2009; VAN DER WERFF; STEG, 2015), expanding the theory with other approaches and variables beyond the original focus on moral considerations can increase its explanatory power (HAN et al., 2015; KOKLIC et al., 2019; SHARMA et al., 2022). Bamberg et al. (2007) have found that social norms, i.e. individuals' expectation of what other individuals believe should or should not be done, is also related to the formative processes of personal norms toward PEB. Indeed, other studies have already integrated personal and social norms in their PEB's analysis (e.g. DE GROOT et al., 2021). Moreover, some researchers have found that including attitude in this adapted model of the

NAM can increase even more its explanatory power (HAN, 2014; HAN et al., 2015; KLOCKNER, 2013). Therefore, considering the influence of the variables from an extended NAM (from now on, extended NAM considers awareness of consequence, outcome efficiency, personal norms, social norms, and attitude) on spillover effects related to circular consumption might offer new insights for the CE literature.

Thus, this research aims to analyze if reported behaviors of recycling and purchase of recycled products are related to the willingness to pay and behavior intention of choosing recycled products over the traditional option. To achieve this goal, this research collected data from Brazilian and Spanish undergraduate students and employed several structural equation modeling to assess the direct effect of reported recycling and purchasing behavior in willingness to pay and in the intention to choose recycled products. The research also assessed the direct and moderating effect of the extended NAM variables in the relationship between reported behavior and willingness to pay, and reported behavior and behavior intention.

4.2. THEORETICAL BACKGROUND AND RESEARCH HYPOTHESES

4.2.1 Circular economy behavior

Considering that individuals have an active role in the CE (KIRCHHERR et al., 2017), different kinds of consumption behaviors can be related to CE (GOMES et al., 2022a), such as extending the life of products as much as possible (i.e. repairing) (VAN DEN BERGE et al., 2023), opting for green packaging (e.g. reusable materials, biodegradable, avoid overpacking) (WALKER et al., 2021), and purchasing products manufactured with recycled materials (MAGNIER et al., 2019). All CE strategies need to be employed in order to achieve its goal, i.e., sustainable development (GARCIA et al., 2021).

Circular behaviors can generally be categorized into different stages of use for products, namely: acquisition, consumption/use, end of use/life (ARIAS et al., 2022; MACKLING; KAUFMAN, 2024). Thus, not only consumption behavior can be related to circular behavior, but also other kinds of PEB related to waste minimization and regeneration (GOMES et al., 2022a). Therefore, both acquisition (e.g., purchase/consumption) and end of life disposal (e.g., recycling) are necessary to close the material and energy loops in the CE (STANGHERLIN et al., 2023). Considering that circular behaviors related to recycling can be related to both acquisition, e.g., purchase of products made of recycled materials (HEIN,

2022), and end of use, e.g., properly managing and disposing waste to recycle (ONEL; MUKHERJEE, 2017), this research focused on recycling.

Consumption aligned to the CE principles present similarities with concepts such as sustainable and green consumption (GARCIA et al., 2021), mainly because all of them aim to mitigate environmental impact in consumption activities. Thus, as well as the PEB literature (BLANKENBERG; ALHUSEN, 2019), several studies have been done to compile elements that influence circular consumption behavior. Camacho-Otero et al. (2018), for example, presented 7 factors that influence the acceptance of circular products, namely: Personal characteristics, Product and service offering, Knowledge and understanding, Experience and social aspects, Risks and uncertainty, Benefits, and Other psychological factors. This research focused on the experience and social aspects, and psychological aspects due to their importance in PEB in general (LI et al., 2019), which includes recycling (ONEL; MUKHERJEE, 2017) and consumption behavior (GOMES et al., 2022b).

4.2.2 The role of past behavior and psychological factors to the adoption of pro-environmental behavior

Habits and past behavior have been regarded as a strong predictor of behavior intention (OUELLETTE; WOOD, 1998), and called to be more included in PEB models (PHIPPS et al., 2013). Han et al. (2015) included past behavior in an extended NAM model to analyze the intention to choose for green hotels and found that the inclusion of past behavior increased the predictive power of the model, even though a direct link between past behavior and behavior intention was not found. Other research, however, have found this direct effect, such as Shishan et al. (2021) who found a positive relationship between dining in green restaurants and further intention to dine in green restaurants. Koklic et al. (2019) have found a positive relationship between past organic food purchasing and the intention to buy organic food. Therefore, considering that the adoption of one type of PEB is an indication of a predisposition to perform the same PEB in the future, which might be considered as temporal spillover (NILSSON et al., 2017), this research's first hypothesis is (Figure 7):

H1. Reported purchasing behavior is positively related to behavior intention to purchase products made of recycled materials instead of traditional products

Penz et al. (2019) found that PEB related to mitigating CO₂ emissions were positively related to the adoption of other PEB also focusing on reducing CO₂ emissions, while Lauren et al. (2017) found that engaging in easy PEB related to saving water was positively related to engaging in more difficult water saving behaviors. More specifically in the CE context, the relationship between recycling and purchasing behavior is still unclear (PHIPPS et al., 2013). One expectation is Stangherlin et al. (2023), who found that individuals engaged in recycling tend to present higher chances to buy recycled products and individuals who buy recycled products have a tendency, in a lower extent, to increase their recycling level. Thus, considering that a past PEB might be related to the adoption of new types of PEB, a behavior spillover (NILSSON et al., 2017), the second research hypothesis is formulated as (Figure 7):

H2. Reported recycling behavior is positively related to behavior intention to purchase products made of recycled materials instead of traditional products

Considering that recycling and purchase of recycled products can be considered PEB, psychological variables commonly employed in the PEB literature, such as awareness of consequence, outcome efficiency, personal norms, social norms, and attitude (LIMA et al., 2023, VAN DER WERFF; STEG, 2015; SHARMA et al., 2023), might support explaining them, as greater levels of consumers' environmental awareness might be related to more engagement in the circular consumption systems (GOMES et al., 2022a). Onel and Mukjerkee (2017), for example, found that personal norms, social norms and attitudes were positively related to recycling behavior. More specifically to purchase intention, Hein (2022) found that personal norms were positively related to the purchase intention of recycled products. Although the NAM variables tend to present stronger predictions in the traditional sequential relationship, other orderings of the variables are also possible (DE GROOT; STEG, 2009). Van der Werff and Steg (2016), for example, presented the direct effect of awareness of consequence and outcome efficiency on behavior intention. De Groot and Steg (2009) and Han et al. (2015) have not found strong moderating effects of awareness of consequence and ascribed responsibility, however, they have tested their moderating effect on the relationship between personal norms and behavior intention, and not in the relationship between past behavior and behavior intention. Thus, these variables were not tested in the spillover context of one behavior affecting another, but rather were tested in a relationship between a psychological variable and a behavior intention. Inspired by Klockner et al. (2013), who through 10 different models, analyzed the relationship of 10 different psychological

variables (e.g., awareness of consequence, ascription of responsibility, personal norms, social norms, and attitude) in the spillover effect of transportation behavior; and considering the aims of this research, the following hypothesis were developed (Figure 7):

H3. Variables from the extended norm activation model are positively related to behavior intention to purchase products made of recycled materials instead of traditional products

H3a. Awareness of consequence about waste generation is positively related to behavior intention to purchase products made of recycled materials instead of traditional products

H3b. Outcome efficiency about choosing products made of recycled materials is positively related to behavior intention to purchase products made of recycled materials instead of traditional products

H3c. Personal norms about choosing products made of recycled materials are positively related to behavior intention to purchase products made of recycled materials instead of traditional products

H3d. Social norms about choosing products made of recycled materials are positively related to behavior intention to purchase products made of recycled materials instead of traditional products

H3e. Attitude toward products made of recycled materials is positively related to behavior intention to purchase products made of recycled materials instead of traditional products

Besides the direct effect, psychological variables from the extended NAM framework have also been related to interaction effects on the PEB literature (e.g., DE GROOT et al., 2021; DE GROOT; STEG, 2009). However, the relationships that these variables present with past behavior have not been extensively investigated (HAN et al., 2015; KOKLIC et al., 2019). The relationship between past behavior and awareness of consequence and outcome efficiency, for example, is not well understood (DE GROOT; STEG, 2009). Awareness about CO₂ emissions was related to positive spillover effects (PENZ et al., 2019). Social norms have already been found to present positive relationships with recycling behavior and also might increase the presence of spillover effects (LING et al., 2023). Therefore, this research expects that these psychological variables can act as moderators variables in the spillover effect of reported circular behaviors and the intention to buy specific products made of recycled materials (Figure 7):

H4. Variables from the extended norm activation model moderates the relationship between reported purchasing behavior of recycled products and behavior intention to choose products made of recycled materials instead of traditional products

H4a. Awareness of consequence about waste generation moderates the relationship between reported purchasing behavior of recycled products and behavior intention to choose products made of recycled materials instead of traditional products

H4b. Outcome efficiency about choosing products made of recycled materials moderates the relationship between reported purchasing behavior of recycled products and behavior intention to choose products made of recycled materials instead of traditional products

H4c. Personal norms about choosing products made of recycled materials moderate the relationship between reported purchasing behavior of recycled products and behavior intention to choose products made of recycled materials instead of traditional products

H4d. Social norms about choosing products made of recycled materials moderate the relationship between reported purchasing behavior of recycled products and behavior intention to choose products made of recycled materials instead of traditional products

H4e. Attitude toward products made of recycled materials moderate the relationship between reported purchasing behavior of recycled products and behavior intention to choose products made of recycled materials instead of traditional products

H5. Variables from the extended norm activation model positively moderate the relationship between reported recycling behavior and behavior intention to choose products made of recycled materials instead of traditional products

H5a. Awareness of consequence about waste generation moderates the relationship between reported recycling behavior and behavior intention to choose products made of recycled materials instead of traditional products

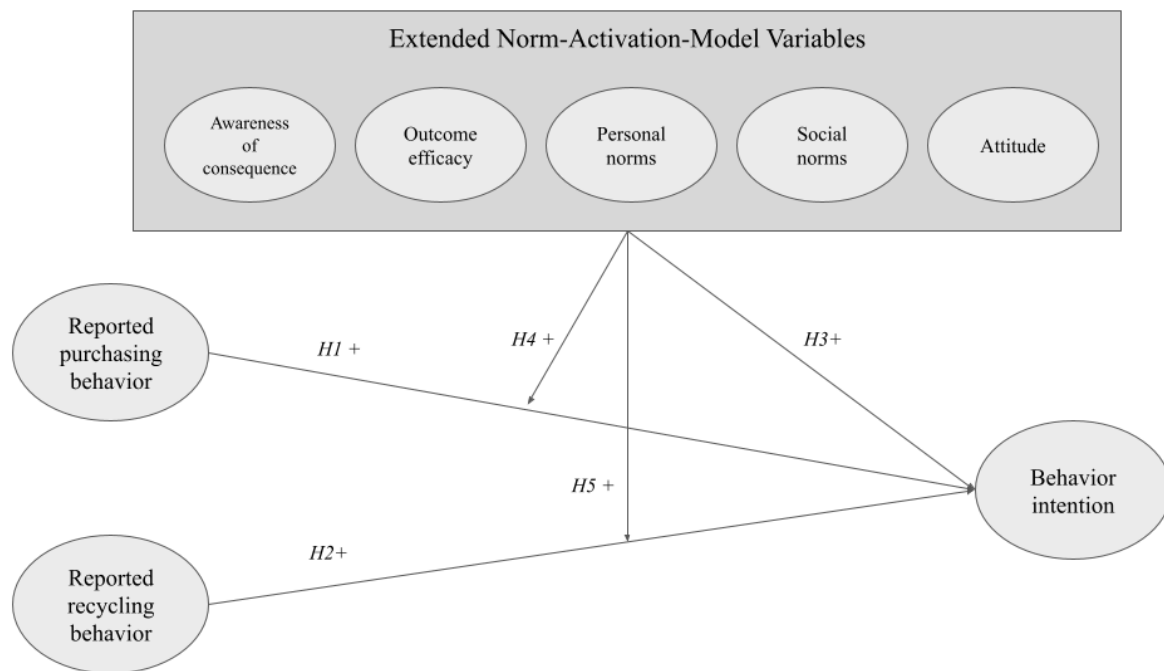
H5b. Outcome efficiency about choosing products made of recycled materials moderates the relationship between reported recycling behavior and behavior intention to choose products made of recycled materials instead of traditional products

H5c. Personal norms about choosing products made of recycled materials moderate the relationship between reported recycling behavior and behavior intention to choose products made of recycled materials instead of traditional products

H5d. Social norms about choosing products made of recycled materials moderate the relationship between reported recycling behavior and behavior intention to choose products made of recycled materials instead of traditional products

H5e. Attitude toward products made of recycled materials moderate the relationship between reported recycling behavior and behavior intention to choose products made of recycled materials instead of traditional products

Figure 7 - Research Model



Source: Developed by the authors

4.3. METHODS

4.3.1 Sample

A total of 206 undergraduate students answered the questionnaire in Brazil. After removing answers that failed to meet the attention check question ($n = 3$), the final sample was composed of 203 valid answers. From the valid answers, 100 (49.26%) were female, 94 (46.30%) were male, 7 (3.45%) did not identify as female or male, and 2 (0.96%) preferred not to answer. Participants' age ranged from 18 to 50 ($M = 22.0039$, $SD = 3.757$), with 67 (33.00%) living with their parents, and 136 (67.00%) not. From the Spanish side, 207 undergraduate students answered the questionnaire. After removing the incorrect answers from the attention check questions ($n = 11$), the final sample was composed of 196 valid answers. From the valid answers, 154 were female (78.57%), 37 were male (18.88%), 2

(1.02%) did not identify as female or male, and 3 (1.53%) preferred not to answer. Participants' age ranged from 18 to 54 ($M = 19.77$, $SD = 3.70$), with 153 (78.06%) living with their parents while 43 (21.94%) not. An a-priori sample size calculation in G*Power (Faul et al., 2009) indicated that, for an effect size of $f^2 = 0.10$ (De Groot et al., 2021), with a minimal statistical power of 0.80, probability level of 0.05, and 5 predictors (i.e., reported purchasing behavior, reported recycling behavior, “extended NAM variable”, reported purchasing behavior * “extended NAM variable”, reported recycling behavior * “extended NAM variable”), the research would need at least 134 individuals per country. Therefore, the sample for both countries were deemed sufficient for the purposes of this study. Previous studies have used students as samples not only for convenience but also because of their role in sustainability, especially as consumers (DO PAÇO; REIS, 2012; LEE et al., 2017). Young adults are considered the “consumers of the future” and are in the phase of developing their personal identity and system of beliefs and values (VERMEIR; VERBEKE, 2008), which makes it particularly relevant for CE.

Besides differences regarding gender and living with family or not in both samples, it is also relevant to mention the countries' differences. Brazil is a developing country with an Human Development Index (HDI) of 0.754 (87th position), while Spain is a developed country with an HDI of 0.905 (27th position). Although both countries do not present completely contrasting cultural values, it is possible to draw some differences, especially regarding Individualism and Indulgence cultural values (HOFSTEDE INSIGHTS, 2023). The last important remark about both countries are their level of CE maturity, CE is still in its infancy in Brazil (DELGADO; LIMA, 2022; SEHNEM et al., 2019), while developed European countries present a more mature stage (HUGHES, 2017; VANHAMÄKI et al., 2021), which influences the degree of products and services related to CE available in the market. All these contextual differences (i.e., human development, cultural values, and CE maturity stage) between Brazil and Spain might influence consumer's circular mindset (GOMES et al., 2022b).

4.3.2 Questionnaire

An online questionnaire was developed on “Free Questionnaire” for the Brazilian sample and on “Google Forms” for the Spanish Sample. The original questions in English were translated to Portuguese by the Brazilian authors and to Catalan by the Spanish author. First, the questionnaire presented the research aims and the ethical statements of anonymity,

confidentiality, exclusively scientific purposes of the usage of the data collected, which includes the right to withdraw from the research at any moment without any type of loss. The consent to participate could be given by individuals if they agree with the ethical statement and were 18 years old or older. The Ethic Committee of the Faculty of Sciences - São Paulo State University approved the research on Brazil (referee number “73010223.9.0000.5398”), while the Ethical Committee from the Autonomous University of Barcelona approved the research on Spain (referee number “6466”). The participants answered questions about awareness of consequence, outcome efficiency, personal and social norms, and attitude towards buying products made of recycled materials. In the sequence, participants answered questions about their recycling and purchasing behavior, and intention to buy a recycled product. Finally, the participants were asked to answer some socio demographic questions. The questionnaire is available at the supplementary material (Table A2). The questionnaire also contained other questions used solely on other research.

4.3.2.1 NAM variables: Awareness of consequence, Outcome efficiency, and Personal norms

The NAM variables related to reducing the amount of waste generated by their consumption behavior were measured with questions adapted from the literature (GOMES et al., 2022b; HEIN, 2022; WERFF; STEG, 2015). All questions ranged from 1 (strongly disagree) to 7 (strongly agree) and respondents indicated to what extent they agree with each statement. Awareness of consequence was measured with three items: *“I am worried about the amount of waste present in the natural environment, such as oceans”*, *“The amount of waste the humans are generating causes important problems for society”*, and *“Waste generation causes serious environmental problems, such as pollution”*. Outcome efficiency was measured with three questions: *“I think it is useful to buy products made of recycled materials to reduce environmental problems”*, *“I think I can contribute to reducing environmental problems by buying products made of recycled materials”*, and *“I think that buying products made of recycled materials increases environmental quality”*. Finally, personal norms were measured with these three questions: *“I feel morally obliged to buy products made of recycled materials, regardless of what other people do”*, *“I get a bad conscience if I do not buy products made of recycled materials”*, and *“It would make me feel a better person if I was able to buy more products made of recycled materials”*. Awareness of consequence presented Cronbach’s Alpha of 0.7 ($M = 6.4$, $SD = 0.74$), 0.7 for Outcome

Efficiency ($M = 5.2$, $SD = 1.3$), and 0.81 for personal norms ($M = 3.6$, $SD = 1.4$) for the Brazilian sample, and 0.77 ($M = 6.2$, $SD = 0.75$), 0.90 ($M = 5.4$, $SD = 1.2$), and 0.78 ($M = 3.6$, $SD = 1.3$), respectively, for the Spanish sample.

4.3.2.2 Social Norms

Social norms to purchase products made of recycled materials were measured with a scale adapted from Bamberg et al. (2007) and Han (2014). The scale is composed of three questions: *“People who are important to me think that I should buy products made of recycled materials”*, *“People who are important to me support that I buy products made of recycled materials”*, and *“People whose opinion I value would prefer that I care for buying products made of recycled materials”*. The questions range from 1 (totally disagree) to 7 (totally agree). Cronbach’s Alpha was 0.79 ($M = 3.2$, $SD = 1.4$) for the Brazilian sample, and 0.84 ($M = 3.5$, $SD = 1.5$) for the Spanish sample.

4.3.2.3 Attitude toward buying recycled products

Attitude toward purchasing products made from recycled materials was measured with five questions adapted from Han (2014). Respondents were asked to answer the following statement: *“For me, buying products made of recycled materials”* in five different scales from 1 to 7: Bad (1) vs Good (7), Foolish (1) vs Wise (7), Unpleasant (1) vs Pleasant (7), Harmful (1) vs Beneficial (7), and Unattractive (1) vs Attractive (7). Cronbach’s Alpha was 0.84 ($M = 5.9$, $SD = 0.99$) for the Brazilian sample, and 0.82 ($M = 5.7$, $SD = 0.89$) for the Spanish sample.

4.3.2.4 Reported behavior

Reported behavior was measured in two ways: recycling behavior and purchasing behavior of products made of recycled material. For recycling behavior, this research adapted four questions from Huffman et al. (2014). All questions were measured with a 7-point Likert scale ranging from 1 (never) to 7 (always): *“How often do you separate paper to be recycled instead of discarding it in another way?”*, *“How often do you bring empty plastic bottles/containers to a recycling bin instead of discarding it in another way?”*, *“How often*

do you bring empty cans to a recycling bin instead of discarding it in another way?”, and *“In general, how often do you separate something that you are not going to use anymore to recycle instead of discarding it in another way?”*. Cronbach’s Alpha was 0.84 ($M = 4.9$, $SD = 1.5$) for the Brazilian sample, and 0.89 ($M = 5.3$, $SD = 1.5$) for the Spanish sample.

For purchasing behavior of products made of recycled materials, this research used three questions adapted from Lima et al. (2023): *“I try to buy products made of recycled materials as much as I can”*, *“When I have the chance to buy a recycled product over a traditional one, I tend to do so”*, and *“I always look for products made of recycled materials when I am shopping”* both questions were in 7-point Likert scale ranging from 1 (Totally disagree) to 7 (Totally agree). Cronbach’s Alpha was 0.87 ($M = 3.7$, $SD = 1.5$) for the Brazilian sample, and 0.83 ($M = 3.8$, $SD = 1.3$) for the Spanish sample.

4.3.2.5 Purchasing intention of products made of recycled materials

To measure behavior intention, we presented our respondents with three scenarios. All scenarios presented a product with two versions: the traditional one and the one made with recycled materials. The first scenario covered a piece of garment common among undergraduate students, i.e. university sweatshirt, in the following way: *“Consider that your undergraduate program is going to sell a sweatshirt with the name and logo of your program. Consider that you could choose two options that have no visual differences, a regular cotton sweatshirt costing R\$120,00 (22.50 €) and a sweatshirt made of recycled materials recovered from the ocean. Imagine that you are considering buying the sweatshirt, how much would you be willing to pay in order to choose the recycled option?”*. Respondents were asked to indicate the maximum they would pay for the recycled option (PRETNER et al., 2021). The scale ranged from 1 - I would not buy for any price, to 13 - no more than R\$240,00 (45.00 €), each higher point in the scale presented an increase of R\$20,00 (approximately, 4.00 €) in the maximum value (Brazil: $M = 7.034$, $SD = 2.142$; Spain: $M = 6.474$, $SD = 2.243$). A second question within this scenario asked how likely individuals would buy the sweatshirt if a visual difference indicating the recycled or traditional version was added to the sweatshirt. The scale ranged from 1 = Totally unlikely, to 7 = Totally likely (Brazil: $M = 4.227$, $SD = 1.604$; Spain: $M = 3.847$, $SD = 1.623$).

The second scenario covered a cheaper and more frequently bought product, i.e. a detergent used for cleaning in domestic tasks, in the following way: *“Consider that you are*

going to buy a detergent to use in your house. You found a traditional option for R\$2,00 (0.50 €) and an optional with a bottle made of recycled plastic recovered from the ocean for R\$3,00 (0.75 €) (both options are from the same brand). What is the probability that you would buy the recycled option?''. The scale ranged from 1 = Totally unlikely, to 7 = Totally Likely. The recycled option was 50% more expensive than the traditional one based on an proximity of the threshold value of 60% found by Galati et al. (2022) in recycled bottle water (Brazil: M = 4.232, SD = 1.960; Spain: M = 5.112, SD = 1.604).

The third and last scenario covered choosing a notepad to be used in an academic event in which the more expensive option (i.e., recycled notepad) would lead to about 20% less budget to be used in other parts of the event (i.e. coffee break). *“Consider that you are helping organize an academic event in the campus (e.g., conference). The organizational committee received some budget from your department to use in the event. Considering that all enrolled individuals will receive a notepad. You have the option to buy a cheaper notepad, made of regular paper, or a recycled notepad (i.e., recycled paper and recycled wire). Both notepads are from the same brand and have the same size. The recycled option is more expensive, thus by choosing it, the organization committee will have less budget for the rest of the event (i.e., the coffee break will receive 10 to 20% less money and should be adapted to this new budget). What is the probability that you would choose the recycled notepad?”* The scale ranged from 1 = Totally unlikely, to 7 = Totally Likely. A previous market search identified recycled paper products being sold for about 20% more than the traditional version of the same brand (Brazil: M = 3.882, SD = 1.705; Spain: M = 4.495, SD = 1.409).

4.3.3 Statistical analysis

This research relied on several models for each country in order to assess the direct effect of reported behavior on purchasing intention, the direct effect of the extended NAM variables on purchasing intention, and the moderating effect of the extended NAM variables in the relationship between reported behavior and purchasing intention. To accomplish these tests, one model was developed for each extended NAM variable and for each country, resulting in a total of 20 models (i.e., 5 variables from extended NAM x 4 different dependent variables) for each country (i.e., total of 40 models) that were tested with the Structural Equation Modeling (SEM) technique. More parsimonious models were developed given the sample size to avoid potential multicollinearity that could arise from the inclusion of multiple

simultaneous explanatory variables. This approach ensures more reliable and interpretable results.

The SEM embraces statistical techniques for analyzing relationships between several variables based on factorial and regression analysis (HAIR et al., 2022). This research relied on the PLS-SEM as it is a non-parametric technique and therefore does not require statistical assumptions regarding data distribution (SARSTEDT et al., 2014). Moreover, PLS-SEM is a suitable approach for testing moderating effects between variables, which is the case of the present research: moderating effect of the extended NAM on the relationship between reported behavior and purchase intention. All these features make PLS-SEM a common tool in the PEB literature (e.g., HAN et al., 2015; LI et al., 2019; LIMA et al., 2023).

After completing all the tests to ensure the reliability and validity of the models, a complete bootstrapping with 10,000 subsamples was employed to check the significance of the path coefficients in the structural models. The two-tailed hypothesis tests were performed to establish the statistical significance of the coefficients, which needs to be considered when interpreting the presented p values. The analysis was made using the SmartPLS 4 (Ringle et al., 2022). Next, a multigroup analysis was performed in order to compare the models from Brazil and Spain.

4.4. RESULTS

4.4.1 Validity and reliability of awareness of consequence, outcome efficiency, personal norms, social norms, attitude, reported recycling and purchasing behavior, and purchasing intention

In order to evaluate the measurement models, the reflective constructs (i.e., awareness of consequence, outcome efficiency, personal norms, social norms, attitudes, reported recycling, reported purchasing, and behavior intention) were evaluated considering their internal consistency and convergent and discriminant validity. The outer loading was not presented here due space constraints, but data will be made available upon request. The Cronbach's alpha were above 0.700, the Average Variance Extracted (AVE) were above 0.500, and the Composite Reliability were above 0.700 in the majority of the cases (Table 13), whenever some data presented lower values than that, the variable was removed and the model checked again, if exception of one case, in all other cases the models measurement

improved after the removal. In these cases, the same variable was removed from the same model for the other country, in order to keep models equal between both countries (HAIR et al., 2021). The discriminant validity was checked using the heterotrait monotrait ratio of correlations (HTMT), all values were below 0.850 (HENSELER et al., 2015). The variance inflation factors (VIFs) were below 3.300, indicating that the models are free of common method bias, including multicollinearity problems (KOCK, 2015). These data are also not presented here due space constraints, but will be made available upon request.

Table 13 - Convergent validity

Model	Variable	Cronbach's α	AVE	Composite reliability (Rho_a)	Composite reliability (Rho_c)	R ²	SRMR
Brazil_AC_Sweatshirt	AC	0.702	0.628	0.708	0.835	10.2%	0.082
	RP	0.867	0.789	0.874	0.918		
	RR	0.838	0.638	0.697	0.876		
Brazil_AC_Visual difference	AC	0.702	0.567	0.522	0.793	4.8%	0.076
	RP	0.867	0.780	1.005	0.914		
	RR	0.838	0.665	0.903	0.887		
Brazil_AC_Detergent	AC	0.702	0.585	0.840	0.807	24.0%	0.081
	RP	0.867	0.789	0.873	0.918		
	RR	0.838	0.672	0.846	0.891		
Brazil_AC_Notepad	AC	0.702	0.590	0.829	0.810	13.3%	0.080
	RP	0.867	0.789	0.884	0.918		
	RR	0.838	0.672	0.860	0.891		
Brazil_OE_Sweatshirt	OE	0.874	0.797	0.896	0.922	7.4%	0.068
	RP	0.867	0.789	0.874	0.918		
	RR	0.838	0.638	0.697	0.876		
Brazil_OE_Visual difference	OE	0.837	0.858	0.881	0.924	6.8%	0.063

Brazil_OE_Detergen t	RP	0.867	0.780	1.005	0.914	15.7%	0.065
	RR	0.838	0.665	0.903	0.887		
	OE	0.874	0.799	0.875	0.922		
	RP	0.867	0.789	0.873	0.918		
	RR	0.838	0.672	0.846	0.891		
	OE	0.874	0.796	0.902	0.921		
Brazil_OE_Notepad	RP	0.867	0.789	0.884	0.918	10.5%	0.066
	RR	0.838	0.672	0.860	0.891		
	PN	0.815	0.685	1.339	0.866		
Brazil_PN_Sweatshi rt	RP	0.867	0.789	0.874	0.918	7.6%	0.075
	RR	0.838	0.638	0.697	0.876		
	PN	0.815	0.718	0.877	0.884		
Brazil_PN_Visual difference	RP	0.867	0.780	1.005	0.914	7%	0.065
	RR	0.838	0.665	0.903	0.887		
	PN	0.815	0.729	0.817	0.890		
Brazil_PN_Detergen t	RP	0.867	0.789	0.837	0.918	21.2%	0.066
	RR	0.838	0.672	0.846	0.891		
	PN	0.815	0.727	0.869	0.889		
Brazil_PN_Notepad	RP	0.867	0.789	0.884	0.918	13.3%	0.065
	RR	0.838	0.672	0.860	0.891		

Brazil_SN_Sweatshirt	SN	0.794	0.672	0.882	0.859		
	RP	0.867	0.789	0.874	0.918	7%	0.071
	RR	0.838	0.638	0.697	0.876		
Brazil_SN_Visual difference	SN	0.696	0.643	6587.369	0.767		
	RP	0.867	0.780	1.005	0.914	3.1%	0.078
	RR	0.838	0.665	0.903	0.887		
Brazil_SN_Detergent	SN	0.794	0.708	0.811	0.879		
	RP	0.867	0.789	0.873	0.918	16.4%	0.065
	RR	0.838	0.672	0.846	0.891		
Brazil_SN_Notepad	SN	0.794	0.705	0.850	0.877		
	RP	0.867	0.789	0.884	0.918	12.9%	0.065
	RR	0.838	0.672	0.860	0.891		
Brazil_AT_Sweatshirt	AT	0.843	0.612	0.858	0.887		
	RP	0.867	0.789	0.874	0.918	7.8%	0.077
	RR	0.838	0.638	0.697	0.876		
Brazil_AT_Visual difference	AT	0.748	0.664	0.747	0.856		
	RP	0.867	0.780	1.005	0.914	7%	0.078
	RR	0.838	0.665	0.903	0.887		
Brazil_AT_Detergent	AT	0.843	0.612	0.860	0.887		
	RP	0.867	0.789	0.873	0.918	15.4%	0.076

	RR	0.838	0.672	0.846	0.891		
	AT	0.843	0.615	0.889	0.888		
Brazil_AT_Notepad	RP	0.867	0.789	0.884	0.918	11.8%	0.076
	RR	0.838	0.672	0.860	0.891		
	AC	0.770	0.682	0.899	0.864		
Spain_AC_Sweatshirt	RP	0.826	0.739	0.868	0.894	6%	0.066
	RR	0.892	0.752	0.953	0.923		
	AC	0.822	0.773	0.741	0.869		
Spain_AC_Visual difference	RP	0.826	0.729	0.976	0.889	6.3%	0.058
	RR	0.892	0.752	0.953	0.924		
	AC	0.770	0.656	0.937	0.850		
Spain_AC_Detergent	RP	0.826	0.740	0.855	0.895	13.2%	0.072
	RR	0.892	0.743	0.992	0.920		
	AC	0.770	0.676	0.799	0.862		
Spain_AC_Notepad	RP	0.826	0.740	0.850	0.895	18.6%	0.071
	RR	0.892	0.749	0.947	0.923		
	OE	0.904	0.834	0.963	0.938		
Spain_OE_Sweatshirt	RP	0.826	0.739	0.868	0.894	2.3%	0.055
	RR	0.892	0.752	0.953	0.923		
	OE	0.893	0.900	1.014	0.947		
Spain_OE_Visual						5.8%	0.060

difference	RP	0.826	0.729	0.976	0.889		
	RR	0.892	0.752	0.953	0.924		
	OE	0.904	0.839	0.906	0.940		
Spain_OE_Detergent	RP	0.826	0.740	0.855	0.895	13.2%	0.059
	RR	0.892	0.743	0.992	0.920		
	OE	0.904	0.838	0.932	0.939		
Spain_OE_Notepad	RP	0.826	0.740	0.850	0.895	16.5%	0.056
	RR	0.892	0.749	0.947	0.923		
	PN	0.784	0.617	1.281	0.819		
Spain_PN_Sweatshirt	RP	0.826	0.739	0.868	0.894	2.1%	0.071
	RR	0.892	0.752	0.953	0.923		
	PN	0.784	0.676	1.247	0.861		
Spain_PN_Visual difference	RP	0.826	0.729	0.976	0.889	5.7%	0.065
	RR	0.892	0.752	0.953	0.924		
	PN	0.784	0.699	0.805	0.874		
Spain_PN_Detergent	RP	0.826	0.740	0.855	0.895	14.1%	0.063
	RR	0.892	0.743	0.992	0.920		
	PN	0.784	0.699	0.791	0.874		
Spain_PN_Notepad	RP	0.826	0.740	0.850	0.895	18.1%	0.062
	RR	0.892	0.749	0.947	0.923		

Spain_SN_Sweatshirt	SN	0.842	0.709	0.744	0.879		
	RP	0.826	0.739	0.868	0.894	2.4%	0.064
	RR	0.892	0.752	0.953	0.923		
Spain_SN_Visual difference	SN	0.784	0.808	1.045	0.893		
	RP	0.826	0.729	0.976	0.889	10.6%	0.070
	RR	0.892	0.752	0.953	0.924		
Spain_SN_Detergent	SN	0.842	0.758	0.857	0.904		
	RP	0.826	0.740	0.855	0.895	16.3%	0.066
	RR	0.892	0.743	0.992	0.920		
Spain_SN_Notepad	SN	0.842	0.751	0.906	0.901		
	RP	0.826	0.740	0.850	0.895	16.6%	0.065
	RR	0.892	0.749	0.947	0.923		
Spain_AT_Sweatshirt	AT	0.819	0.571	0.867	0.868		
	RP	0.826	0.739	0.868	0.894	5.8%	0.078
	RR	0.892	0.752	0.953	0.923		
Spain_AT_Visual difference	AT	0.738	0.571	0.793	0.784		
	RP	0.826	0.729	0.976	0.889	6.1%	0.071
	RR	0.892	0.752	0.953	0.924		
Spain_AT_Detergent	AT	0.819	0.579	0.827	0.873		
	RP	0.826	0.740	0.855	0.895	13.7%	0.076

	RR	0.892	0.743	0.992	0.920		
	AT	0.819	0.581	0.821	0.874		
Spain_AT_Notepad	RP	0.826	0.740	0.826	0.895	18.4%	0.074
	RR	0.892	0.749	0.892	0.923		

AC = Awareness of consequence, OE = Outcome efficiency, PN = Personal norms, SN = Social norms, AT = Attitude, RR = Reported recycling behavior, RP = Reported purchasing behavior, BI = Behavior intention. Source: Developed by the authors

4.4.2 Relationships between awareness of consequence, outcome efficiency, personal norms, social norms, attitude, reported recycling and purchasing behavior, and purchasing intention

To test the hypotheses presented in this research, a total of 40 PLS-SEM models were employed in the research, 20 (5 different moderating variables and 4 different dependent variables) for the Brazilian and Spanish sample. Due to space constraints, only the significant relationships are presented in this article (Table 14). The rest of the data will be made available upon request. Considering the exploratory nature of the research, we considered a less stringent threshold for significant p values (i.e., $p < 0.10$) (DAHIRU, 2008), which has already been employed in the literature (LIMA et al., 2023). The Brazilian models presented 25 direct relationships and 5 moderating relationships, while the Spanish models presented 23 direct relationships and 1 moderating relationship. In Brazil, the models related to detergent purchasing behavior presented higher values for explaining the variance, i.e., R^2 , (15.4% to 24%), followed by the notepad models (10.5% to 13.3%), sweatshirt (7% to 10.2%), and visual difference in the sweatshirt (3.1% to 7%). In Spain, the notepad models presented higher R^2 (16.5% to 18.6%), followed by the detergent models (13.2% to 16.3%), visual difference in the sweatshirt (5.7% to 10.6%), and sweatshirt (2.1% to 6%) (Table 1). The standardized root mean square residual (SRMR) of the models were below the accepted value of 0.100 for the models (Table 13) (HU; BENTLER, 1998).

Table 14 - Significant relationships

Model	Relationship	β	M	SE	t	p	f^2
Brazil_AC_Sweatshirt	AC $\rightarrow$ BI_Sweatshirt	0.209	0.196	0.093	2.240	0.025	0.044
	RP $\rightarrow$ BI_Sweatshirt	0.174	0.183	0.075	2.338	0.019	0.028
Brazil_AC_Detergent	AC $\rightarrow$ BI_Detergent	0.330	0.336	0.062	5.307	0.000	0.138
	RP $\rightarrow$ BI_Detergent	0.231	0.228	0.072	3.215	0.001	0.049
	RR * AC $\rightarrow$ BI_Detergent	0.147	0.149	0.075	1.962	0.050	0.025
Brazil_AC_Notepad	AC $\rightarrow$ BI_Notepad	0.235	0.239	0.064	3.689	0.000	0.053
	RP $\rightarrow$ BI_Notepad	0.164	0.164	0.077	2.111	0.035	0.023
Brazil_OE_Sweatshirt	RP $\rightarrow$ BI_Sweatshirt	0.191	0.194	0.084	2.270	0.023	0.029

Brazil_OE_Visual Difference	AT → BI_Visual Difference	0.194	0.191	0.076	2.552	0.011	0.033
Brazil_OE_Detergent	OE → BI_Detergent	0.203	0.203	0.075	2.712	0.007	0.041
	RP → BI_Detergent	0.257	0.251	0.080	3.215	0.001	0.057
Brazil_OE_Notepad	RP → BI_Notepad	0.177	0.175	0.084	2.102	0.036	0.026
	RP * OE → BI_Notepad	0.161	0.150	0.096	1.675	0.094	0.021
Brazil_PN_Sweatshirt	PN → BI_Sweatshirt	0.147	0.161	0.086	1.723	0.085	0.017
	RP → BI_Sweatshirt	0.150	0.150	0.085	1.761	0.078	0.016
Brazil_PN_Detergent	PN → BI_Detergent	0.354	0.359	0.080	4.402	0.000	0.114
Brazil_PN_Notepad	PN → BI_Notepad	0.216	0.221	0.086	2.512	0.012	0.039
	RP * PN → BI_Notepad	0.121	0.115	0.072	1.683	0.092	0.016
Brazil_SN_Sweatshirt	RP → BI_Sweatshirt	0.165	0.164	0.092	1.797	0.072	0.020
Brazil_SN_Detergent	SN → BI_Detergent	0.191	0.200	0.074	2.575	0.010	0.032
	RP → BI_Detergent	0.216	0.212	0.084	2.566	0.010	0.036
Brazil_SN_Notepad	SN → BI_Notepad	0.212	0.220	0.075	2.842	0.004	0.038
	RR → BI_Detergent	0.132	0.153	0.069	1.916	0.055	0.016
Brazil_AT_Sweatshirt	AT → BI_Sweatshirt	0.165	0.167	0.096	1.708	0.087	0.019
Brazil_AT_Visual Difference	AT → BI_Visual Difference	0.198	0.199	0.090	2.210	0.027	0.027
	RR * AT → Visual Difference	0.154	0.136	0.089	1.724	0.085	0.024
Brazil_AT_Detergent	AT → BI_Detergent	0.218	0.223	0.076	2.844	0.004	0.036
	RP → BI_Detergent	0.209	0.202	0.086	2.435	0.015	0.023
Brazil_AT_Notepad	AT → BI_Notepad	0.217	0.227	0.077	2.806	0.005	0.034
	RP * AT → Detergent	0.147	0.135	0.085	1.741	0.082	0.018
Spain_AC_Visual Difference	RP → BI_Visual Difference	0.191	0.189	0.074	2.574	0.010	0.034
	RP * AC → Visual Difference	-0.174	-0.146	0.097	1.784	0.075	0.018
Spain_AC_Detergent	RP → Detergent	0.282	0.276	0.070	4.053	0.000	0.076
Spain_AC_Notepad	AC → BI_Notepad	0.195	0.197	0.068	2.888	0.004	0.040

	RP → BI_Notepad	0.354	0.349	0.062	5.733	0.000	0.128
Spain_OE_Visual Difference	RP → BI_Visual Difference	0.231	0.227	0.078	2.940	0.003	0.044
Spain_OE_Detergent	OE → BI_Detergent	0.130	0.134	0.075	1.731	0.083	0.015
	RP → BI_Detergent	0.247	0.244	0.073	3.394	0.001	0.053
Spain_OE_Notepad	OE → BI_Notepad	0.346	0.341	0.068	5.106	0.000	0.107
Spain_PN_Visual Difference	RP → BI_Visual Difference	0.173	0.163	0.092	1.874	0.061	0.020
Spain_PN_Detergent	RP → BI_Detergent	0.220	0.215	0.077	2.845	0.004	0.032
	RR * PN → Detergent	0.160	0.147	0.093	1.728	0.084	0.022
Spain_PN_Notepad	PN → BI_Notepad	0.200	0.203	0.091	2.189	0.029	0.031
	RP → BI_Notepad	0.267	0.262	0.086	3.110	0.002	0.050
Spain_SN_Visual Difference	SN → BI_Visual Difference	-0.263	-0.251	0.106	2.489	0.013	0.061
	RP → BI_Visual Difference	0.309	0.299	0.088	3.523	0.000	0.077
Spain_SN_Detergent	SN → BI_Detergent	0.213	0.216	0.074	2.877	0.004	0.041
	RP → BI_Detergent	0.190	0.192	0.073	2.617	0.009	0.009
Spain_SN_Notepad	RP → BI_Notepad	0.345	0.340	0.074	4.684	0.000	0.097
Spain_AT_Sweatshirt	AT → BI_Sweatshirt	0.177	0.188	0.097	1.820	0.069	0.022
Spain_AT_Visual Difference	RP → BI_Visual Difference	0.147	0.151	0.085	1.739	0.082	0.017
Spain_AT_Detergent	AT → BI_Detergent	0.171	0.185	0.080	2.129	0.033	0.023
	RP → BI_Detergent	0.228	0.216	0.079	2.880	0.004	0.042
Spain_AT_Notepad	AT → BI_Notepad	0.170	0.176	0.080	2.121	0.034	0.024
	RP → BI_Notepad	0.305	0.297	0.075	4.093	0.000	0.080

AC = Awareness of consequence, OE = Outcome efficiency, PN = Personal norms, SN = Social norms, AT = Attitude, RR = Reported recycling behavior, RP = Reported purchasing behavior, BI = Behavior intention. Source: Developed by the authors

Considering that each hypothesis presented more than one model, this research considered an hypothesis as approved if at least 50% of the models supported it, partially supported if at least 25% of the models supported it, and, otherwise, the hypothesis was

rejected. Thus, the results indicates that: reported purchasing of recycled products is positively related to purchase intention of specific products (H1 supported); reported recycling behavior is not positively related to purchase intention of specific products (H2 rejected); awareness of consequence, personal norms, and attitude are positively related to purchase intention of specific products (H3a, H3c, and H3e supported), while outcome efficiency and social norms are positively related, but at a lower extend (H3b and H3d partially supported); only 3 significant moderating effects were found for the relationship between reported purchasing behavior and purchase intention, all of them to the notepad product, by outcome efficiency, personal norms, and attitude (H4a, H4b, H4c, H4d, and H4e not supported); and only 3 significant moderating effects were found for the relationship between reported purchasing behavior and purchase intention, 2 of them related to the detergent product (awareness of consequence and personal norms), and 1 with the visual difference in the sweatshirt (attitude) (H5a, H5b, H5c, H5d, and H5e not supported) (Table 15).

Table 15 - Hypotheses' results

Hypothesis	Models with Significant relationships	Status
H1	Brazil_AC_Sweatshirt	Supported
	Brazil_AC_Detergent	
	Brazil_AC_Notepad	
	Brazil_OE_Sweatshirt	
	Brazil_OE_Detergent	
	Brazil_OE_Notepad	
	Brazil_PN_Sweatshirt	
	Brazil_SN_Sweatshirt	
	Brazil_SN_Detergent	
	Brazil_AT_Detergent	
	Spain_AC_Visual Difference	
	Spain_AC_Detergent	
	Spain_AC_Notepad	
	Spain_OE_Visual Difference	
	Spain_OE_Detergent	
	Spain_PN_Visual Difference	
	Spain_PN_Detergent	
	Spain_PN_Notepad	
	Spain_SN_Visual Difference	
	Spain_SN_Detergent	
	Spain_SN_Notepad	
	Spain_AT_Visual Difference	
	Spain_AT_Detergent	
	Spain_AT_Notepad	
H2	Brazil_SN_Notepad	Not supported

H3a	Brazil_AC_Sweatshirt Brazil_AC_Detergent Brazil_AC_Notepad Spain_AC_Notepad	Supported
H3b	Brazil_OE_Detergent Spain_OE_Detergent Spain_OE_Notepad	Partially supported
H3c	Brazil_PN_Sweatshirt Brazil_PN_Detergent Brazil_PN_Notepad Spain_PN_Notepad	Supported
H3d	Brazil_SN_Detergent Brazil_SN_Notepad Spain_SN_Detergent	Partially supported
H3e	Brazil_AT_Sweatshirt Brazil_AT_Visual Difference Brazil_AT_Detergent Brazil_AT_Notepad Spain_AT_Sweatshirt Spain_AT_Detergent Spain_AT_Notepad	Supported
H4a	-	Rejected
H4b	Brazil_OE_Visual Difference Brazil_OE_Notepad	Partially supported
H4c	Brazil_PN_Notepad	Rejected
H4d	-	Rejected
H4e	Brazil_AT_Notepad	Rejected
H5a	Brazil_AC_Detergent	Rejected
H5b	-	Rejected
H5c	Spain_PN_Detergent	Rejected
H5d	-	Rejected
H5e	Brazil_AT_Visual Difference	Rejected

AC = Awareness of consequence, OE = Outcome efficiency, PN = Personal norms, SN = Social norms, AT = Attitude, RR = Reported recycling behavior, RP = Reported purchasing behavior, BI = Behavior intention. Source: Developed by the authors

4.4.3 Differences between circular behavior in brazil and spain

The Brazilian sample presented higher willingness to pay for the recycled sweatshirt and were more prone to buy it when there is a visual difference in both models. On the other

hand, the Spanish sample presented higher mean than the Brazilian in the intention to buy the recycled detergent and notepad. A total of 11 significant differences were found between the Brazilian and Spanish context (Table 16), being 8 differences related to direct effect, and 3 from moderating effect.

Table 16 - between the Brazil and Span

Model	Relationship	Δ	ρ
Δ Brazil - Spain: AC_Detergent	AC $\rightarrow$ BI_Detergent	0.234	0.013
Δ Brazil - Spain: AC_Notepad	RP $\rightarrow$ BI_Notepad	-0.195	0.046
Δ Brazil - Spain: OE_Visual Difference	AC $\rightarrow$ BI_Visual Difference	0.334	0.006
	RP $\rightarrow$ BI_Visual Difference	-0.182	0.095
Δ Brazil - Spain: PN_Visual Difference	RR * PN $\rightarrow$ BI_Visual Difference	0.274	0.071
Δ Brazil - Spain: PN_Detergent	PN $\rightarrow$ BI_Detergent	0.267	0.020
Δ Brazil - Spain: SN_Visual Difference	SN $\rightarrow$ BI_Visual Difference	0.321	0.074
Δ Brazil - Spain: SN_Detergent	RP * SN $\rightarrow$ BI_Detergent	0.181	0.066
Δ Brazil - Spain: SN_Notepad	RP $\rightarrow$ BI_Notepad	-0.245	0.033
Δ Brazil - Spain: AT_Notepad	RP $\rightarrow$ BI_Notepad	0.047	0.660
	RP * AT $\rightarrow$ BI_Notepad	0.220	0.049

AC = Awareness of consequence, OE = Outcome efficiency, PN = Personal norms, SN = Social norms, AT = Attitude, RR = Reported recycling behavior, RP = Reported purchasing behavior, BI = Behavior intention. Source: Developed by the authors

4.5. DISCUSSIONS

The present research analyzed the relationship of reported recycling and purchasing behavior with purchase intention in a CE context. Thus, this research also attends the call to consider behavior as an independent variable and not only as a dependent variable (PHIPPS et al., 2013). To achieve these research goals, a total of 40 models including variables from an extended NAM framework (HAN, 2014; VAN DER WERFF; STEG, 2015) were applied with Brazilian and Spanish data. The findings from both countries support H1 while not support H2, that is, general reported purchasing behavior of recycled products is positively related to the intention to purchase different specific products made of recycled materials, while reported recycling behavior is not related to purchase intention. The higher number of significant relationships with behavior intention for the reported buying behavior than for the recycling reported behavior might be related to the moral licensing effect (TRUELOVE et al., 2014), that is, individuals who already perform a PEB believe that they are already doing their part for the issue and do not engage in some other PEB. When considering sustainable consumptions, people tend to show more consistent behaviors in more similar behaviors (PENZ et al., 2019). Moreover, aspects of recycled products, such as perceived inferior quality or disgust (POLYPORTIS et al., 2022) might be reasons for why some individuals are engaged in recycling but not in the acquisition of recycled products. Therefore, these findings offer new evidence that even individuals that support closing the material and energy cycle by properly disposing of their waste are not necessarily willing to close the loop by acquiring recycled materials, posing challenges for the full potential of the CE. Future research could analyze if reported purchasing and recycling behavior are related to behavior intentions toward specific recycling behavior.

These research findings from both countries supported Hypothesis 3, the variables from the extended NAM framework presented a positive relationship with purchase intention of different products made of recycled materials. These findings are aligned with the literature that suggests that beliefs that individuals have about the environmental condition and their possibility to mitigate these issues (ELGAAIED, 2012; VAN DER WERFF; STEG, 2016), personal norms (LIMA et al., 2023), social norms (CIALDINI et al., 1990), attitude (SETHI et al., 2018). However, the influence of these variables also depends a lot on the product, in the case of this research, the detergent with the recycled bottle and the recycled notepad presented were more commonly related to the extended NAM model than the sweatshirt, reinforcing that types and attributes of the products are fundamental aspects to be

developed in order to foster CE. The findings suggest that attitude and personal norms are the strongest predictors of purchasing intention among the variables tested in this research, reinforcing the call to combine moral models (i.e., NAM) with other variables, such as attitudes (HAN et al., 2015). Also, awareness of consequence presents more relationships than outcome efficiency, even though it comes before in the causal chain of the NAM model, being “further” to behavior (VAN DER WERFF; STEG, 2015), the literature have already found awareness of consequence as presenting a stronger relationship with behavior intention than outcome efficiency (VAN DER WERFF; STEG, 2016).

The research findings did not present enough support for hypotheses 4 and 5, that the extended NAM variables moderate the relationship between reported recycling and purchasing behavior, and purchase intention. In the case of the detergent and notepad, there were some significant moderating effects, however, not in the sweatshirt case, which reinforces that purchase intentions for particular products are affected by different aspects. Future research could combine the variables employed in this research with other variables related to the product's characteristics, such as perceived quality.

The significant differences found in relationships between both countries reinforces that individual nationality is one of the aspects that influence the adoption of circular behavior (GOMES et al., 2022a). Contrary to Dobbelstein and Lochner (2023), who found higher behavior intentions for a developing country (i.e., South Africa) than a developed country (i.e., Germany), the present research found a higher behavior intention for the developed country. However, when considering willingness to pay, the Brazilian sample presented higher mean than the Spanish sample.

5.2 Practical and policy implication

A better understanding of factors that affect purchase intention of recycled products are important to develop strategies to increase this kind of behavior (DOBDELSTEIN; LOCHNER, 2023). Considering that the results suggest that recycling is not associated with intention to choose recycled products, marketing and educational campaigns could be made in recycling spots to stimulate individuals who recycle to opt for recycled products when shopping, as this behavior is necessary to close material cycles completely.

4.5.1 Limitations

The present research presents some limitations. First, this research did not include questions to measure aspects of the products (e.g., safety, favorable image, attractiveness), which also affects the purchase intention and might explain the relatively low R^2 of the models, especially considering the sweatshirt purchasing intention (POLYPORTIS et al., 2022). The research also did not include a visual representation of the sweatshirt, which is an important information for pieces of cloth. However, it is a common product present in the universities, being expected that the students have an image in mind. Another factor might be the lack of a control question regarding if the individual already had enough winter clothes, which would be particularly important in Brazil, which has a predominant hot weather.

A second limitation is the lack of control variables in the PLS-SEM analysis made in the research. This was due to the “no possible solution” occurring when we tried to employ the models with the socio demographic variables (i.e., age, gender, living status) as control variables. The “no possible solution” issue is described in the SmartPLS¹ when the bootstrapping routine and at least one of the bootstrapping samples result in an invalid solution. One of the suggestions given in the software was to increase the sample, which would not be possible due to constraints in data collection faced by the researchers. However, we reinforce that the sample size was deemed adequate with a priori test made on G*Power (as presented in the method section). The other suggestion indicated was to remove the control variables from the model, which was the solution adopted.

4.6 CONCLUSIONS

The present research analyzed the relationship of reported recycling and purchasing behavior of recycled products with purchasing intention of different products made of recycled materials, and also the direct and moderating effect of an extended NAM model in the behaviors relationship. The findings indicated that reported purchasing behavior has a strong relationship with purchasing intention of recycled products, while recycling behavior did not seem to be a good predictor of purchase intention. These results highlight challenges in closing material and energy loops in a CE economy context, as individuals are expected to properly dispose of their waste (e.g., recycle) but also to acquire products made of recycled materials. All variables from the extended NAM present direct relationships with behavior intention, especially personal norms and attitudes, which supports the claim that the inclusion

¹ <https://www.smartpls.com/faq/documentation/consistent-pls-problems/>

of more variables in moral frameworks might increase the predictive power of the model. However, the extended NAM variables only presented few moderating effects between reported behavior and behavior intention, indicating the necessity to test the moderating power of other variables in order to support increasing circular behavior.

4.7 ARTICLE

This article is intended to be submitted to a journal under the title “Like the windmills of your mind: The role of psychological variables in moderating past circular behavior and purchasing intention” with the following authorship:

1. **Pedro Augusto Bertucci Lima:** Leading authorConceptualization, Methodology, Data Curation, Formal analysis, Writing - Original Draft.
2. **David Badajoz-Dávila:** Conceptualization, Methodology, Writing - Original Draft. Writing - Review and Editing.
3. **Octaviano Rojas Luiz:** Conceptualization, Methodology, Software, Formal analysis, Writing - Original Draft. Writing - Review and Editing.
4. **Enzo Barberio Mariano:** Supervision, Writing - Review and Editing.
5. **Lise Magnier:** Methodology, Supervision, Validation, Writing - Original Draft. Supervision, Writing - Review and Editing.

“I am everyday people”

Sylvester Stewart

5. ARTICLE 4 - HUMAN CAPABILITIES AND PRO-ENVIRONMENTAL BEHAVIOR

5.1. INTRODUCTION

The world's ecosystem faces severe problems related to climate change, biodiversity loss, and degradation and pollution of the natural environment that are rooted in human behavior (UNEP, 2021). Several studies have investigated strategies to increase the number of pro-environmental behaviors (PEB) (LIMA et al., 2023; NIELSEN et al., 2021; STEG, 2016), which include those behaviors that damage the environment relatively little, or even benefit the environment (STEG; VLEK, 2009). However, their focus has largely been on the psychological aspects of human behavior, without considering capabilities that individuals actually have to adopt these behaviors. Including a capability approach perspective (Sen, 2010) can increase the understanding of the factors related to PEB, factors that can also interact with these psychological aspects, increasing or decreasing their effect on PEB. Only few studies to date have analyzed the relationship between capabilities, psychological aspects and PEB (e.g., LESSMANN; MASSON, 2015). The main distinctions of the capabilities for the PEB literature are its focus on freedom and agency (SEN, 2010), which could affect individuals' relationships with sustainability (LIMA et al., 2021; SEN, 2013) through their behavior.

The capability approach (SEN, 2010) assumes that the development of a region should be seen in terms of an expansion of the freedoms of individuals (to be and have whatever one values), i.e., human development, rather than purely economic development. The two main concepts in the capability approach are functionings and capabilities. Functionings are an individual's being and doing, such as choosing to follow an ecological career or to buy from a certified company. Capabilities, also referred to as human capabilities in this research, is the opportunities that individuals have to be and have whatever they value. Examples of capabilities include being able to choose any kind of career to follow, or any product to buy in the market. The distinction between functionings and capabilities is made because of the aspect of freedom/opportunities embedded in the capabilities concept (SEN, 2010). For example, the act of walking to work may be due to an individual's choice to exercise or to reduce CO₂ emissions, or the lack of another option (e.g., lack of public

transportation or lack of resources to buy a vehicle); it is the same functioning but a completely different set of capabilities.

The human development literature (DUROY, 2008), and, more specifically, the capability approach perspective (COMIM et al., 2007, SEN, 2013), suggests that increasing individuals' opportunities might increase the adoption of PEB. However, few investigations have been done to check these assumptions (LESSMANN; MASSON, 2015), as the literature mainly refers to socio demographic data for analyzing capabilities that individuals have (BLANKENBERG; ALHUSEN, 2019). Although socio demographic data present relationships with human capabilities, it does not fully represent the opportunities individuals have to be and do whatever they value. Thus, specifically addressing the role of capabilities on PEB can contribute to the literature by supporting a new perspective in analyzing PEB. In this way, this research aims to examine the relationships between human capabilities and PEB. To achieve this goal, the research relied on normative models of PEB, which are extensively used in the literature (e.g., BAMBERG et al., 2007; DE GROOT et al., 2021; STEG et al., 2011). More specifically, this study's main objectives are to (1) assess the direct relationship of capabilities and specific dimensions of it on the adoption of three different kinds of PEB: General PEB, household waste and recycling, and environmental citizenship; and, (2) the moderating role of these dimensions on the relationship between personal norms and the three types of PEB.

5.2 THEORETICAL BACKGROUND

Capabilities are a multidimensional concept, that is, excelling in one aspect of life (i.e., dimension) does not compensate for a profound deprivation in another dimension (HENDERSON; FOLLETT, 2020). For example, being healthy does not compensate for a lack of education and vice versa. However, there is not a consensus about what dimensions should be considered in capabilities measurements, to the extent that differences in the considered dimensions of capabilities have been seen in several studies (e.g., AL-JANABI et al., 2012; DE ROSA, 2018; LORGELLY et al., 2015; SIMON et al., 2013). Although these studies show differences on aspects such as specification grade, number of dimensions and types of capabilities, the dimensions also seem to share some common characteristics.

It is possible to define three further generic dimensions of capabilities that seem to represent all the measures commonly used: (i) capabilities related to biological and physical

human needs (human needs CAP), which are capabilities that ensure physiological well-being; (ii) capabilities related to the fundamental interests of a human agent (human agency CAP), which include capabilities related to the autonomous development of oneself in relation to work, skills, and critical thinking; and (iii) capabilities related to the fundamental interests of a social being (social being CAP), which entail capabilities concerning community involvement in the form of political freedom and access to goods and services (NIELSEN; AXELSEN, 2017). By accepting these three dimensions, a higher degree of generalization can be achieved, as they are going to be present despite the specific dimensions contemplated while measuring capabilities. Hence, besides relying only on capabilities as a whole, this research also considered these three dimensions as suggested by Nielsen and Axelsen (2017). This approach aims to analyze if dimensions of capabilities can be useful in better understanding what capabilities should be improved to support specific types of PEB.

5.2.1 Capability approach and pro-environmental behavior

More developed regions - in terms of income and human development - seem to present higher levels of environmental protection, both in the public domain (FURLAN; MARIANO, 2022; LIMA et al., 2022) and in individual behaviors (MORREN; GRINSTEIN, 2016; PISANO; LUBELL, 2017). This is in accord with the affluence hypothesis, in which individuals in more developed countries would have their basic needs fulfilled and start to have higher levels of concern toward quality-of-life issues (DUROY, 2008). Thus, through the capability approach perspective, the expansion of an individuals' opportunities in life, i.e., capabilities, could be linked to a greater occurrence of PEB. However, this might not always be the case, as some studies suggest that individuals in developing regions present higher levels of some kinds of PEB (DUROY, 2008) (see Milfont and Markowitz (2016) for a review). The controversial results seen between human development and PEB may be explained by two reasons: 1) as human development is a multidimensional concept, by considering a composite index (e.g., HDI) as is done in most research, there might be an overlap among the dimensions related to PEB; and, 2) the psychological aspects inherent to human behavior that motivate the adoption of PEB.

Using an overall measurement of capabilities may possibly bias the aggregate value, with dimensions differently related to the behavior analyzed. We therefore employ an overall measurement of human capabilities, and three general dimensions that embrace the

dimensions usually employed in theoretical and empirical capabilities research. The aggregate measurement of capabilities considers the overall level of capabilities that an individual has, rather than distinguishing the dimensions of each (e.g., physical health and knowledge). By considering dimensions of capabilities in a disaggregated manner, however, it is possible to make an analysis with dimensions that have aspects that can be more or less related to a specific PEB. For example, human needs CAP could be more strongly related to PEB that demand more physical effort to be performed; human agency CAP could be more related to PEB that demand more practical and theoretical knowledge to be performed; and social being CAP might demand more social relationships.

Research relying only on human capabilities to analyze PEB lacks psychological variables that affect the behavioral structure of individuals. In the capability approach, the capability set of individuals are related to what they “reason to value” and so a screening process based on individuals’ values selects, among all possibilities from the individual conversion factors, the possibilities that would compound their capabilities and functionings (OSMANI, 2016). Capabilities, therefore, are not the motivation for the behavior, but it is what allows the individual to pursue the motivation. As “the whole point of the capability approach is to find ways of enabling people to lead the kind of life they have reason to value” (OSMANI, 2016, p. 10), inner aspects of individuals (e.g., psychological features) would be the motivation behind the “reason to value” and the capabilities would represent which functionings the individual could achieve. Considering that multiple studies strongly suggest that PEB includes complex functionings (DEAN et al., 2021; LAMM et al., 2022; LARSON et al., 2015) and capabilities (BLANKENBERG; ALHUSEN, 2019; MEINZEN-DICK et al., 2014), it would be relevant to integrate the different dimensions of capabilities with a strong psychological factor that has been shown to explain various types of PEB. Personal norms seem to fit this condition, as literature shows they are theoretically and empirically one of the key predictors for (various types of) PEB (DE GROOT et al., 2021). Hence, the present study will combine human capabilities with this psychological factor.

5.2.2 Personal norms and pro-environmental behavior

A fair share of reasons to engage in PEB are rooted in psychological factors (KOLLMUSS; AGYEMAN, 2002; VAN VALKENGOED et al., 2022), personal norms being one of the main factors (DE GROOT et al., 2021). Personal norms are feelings of moral obligation toward a behavior that increases or decreases the propensity to perform it

(SCHWARTZ, 1977). Indeed, several studies have found a strong and positive relationship between personal norms and PEB (e.g., BAMBERG et al., 2007; DE GROOT; STEG, 2010b; DE GROOT et al., 2021; HEIN, 2022; STEG et al., 2011; VAN DER WERFF; STEG, 2015; VAN RIPER; KYLE, 2014). That is, the stronger one's personal norm toward a specific PEB, the stronger one's intentions and behaviors in relation to this PEB. However, even if individuals feel a moral obligation to act pro-environmentally, they might not be able to accomplish this behavior because of some sort of constraint (e.g., availability, financial resources) (BOUMAN et al., 2021; MEINZEN-DICK et al., 2014). In line with the capability approach, one might argue that this behavior will be missing in their capability set. Thus, the psychological motivation to perform the behavior only partly explains actual PEB.

In order to perform PEB, individuals must recognize their capacity to do so (BAMBERG et al., 2007). In psychological research, this assumption is usually addressed by (1) socio demographic data (BLANKENBERG; ALHUSEN, 2019; LAMM et al., 2022), which are often related very weakly and inconsistently to various types of PEB (SARGISSON et al., 2020); or, by (2) including the concept of self-efficacy or perceived behavior control (i.e., the perceived opportunities and abilities that people have to perform a certain behavior (AJZEN, 1991), which has been strongly related to different types of PEB (LAMM et al., 2022; VAN VALKENGOED et al., 2022). However, self-efficacy or perceived behavior control are usually measured and directed toward specific behaviors and perceptions of such specific behavior only (BOCKARJOVA; STEG, 2014). Moreover, it might not necessarily reflect the actual control the individual has to perform the specific types of PEB being analyzed (KLOCKNER, 2013). We argue that the capability approach, hence the focus on what individuals are able to be and do in their lives and not on the quantity of resources or preferences given to a specific behavior (COMIM et al., 2007), can be a way to broaden the theoretical approach (SNIEHOTTA et al., 2014) in relation to how individuals perceive their condition to perform a PEB. Thus, capabilities can be a useful addition to psychological factors, such as personal norms, for explaining PEB.

5.2.3 Conceptual model and hypothesis

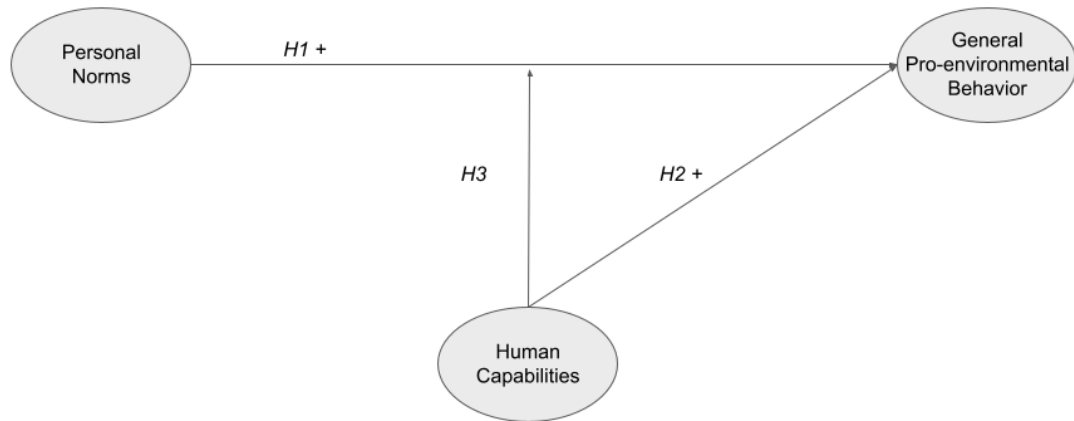
The main aim of this research is to assess the direct and moderating effect of human capabilities on PEB. Higher levels of human capabilities offer opportunities for individuals to support sustainability goals (LESSMANN; MASSON, 2015), as capabilities are related to individuals' opportunities to be (e.g., sustainable lifestyle), do (e.g., PEB), and have (e.g.,

environmental consumption) (COMIM et al., 2007). Thus, following the affluence hypothesis (DUROY, 2008) and previous research (LESSMANN; MASSON, 2015), higher levels of human capabilities would be related to higher levels of PEB.

Higher levels of capabilities can help overcome the different barriers that prevent individuals from performing a desired PEB, even when there is a strong motivation, such as personal norms (KOLLMUSS; AGYEMAN, 2002; MEINZEN-DICK et al., 2014). The process of human development, which expands human capabilities, increases the opportunities that individuals have to accomplish PEB, which could potentially be associated with a higher number of (different types of) PEB being performed. With more freedom and opportunities to act, individuals can convert the motivation to act into PEB (LESSMANN; MASSON, 2015). Thus, higher levels of capabilities could potentially strengthen the relationships between psychological predictors of PEB (e.g., personal norms) and PEB. However, broadening the set of choices for individuals could also make it more difficult to choose the best option according to an individual's own preference (SCHWARTS, 2004). Hence, although capabilities could strengthen the relationship between psychological predictors and PEB, they might also weaken this relationship. Considering that different levels of capabilities can modify the propensity to engage in PEB directly as well as indirectly through the role it might have on the relationship between psychological factors and PEB, this research not only focuses on the direct relationship between capabilities and PEB, but also investigates the moderating role of capabilities on the relationship between personal norms and PEB. Investigating the direct and moderating role of capabilities can contribute to a better understanding of how increasing individuals' opportunities in life (i.e., capabilities) can facilitate or hinder the adoption of PEB.

The present research first aims to validate the relationships between personal norms and PEB, something which is well established in the literature (e.g., BAMBERG et al., 2007; DE GROOT et al., 2021; HEIN, 2022; VAN DER WERFF; STEG, 2015). Next, the research assesses the relationship of human capabilities with PEB, both by analyzing the direct relationship of capabilities on PEB and the moderation role of the relationship between personal norms and PEB. The conceptual model presented in Figure 8 summarizes the research aims.

Figure 8 - Conceptual model and research hypothesis



Source: Developed by the authors

Thus, the research aims to test the following three main hypotheses:

Hypothesis 1. Personal norms toward general PEB are positively related to general PEB.

Hypothesis 2. Human capabilities are positively related to general PEB.

Hypothesis 3. The relationship between personal norms and general PEB is significantly altered by different levels of capabilities.

A wide range of behaviors can be considered pro-environmental, and each of these behaviors differ in terms of cognitive, physical, and financial efforts (KNEEBONE et al., 2020). Therefore, the present research aims to validate its claims by testing the three hypotheses with “general PEB” (HANSMANN et al., 2020) and with two specific types of PEB that have been widely explored in the PEB literature, namely household waste and recycling (household waste PEB) (e.g., ANDERSSON; VON BORGSTEDT, 2010; GOH et al., 2022; RIBEIRO-RODRIGUES et al., 2021), and environmental citizenship (citizenship PEB) (e.g., LARSON et al., 2015; ZHANG et al., 2017; VAN RIPER; KYLE, 2014; YIN et al., 2021). These PEB were also chosen because of the substantial difference among them: (1) general PEB aggregates an individual’s perception about the overall plethora of PEB, (2) household waste PEB includes behaviors that directly deals with managing material waste (e.g., empty cans and paper), and (3) environmental citizenship is coupled to the relationships with society, such as social interaction with other individuals and organizations. It is expected

that these particularities of each kind of behavior will present different relationships with human capabilities, as these behaviors perform in different efforts and contexts.

It is expected that the same direction in the relationship between personal norms toward general PEB and general PEB, household waste PEB, and citizenship PEB will be found (i.e., Hypothesis 1), but with a stronger effect size between personal norms and general PEB. This is because personal norms behavior has been measured toward general PEB rather than toward the two specific types of PEB (STEG et al., 2011; VAN WERFF; STEG, 2015). For Hypothesis 2, it is expected that the two specific PEB will present similar results to the general PEB, being in accord with the affluence hypothesis (DUROY, 2008) and previous research on capabilities and PEB (LESSMANN; MASSON, 2015). For Hypothesis 3, it is expected that higher levels of human capabilities are linked with more pronounced relationships between personal norms and PEB, as higher levels of overall capabilities would increase an individual's set of capabilities, facilitating the realization of household waste PEB and citizenship PEB (LESSMANN; MASSON, 2015).

To further validate the hypotheses involving human capabilities, different measures of capabilities have been included in this study. Research applying the capability approach as a theoretical framework has suggested that capabilities are likely multi-dimensional (NUSSBAUM, 2000; SEN, 2010), while the empirical studies in this field have often analyzed it in an aggregated construct (LESSMAN; MASSON, 2015; LORGELLY et al., 2015; SIMON et al. 2013). Based on this paradox in the literature, the present study aims to validate Hypothesis 2 and 3 including the general measure of capabilities (i.e., aggregated dimension) but also the three specific dimensions of capabilities, as highlighted by Nielsen and Axelsen (2017) (i.e., human needs CAP, human agency CAP, and social being CAP). With this in mind, the further validation of Hypothesis 2 and 3 also provide information of how specific dimensions of human capabilities are related to different PEB.

This research is a first exploration of to what extent it is useful to include a general index (aggregated) versus three disaggregated specific dimensions of capabilities to explain different types of PEB. Therefore, it is not possible to predict which dimensions will be more related to each PEB, more so since different PEB require a different set of effort (KNEEBONE et al., 2020) and conversion factors (LESSMANN; MASSON, 2015) to be performed. However, it is expected that a similar positive relationship between the capabilities and general and specific PEB (Hypothesis 2) will be found, regardless of whether capabilities were measured as an aggregated construct or in general dimensions. Such results would be aligned with previous assumptions about the positive relationship between

capabilities and PEB (LESSMANN; MASSON, 2015; SEN, 2013). For Hypothesis 3, the prediction is more difficult, in that the expectation is to have both a negative and a positive moderating role of capabilities on the relationships between personal norms and general and specific PEB.

5.3 Method

5.3.1 Sampling and participants

The study used a convenience sampling strategy targeting Brazilians over 18 years old. To gather the data, an online questionnaire was distributed by email and social media (Facebook, LinkedIn, Instagram, and WhatsApp) through the first two authors' networks. Respondents were asked to share the questionnaire with other potential respondents (i.e., snowball sampling; JOHNSON, 2014).

This research was approved by the Ethic Committee of the Faculty of Sciences, São Paulo State University, Brazil, with the code number: 57949622.8.0000.5398. First, the questionnaire presented the research aims (to investigate the relationship among human capabilities, personal values, and PEB) and the ethical statements of anonymity, confidentiality, and the exclusively scientific purposes of the usage of the data collected, including the assured right to withdraw from the study at any moment without any type of loss. The consent to participate was given to those individuals who agreed with the ethical statement and were 18 years old or older.

A total of 766 individuals answered the questionnaire. After removing (1) the respondents who did not complete the attention questions ($n=18$), who were not Brazilian ($n=1$) or who were Brazilians living outside Brazil ($n=10$), and (2) incomplete questionnaires ($n=41$), the final sample was composed of 696 respondents. An a-priori sample size calculation in G*Power (FAUL et al., 2009) indicated that the research would need at least 114 individuals for an effect size of $f^2 = 0.10$ (DE GROOT et al., 2021), with a minimal statistical power of 0.80, probability level of 0.05, and three predictors (i.e., personal norms, human capabilities, and personal norms * human capabilities). Therefore, a sample of 696 respondents was deemed to provide sufficient statistical power for the aim of this research.

Of the final sample, 420 participants were women (60.34%) and 276 were men (39.66%), with ages ranging from 18 to 75 years old ($M = 37.280$, $SD = 11.622$). 556 individuals were white (79.89%), 30 were black (4.30%), 82 were “pardo” (a Brazilian

connotation for multiracial individuals) (11.78%), 22 were Asian (3.15%), and 6 preferred not to answer (0.86%). The vast majority of the sample was composed of highly educated individuals, as 650 (93.4%) had completed at least some form of higher education. Also, most respondents had a medium to high income, 473 individuals (67.96%) having a monthly income equal or higher to R\$4,848.00 (four times the Brazilian minimum wage). By contrast, around 51.1% of the Brazilian population is female (IBGE, 2023), 56.1% of Brazilians are black or “pardo” (IBGE, 2023), only 17.4% of the population over 25 years old has completed tertiary education (IBGE, 2023), and no more than 18% of households have a monthly income higher than R\$4,127.41 (CARVALHO, 2021). Therefore, the sample was determined to be one of convenience: overrepresenting female, white, well-educated and higher income individuals.

Using a convenience sample is a well-accepted approach in the PEB literature (e.g., DE GROOT et al., 2021; FERRARA et al., 2020; JIMÉNEZ-PARRA et al., 2014; KUMAR et al., 2021), as convenience sampling allows for a higher number of respondents and, consequently, increases statistical power, making comparisons with research findings across other studies easier. Furthermore, the aim of our study focused on testing internal validity (rather than external validity) between the relationships of interest (i.e., relationships between capabilities, personal norms, and PEB). For this aim, the advantage of a high statistical power outweighs the disadvantage of the representativeness of the sample (ETIKAN et al., 2016). Based on these reasons, the convenience sample of the present study was deemed sufficient.

5.3.2 Questionnaire and measures

An online questionnaire was created with Google Forms. The questionnaire started with questions regarding human capabilities followed by questions about personal norms toward general PEB. Next, respondents were asked about the frequency with which they perform some PEB. In the final part, respondents were asked socio demographic questions, before being thanked for their participation and then debriefed.

With the exception of the questions to measure the capabilities dimensions, all the questionnaire questions were based on validated scale items from previous studies (see Appendix Table A5 for an overview of all items of the questionnaire). All items related to the main constructs were answered on a 7-point Likert scale, ranging from 1 (strongly agree) to 7 (strongly disagree), unless stated otherwise below. The capabilities dimensions questions

were developed based on the theoretical framework (NIELSEN; AXELSEN, 2017) and went through a correlation analysis validation (TAHERDOOST, 2016).

To increase the quality of the data, we included four attention questions (BULLOCK et al., 2017; HE et al., 2022) (e.g., “*Please, select number 5*”) and we removed the answers that did not pass these questions (n=18). A pretest among the first author’s network (N=14) was made before applying the questionnaire. This was done to verify whether respondents might have difficulty in answering any aspects of the questionnaire. The respondents did not report any major issues in filling out the questionnaire. A few typing mistakes were identified and corrected before the official submission was prepared.

5.3.2.1 Human capabilities questionnaire

A specific aim of the present research was to make comparisons between the conceptual model and the research hypotheses (Figure 1). As a consequence, we included a general measurement of capabilities in one model (Model 1) and the three dimensions of capabilities in another model (Model 2). Both models followed the same structure: that is, we tested the direct relationship of personal norms on PEB (H1), the direct relationships of human capabilities on PEB (H2), and the moderating role of capabilities on the relationship between personal norms and PEB (H3). Hence, the research relied on two approaches to measure human capabilities, the only difference between Model 1 and 2 being the way in which the human capabilities were measured.

5.3.2.1.1 General measurement of capabilities (Model 1)

For testing Model 1 (i.e., general capabilities), human capabilities were measured with the Oxford Capabilities Questionnaire-Mental Health (OxCAP-MH, SIMON et al., 2013), which is a short-version of the scale developed by Anand et al. (2009) based on the theoretical works of Martha Nussbaum (2000). The OxCAP-MH has 16 questions following a 7-point Likert scale ranging from 1 (never / totally unsuitable / unsafe / unlikely / disagree) to 7 (always / totally suitable / safe / likely / agree). The scale aggregates all questions in a final capability score by calculating the average of the responses (LORGELLY et al. 2015; SIMON et al. 2013). The present study used the Portuguese version of the instrument, adapted and validated by Luiz (2022) (Table A1).

5.3.2.1.2 Measurement of capabilities dimensions (Model 2)

For testing Model 2 (i.e., three dimensions of capabilities), we developed three single-item questions capturing each dimension integrally, as highlighted by Nielsen and Axelsen (2017; Table 1). We opted for single-item questions so respondents would rate their general perception of each dimension, similar to what is done with quality of life questionnaires, which is a construct related to capabilities (LORGELLY et al., 2015). The questions were structured as Likert scales ranging from 1 (totally disagree) to 7 (totally agree). We decided to develop these questions as the literature lacked a specific instrument for measuring the three capabilities dimensions, and the application of statistical tests to create dimensions based on other questionnaires, e.g., OxCAP-MH, did not present consistent results (LUIZ et al., 2023).

Table 19 - Capabilities general dimensions questionnaire

Capability dimension	Question
Capabilities related to biological and physical human needs (Human needs CAP)	<i>"My biological and physical needs are fulfilled"</i>
Capabilities related to fundamental interests of a human agent (Human agency CAP)	<i>"I have autonomy to develop myself in the areas that I desire"</i>
Capabilities related to fundamental interests of a social being (Social being CAP)	<i>"I am integrated into society as much as I would like"</i>

Source: Developed by the authors

To increase the chance that the three items that we developed based on face validity only were actually measuring the three dimensions of capabilities (i.e., the three theoretical constructs), we tested for its concurrent validity, that is, whether the instrument corresponded to an already established instrument used to measure the same construct (i.e., human capabilities) (TAHERDOOST, 2016). We relied on correlation analysis (TAHERDOOST, 2016) with the OxCAP-MH, an already validated instrument for measuring capabilities, and with a quality of life (QoL)² measurement, as QoL tends to correlate well with capabilities. This type of validation process has also been used to develop the OxCAP-MH instrument (LORGELLY et al., 2015).

² Quality of life was measured with the Global Quality of Life Scale (QoL): *"Please, indicate your global quality of life according to the scale: (0 = no quality of life, and 10 = perfect quality of life)"* (Hyland & Sodergren, 1996).

5.3.2.2 Personal norms

Personal norms toward general PEB were measured with a scale adapted from Steg et al. (2011). For simplicity in answering the questionnaire, the research used only personal norms toward general PEB. This was done as the main behavior analyzed in the research was general PEB rather than the two specific types of PEB (i.e., household waste and recycling and environmental citizenship). We acknowledged that this decision would likely decrease the effect size of the relationship between personal norms and the two specific types of PEB. The scale comprised four questions: *“I feel morally obliged to act in a pro-environmental manner, regardless of what other people do”*, *“I feel it is morally right to act pro-environmentally as much as possible”*, *“I have a bad conscience if I do not act pro-environmentally when I can”*, and *“It would make me feel a better person if I was able to act in a more pro-environmental way”*. The questions ranged from 1 (totally disagree) to 7 (totally agree). To increase the reliability and validity of measuring personal norms with these four items, all questions were translated to Brazilian Portuguese with the back translation method provided by an English teacher (BRISLIN, 1970).

5.3.2.3 Pro-environmental behavior

PEB was measured with a 19-item questionnaire including self-reported behaviors based on previous instruments in the literature (Table S1) (KAISER; WILSON, 2004; MARKLE, 2013; OBERY; BANGERT, 2017; RIBEIRO-RODRIGUES et al., 2021). The 19 questions included items to measure general PEB and a composite measure of household waste PEB and citizenship PEB. All the questions followed a 7-point Likert scale, ranging from 1 (totally disagree or never) to 7 (totally agree or always). As with personal norms, the items that were not available in Brazilian Portuguese were translated, with the back translation method provided by an English teacher (BRISLIN, 1970).

5.3.3 Analysis

Due to the nature of the variables studied, which can be better measured indirectly by aggregating indicators, the use of Structural Equation Modeling (SEM) was deemed most appropriate for the research. SEM can be described as a group of statistical techniques for analyzing the relationship between multiple variables based on factorial and regression analysis (HAIR et al., 2022). PLS-SEM also does not require statistical assumptions about

data distribution (normality for example), as it is a non-parametric technique (SARSTEDT et al., 2014). These aspects also make the PLS-SEM appropriate for exploratory research, and it is commonly used in the PEB literature (e.g., GOH et al., 2022; HEIN, 2022).

PLS-SEM also allows for the testing of moderation effects. In both models presented in this research, capabilities were used as moderators of the relationship between personal norms and PEB. In Model 1, the general measurement of capabilities was the moderator, while in Model 2 the dimensions of capabilities were the moderators. A complete bootstrapping with 10,000 subsamples was performed in order to test the loadings and path coefficients in the structural model. The statistical significance of the coefficients was established using two-tailed hypothesis tests, which must be considered when interpreting the reported *p* values. The analysis was made using the SmartPLS 4 (RINGLE et al., 2022) and RStudio software.

To control the models for possible confounding effects on PEB from other variables, we included control variables for age, education, gender, and income. These are sociodemographic variables recognized for their possible relationships with PEB (BLANKENBERG; ALHUSEN, 2019; LAMM et al., 2022; LESSMANN; MASSON, 2015; LIMA et al., 2023; YURIEV et al., 2020). There are indications in the literature for a positive and negative effect of age on PEB (WIERNIK et al., 2013). Past research has indicated that older individuals might present higher levels of PEB (WANG et al., 2021). This higher tendency to perform PEB may be related to more autonomy that individuals have when they reach maturity, such as being responsible for their own purchases (BINDER et al., 2020), seeking meaning from life or pro-social goals during later stages of life (WANG et al., 2021). Higher levels of education can be related to higher concern toward social welfare and an increased importance in the perception of environmental issues (MEYER, 2015). The theoretical explanation for the positive relationship between women and nature has ranged from different perspectives throughout the years, such as biological, social, material, and ideological (see MEINZEN-DICK et al., 2014 for a review). Although a precise explanation is still under discussion, empirical studies have found a higher propensity for women to engage in PEB rather than men (e.g., VICENTE-MOLINA et al. 2018). Research has found both positive and negative effects of income on PEB (BLANKENBERG; ALHUSEN, 2019). In the positive relationship, PEB becomes more feasible after securing the basic needs of individuals that are strongly related to financial resources (BINDER et al., 2020) and that are associated with the higher costs of some PEB, e.g., choosing organic food (BULLOCK et al., 2017). In the negative relationship, available financial resources may lead to an increase in

consumption (CHITNIS et al., 2013), which has a negative effect on the environment. Thus, although these control variables depend on the type of PEB to understand the direction of the relationship (WIERNIK et al., 2013), they could potentially affect the relationships of interest in the present study, especially because these factors are also related to capabilities (ANAND; SEN, 2000; SEN, 2010) (e.g., higher income, as well as a higher educational level, usually provide more opportunities in life).

5.4. RESULTS

5.4.1 Test of validity for the capabilities dimension measurement

To analyze if the questions developed to measure the three capabilities dimensions used in Model 2 were measuring capabilities in a valid way, this research examined the correlations between these dimensions, the OxCAP-MH, and QoL (TAHERDOOST, 2016). The correlations between the three capabilities dimensions and the OxCAP-MH were: human needs CAP: 0.537, $p < 0.001$; human agency CAP: 0.553, $p < 0.001$; and social being CAP: 0.601, $p < 0.001$. The correlations between the three capability dimensions with QoL were: human needs CAP: 0.532, $p < 0.001$; human agency CAP: 0.457, $p < 0.001$; and social being CAP: 0.514, $p < 0.001$. Considering that capabilities are multidimensional (HENDERSON; FOLLETT, 2020), we made an index by giving equal weights to the three dimensions and comparing them to the OxCAP-MH and the QoL. The composite index created with the dimensions presented higher correlations than the isolated dimensions, (0.683, $p < 0.001$) and (0.605, $p < 0.001$) (Figures A13 and A14), respectively, which reinforces the validity of the instrument. Correlations between 0.36 and 0.67 can be considered moderate and correlations higher than 0.68 can be considered strong (TAYLOR, 1990). Thus, the instrument developed to measure the general dimensions of capabilities was considered valid for the initial exploration proposed in this research. In the next section we present the validity tests of the full measurement model.

5.4.2 Validity and reliability of human capabilities, personal norms and pro-environmental behavior

To assess the measurement models, the reflective constructs (i.e., personal norms and PEB) were evaluated regarding their internal consistency and convergent and discriminant validity. When all the questions were present in the constructs, the outer loading of the variables were between 0.400 and 0.700 for the household waste PEB and citizenship PEB. In cases where the outer loadings are between 0.400 and 0.700 the rule of thumb is to exclude the indicator and check whether the outer loading increases or not (HAIR et al., 2009). After excluding the variables household waste PEB1, household waste PEB6, household waste PEB7 and household waste PEB8, and citizenship PEB4, citizenship PEB5, and citizenship PEB6, the outer loadings surpassed the threshold point of 0.700 (HAIR et al., 2009). Thus, we decided to maintain the models without these variables. After applying the necessary changes to the models, all Cronbach's alphas were above 0.700, the Average Variance Extracted (AVE) were above 0.500, and all the Composite Reliability (CR) were above 0.700. These are all considered to be valid values (HAIR et al., 2021) (Table 2).

Table 20 - Internal consistency and convergent validity

Construct	Items (reflexive measure)	Outer loading	p(t)	Cronbach's α	AVE	Composite reliability (Rho_a)	Composite reliability (Rho_c)
PN	PN1	0.801	29.542	0.789	0.611	0.812	0.862
	PN2	0.836	38.634				
	PN3	0.816	40.005				
	PN4	0.663	16.218				
General PEB	General PEB1	0.875	84.869	0.843	0.679	0.855	0.894
	General PEB2	0.797	34.493				
	General PEB3	0.812	36.055				
	General PEB4	0.809	47.516				
Household waste PEB	Household waste PEB2	0.786	20.748	0.709	0.536	0.718	0.821
	Household waste PEB3	0.790	20.336				
	Household waste PEB4	0.705	17.386				
	Household waste PEB5	0.636	12.105				
Citizenship PEB	Citizenship PEB1	0.796	43.007	0.752	0.574	0.776	0.842
	Citizenship PEB2	0.813	44.124				
	Citizenship PEB3	0.788	37.685				
	Citizenship PEB6	0.616	16.220				

Notes. PN = Personal Norms, General PEB = general pro-environmental behavior, Household waste PEB = household waste and recycling pro-environmental behavior, and Citizenship PEB = environmental citizenship pro-environmental behavior. Source: Developed by the authors

The discriminant validity was assessed using the heterotrait-monotrait ratio of correlations (HTMT, Table 3). All values were below 0.850, and therefore considered valid (HENSELER et al., 2015). All the variance inflation factors (VIFs) were below 3.300, which indicates that the model is free of common method bias, including multicollinearity issues (KOCK, 2015). Considering that the results from both models were very similar, and due to space constraint, only the tables relating to the results of the Model 2 are presented here (results from Model 1 are available upon request). In the next section, we checked the structural models for Model 1 and Model 2.

Table 21 - Descriptive statistic and discriminant validity (HTMT-ratio)

Variable	M	SD	PN	General PEB	Household waste PEB	Citizenship PEB	Human needs CAP	Human agency CAP	Social being CAP	Age	Gender	Income	Level of education
PN	6.152	1.316											
General PEB	5.692	1.380	0.637										
Household waste PEB	4.759	2.105	0.340	0.674									
Citizenship PEB	3.965	1.810	0.443	0.722	0.694								
Human needs CAP	5.605	1.412	0.054	0.046	0.079	0.047							
Human agency CAP	5.693	1.429	0.039	0.022	0.084	0.102	0.222						
Social being CAP	4.846	1.429	0.050	0.016	0.044	0.036	0.436	0.206					
Age	37.280	11.622	0.103	0.191	0.265	0.273	0.060	0.068	0.006				
Gender	-	-	0.207	0.111	0.162	0.173	0.054	0.115	0.059	0.067			
Income	-	-	0.031	0.015	0.128	0.029	0.100	0.123	0.119	0.364	0.133		
Level of education	-	-	0.077	0.144	0.231	0.189	0.020	0.006	0.058	0.394	0.053	0.262	

PN = Personal Norms, General PEB = general pro-environmental behavior, Household waste PEB = household waste and recycling pro-environmental behavior, and Citizenship PEB = environmental citizenship pro-environmental behavior, Human needs CAP = capabilities related to human needs, Human agency CAP = capabilities related to human agent, and Social being CAP = capabilities related to social being. Source: Developed by the authors

5.4.3 Relationships between human capabilities, personal norms and pro-environmental behavior

To test the hypotheses presented in this research, we checked the structural analysis of both models (Model 1 and Model 2). Considering the exploratory nature of the research, in which even predicting the direction of the moderating effect of capabilities on the personal norms and PEB relationship is difficult, we considered a less stringent threshold for significant p values (i.e., $p < 0.10$) (DAHIRU, 2008). The relationships between personal norms, the general capabilities measure (Model 1), the three capability dimensions (Model 2), and the moderator terms between personal norms and capabilities on general PEB, household waste PEB, and citizenship PEB are shown in Table 4 (Model 1) and Table 5 (Model 2).

Model 1, including personal norms toward general PEB and the general capabilities measurement (i.e., OxCAP-MH), explained 36.6% of variance for general PEB ($R^2 = 0.326$), 14.0% for household waste PEB ($R^2 = 0.140$), and 18.9% for citizenship PEB ($R^2 = 0.189$)³. The standardized root mean square residual (SRMR) of the model was 0.114, which is above the accepted value of < 0.100 (HU; BENTLER, 1998). However, as debate on the precision of the model fitness assessment in PLS-SEM remains open (HAIR et al., 2021; Schuberth et al., 2022), we decided to continue the analysis with the model. Personal norms presented a significant positive relationship with all three PEB: general PEB ($\beta = 0.521$, $p = 0.000$), household waste PEB ($\beta = 0.225$, $p = 0.000$), and citizenship PEB ($\beta = 0.320$, $p = 0.000$), supporting Hypothesis 1. General capabilities only presented a positive and significant relationship with general PEB ($\beta = 0.099$, $p = 0.005$); the relationships with household waste PEB ($\beta = 0.055$, $p = 0.115$), and citizenship PEB ($\beta = 0.014$, $p = 0.708$), were not significant, which provided limited support for Hypothesis 2. The moderator effects of general capabilities on the effect of personal norms on any of the three PEB were not significant: general PEB ($\beta = -0.009$, $p = 0.835$), household waste PEB ($\beta = 0.050$, $p = 0.240$), citizenship PEB ($\beta = 0.006$, $p = 0.868$). Therefore, Hypothesis 3 was rejected.

Model 2, including personal norms toward general PEB with the three capabilities dimensions, explained 33.31% of variance for general PEB ($R^2 = 0.331$), 15.6% for household waste PEB ($R^2 = 0.156$), and 20.6% for citizenship PEB ($R^2 = 0.206$). Although the SRMR of 0.104 from Model 2 is somewhat better than Model 1, it is still at the upper end of the accepted value of < 0.100 (Hu & Bentler, 1998). Personal norms showed a significant

³We opted for R^2 and not the adjusted R^2 “But because of the correction factor introduced to account for data and model size, the adjusted R^2 is not a precise indication of an endogenous construct’s explained variance” (Hair et al., 2021)

positive relationship with all the three PEB: general PEB ($\beta = 0.535$, $\rho = 0.000$), household waste PEB ($\beta = 0.249$, $\rho = 0.000$), and citizenship PEB ($\beta = 0.308$, $\rho = 0.000$), supporting Hypothesis 1. Considering the capabilities dimensions, human needs CAP were not related to general PEB ($\beta = 0.056$, $\rho = 0.114$), were positively related to household waste PEB ($\beta = 0.081$, $\rho = 0.046$), and were not related to citizenship PEB ($\beta = 0.022$, $\rho = 0.577$). Human agency CAP were not related to general PEB ($\beta = 0.022$, $\rho = 0.519$) nor household waste PEB ($\beta = -0.029$, $\rho = 0.463$), and were negatively related to citizenship PEB ($\beta = -0.080$, $\rho = 0.024$). Social being CAP were not related to any of the PEB: general PEB ($\beta = 0.001$, $\rho = 0.965$), household waste PEB ($\beta = 0.006$, $\rho = 0.893$), citizenship PEB ($\beta = 0.026$, $\rho = 0.515$). Therefore, considering that there were only some positive significant relationships with small effect sizes, Hypothesis 2 was limitedly supported.

The moderation analysis in Model 2 shows that the human needs CAP did not moderate the relationship between personal norms and general PEB ($\beta = -0.008$, $\rho = 0.832$, $f^2 = 0.000$) nor the relationship between personal norms and household waste PEB ($\beta = -0.031$, $\rho = 0.497$, $f^2 = 0.001$). However, it did positively moderate the relationship between personal norms and citizenship PEB ($\beta = 0.062$, $\rho = 0.087$, $f^2 = 0.004$). The human agency CAP moderated the relationship between personal norms and the three PEBs negatively: general PEB ($\beta = -0.094$, $\rho = 0.024$, $f^2 = 0.011$), household waste PEB ($\beta = -0.089$, $\rho = 0.042$, $f^2 = 0.008$), and citizenship PEB ($\beta = -0.093$, $\rho = 0.013$, $f^2 = 0.009$). The social being CAP did not moderate the relationship between personal norms and general PEB ($\beta = 0.036$, $\rho = 0.359$, $f^2 = 0.002$), while it positively moderated the relationship between personal norms and household waste PEB ($\beta = 0.073$, $\rho = 0.095$, $f^2 = 0.005$); it did not moderate the relationship between personal norms and citizenship PEB ($\beta = -0.053$, $\rho = 0.116$, $f^2 = 0.003$). All the f^2 for the significant moderations of capabilities on the personal norms-PEB relationships correspond to small effect sizes (AGUINIS et al., 2005). Therefore, considering there were some weak significant relationships, Hypothesis 3 was partially supported.

5.4.4 Control variables

In Model 1 and 2, age, gender, income, and education were included as control variables due to their possible confounding effect on PEB (BLANKENBERG; ALHUSEN, 2019; LAMM et al., 2022; LESSMANN; MASSON, 2015; LIMA et al., 2023; YURIEV et al., 2020; see Table 4 and Table 5). Considering that all the control variables presented at least one significant relationship, the four were kept in both models. In Model 1, with the

general capability measurement, age was positively related to the three PEB: general PEB ($\beta = 0.141$, $\rho = 0.000$), household waste PEB ($\beta = 0.176$, $\rho = 0.000$), and citizenship PEB ($\beta = 0.216$, $\rho = 0.000$). Gender was positively related to household waste PEB ($\beta = 0.217$, $\rho = 0.005$) and citizenship PEB ($\beta = 0.196$, $\rho = 0.009$). Income was negatively related to general PEB ($\beta = -0.100$, $\rho = 0.008$), and environmental PEB ($\beta = -0.066$, $\rho = 0.085$). Education was positively related to the three PEB: general PEB ($\beta = 0.054$, $\rho = 0.097$), household waste PEB ($\beta = 0.109$, $\rho = 0.005$), and citizenship PEB ($\beta = 0.065$, $\rho = 0.091$) (Table 4).

Table 22 - Results of the structural analysis of Model 1

Direct effect	β	M	SE	t	p	f^2
PN → General PEB	0.521	0.522	0.035	14.992	0.000	0.385
PN → Household waste PEB	0.225	0.226	0.042	5.324	0.000	0.056
PN → Citizenship PEB	0.320	0.322	0.034	9.455	0.000	0.121
General CAP → General PEB	0.099	0.099	0.036	2.790	0.005	0.013
General CAP → Household waste PEB	0.055	0.055	0.039	1.421	0.155	0.003
General CAP → Citizenship PEB	0.014	0.015	0.039	0.374	0.708	0.000
Moderation effect	β	M	SE	t	p	f^2
PN * General CAP → General PEB	-0.009	-0.006	0.041	0.209	0.835	0.000
PN * General CAP → Household waste PEB	-0.050	-0.047	0.043	1.176	0.240	0.003
PN * General CAP → Citizenship PEB	0.006	0.006	0.036	0.166	0.868	0.000
Control Variables	β	M	SE	t	p	f^2
Age → General PEB	0.141	0.216	0.033	4.249	0.000	0.023
Age → Household waste PEB	0.176	0.176	0.039	4.554	0.000	0.027
Age → Citizenship PEB	0.216	0.216	0.037	5.790	0.000	0.044
Gender → General PEB	0.038	0.035	0.067	0.565	0.572	0.000
Gender → Household waste PEB	0.217	0.216	0.077	2.813	0.005	0.012

Gender → Citizenship PEB	0.196	0.195	0.075	2.610	0.009	0.010
Income → General PEB	-0.100	-0.100	0.038	2.637	0.008	0.012
Income → Household waste PEB	-0.029	-0.029	0.045	0.634	0.526	0.001
Income → Citizenship PEB	-0.066	-0.067	0.038	1.724	0.085	0.004
Level of education → General PEB	0.054	0.055	0.033	1.657	0.097	0.004
Level of education → Household waste PEB	0.109	0.110	0.039	2.811	0.005	0.011
Level of education → Citizenship PEB	0.065	0.065	0.038	1.691	0.091	0.004

PN = Personal Norms, General PEB = general pro-environmental behavior, Household waste PEB = household waste and recycling pro-environmental behavior, and Citizenship PEB = environmental citizenship pro-environmental behavior, Human needs CAP = capabilities related to human needs, Human agency CAP = capabilities related to human agent, and Social being CAP = capabilities related to social being. Source: Developed by the authors

In Model 2, age was positively related to the three PEB: general PEB ($\beta = 0.153$, $\rho = 0.000$), household waste PEB ($\beta = 0.185$, $\rho = 0.000$), and citizenship PEB ($\beta = 0.224$, $\rho = 0.000$). Gender was positively related to household waste PEB ($\beta = 0.201$, $\rho = 0.010$), and citizenship PEB ($\beta = 0.195$, $\rho = 0.009$). Income was negatively related to general PEB ($\beta = -0.084$, $\rho = 0.009$). Education was positively related to household waste PEB ($\beta = 0.104$, $\rho = 0.007$) (Table 5). Therefore, the results of the structural models as reported in this paper were corrected for the demographics age, education, gender and income.

Table 22 - Results of the structural analysis of Model 2

Direct effect	β	M	SE	t	p	f^2
PN → General PEB	0.535	0.536	0.036	14.848	0.000	0.387
PN → Household waste PEB	0.249	0.249	0.040	6.288	0.000	0.067
PN → Citizenship PEB	0.308	0.311	0.035	8.798	0.000	0.108
Human needs CAP → General PEB	0.056	0.056	0.036	1.579	0.114	0.004
Human needs CAP → Household waste PEB	0.081	0.081	0.041	1.999	0.046	0.006
Human needs CAP → Citizenship PEB	0.022	0.020	0.039	0.557	0.577	0.000
Human agency CAP → General PEB	0.022	0.021	0.033	0.645	0.519	0.001
Human agency CAP → Household waste PEB	-0.029	-0.031	0.040	0.733	0.463	0.001
Human agency CAP → Citizenship PEB	-0.080	-0.081	0.036	2.255	0.024	0.007
Social being CAP → General PEB	0.001	0.002	0.034	0.044	0.965	0.000
Social being CAP → Household waste PEB	0.006	0.007	0.041	0.135	0.893	0.000
Social being CAP → Citizenship PEB	0.026	0.028	0.040	0.651	0.515	0.001
Moderation effect	β	M	SE	t	p	f^2
PN * Human needs CAP → General PEB	-0.008	-0.003	0.0039	0.212	0.832	0.000
PN * Human needs CAP → Household waste PEB	-0.031	-0.0225	0.046	0.678	0.497	0.001
PN * Human needs CAP → Citizenship PEB	0.062	0.064	0.036	1.709	0.087	0.004

PN * Human agency CAP → General PEB	-0.094	-0.090	0.042	2.251	0.024	0.011
PN * Human agency CAP → Household waste PEB	-0.089	-0.084	0.044	2.032	0.042	0.008
PN * Human agency CAP → Citizenship PEB	-0.093	-0.093	0.037	2.494	0.013	0.009
PN * Social being CAP → General PEB	0.036	0.035	0.040	0.917	0.359	0.002
PN * Social being CAP → Household waste PEB	0.073	0.068	0.043	1.670	0.095	0.005
PN * Social being CAP → Citizenship PEB	-0.053	-0.056	0.034	1.571	0.116	0.003
Control Variables	β	M	SE	t	p	f^2
Age → General PEB	0.153	0.152	0.044	4.576	0.000	0.027
Age → Household waste PEB	0.185	0.185	0.039	4.807	0.000	0.031
Age → Citizenship PEB	0.224	0.224	0.037	6.005	0.000	0.048
Gender → General PEB	0.027	0.025	0.067	0.405	0.685	0.000
Gender → Household waste PEB	0.201	0.199	0.078	2.585	0.010	0.011
Gender → Citizenship PEB	0.195	0.195	0.075	2.614	0.009	0.011
Income → General PEB	-0.084	-0.085	0.036	2.311	0.021	0.009
Income → Household waste PEB	-0.028	-0.029	0.044	0.641	0.522	0.001
Income → Citizenship PEB	-0.049	-0.051	0.037	1.329	0.184	0.002
Level of education → General PEB	0.047	0.048	0.033	1.425	0.154	0.003
Level of education → Household waste PEB	0.104	0.106	0.039	2.690	0.007	0.010

Level of education → Citizenship PEB	0.056	0.057	0.039	1.443	0.149	0.003
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PN = Personal Norms, General PEB = general pro-environmental behavior, Household waste PEB = household waste and recycling pro-environmental behavior, and Citizenship PEB = environmental citizenship pro-environmental behavior, Human needs CAP = capabilities related to human needs, Human agency CAP = capabilities related to human agent, and Social being CAP = capabilities related to social being. Source: Developed by the authors

5.5. DISCUSSION

The present research examined the relationships between general and three specific dimensions of capabilities, personal norms and different types of PEB. To validate these relationships, we examined them across three different types of PEB (i.e., general PEB, household waste PEB, and citizenship PEB) in two models: the first model relied on an established aggregated measurement of human capabilities (LORGELLY et al., 2015), and the second model included a subdivision of capabilities in three dimensions of capabilities, as suggested by Nielsen and Axelsen (2017).

The results of both models supported Hypothesis 1, that is, personal norms toward general PEB are positively related to general PEB, household waste PEB, and citizenship PEB. These results are in accordance with previous research indicating personal norms as positively related to PEB (e.g., VAN DER WERFF; STEG, 2015), household waste PEB (e.g., ANDERSSON; VON BORGSTEDT, 2010; GOH et al., 2022), and citizenship PEB (e.g., STEG et al., 2011; VAN RIPER; KYLE, 2014; ZHANG et al., 2017). The findings provide further evidence for the assumption that PEB is strongly embedded in moral considerations, such as represented in personal norms, and as indicated by theories such as the norm activation theory (SCHWARTZ, 1977) or its extension the value-belief-norm theory (STERN, 2000). The stronger relationship between personal norms in terms of general PEB rather than specific types of PEB in both models confirms that personal norms are better predictors when they have been specified to the specific type of behavioral context (VAN DER WERFF; STEG, 2015; STEG et al., 2011).

The research findings of both models showed mixed results regarding the relationship between human capabilities and general and specific types of PEB. More precisely, Model 1 only presented a weak positive relationship between capabilities and general PEB, and Model 2 only presented a weak positive relationship between human needs CAP and household waste PEB, and a weak negative relationship between human agency CAP and citizenship PEB. Thus, Hypothesis 2 was only supported to a limited extent. These results therefore offer little support for the affluence hypothesis (DUROY, 2008), which assumes that higher levels of capabilities could be linked to a greater occurrence of PEB. Moreover, Model 2 presented a negative relationship between one dimension of capabilities and a specific type of PEB, contradicting the expectation that increasing capabilities would be associated with higher levels of PEB (LESSMANN; MASSON, 2015). Therefore, capabilities could be useful to

include in PEB research, but not merely because capabilities increase one's opportunities to perform PEB, but equally because, depending on its specific dimension, it might provide barriers to performing certain types of PEB. Future research could examine these specific boundary conditions of the relationship between different dimensions of human capabilities on different kinds of PEB in more detail. Moreover, future studies could analyze the relationships between capabilities and other variables usually employed in the PEB, such as self-efficacy.

The findings of both models presented mixed results regarding the moderating role of human capabilities in the relationship between personal norms and general and specific types of PEB. Model 1 showed no significant moderating effect of the aggregated measure of capabilities, personal norms and (specific types of) PEB. Model 2 showed (1) a positive moderating effect of human needs CAP on the relationship between personal norms and citizenship PEB; (2) negative moderating effects of human agency CAP on the relationship between personal norms and general PEB, household waste PEB, and citizenship PEB relationships; and, (3) a positive moderating effect of social being CAP on the relationship between personal norms and household waste PEB. All these moderating effects showed small effect sizes. Thus, Hypothesis 3 was only limitedly supported. Although based on the literature higher capabilities function as higher opportunities (LESSMANN; MASSON, 2015) to act upon one's personal norms and consequently act in line with this norm, our findings suggest that this relationship is more complex than suggested. Specifically, the results show that only specific dimensions of capabilities (rather than the aggregated construct) moderate the relationship between personal norms and PEB, and that this moderator effect largely depends on the specific dimension of capabilities as well as the specific type of PEB.

For the PEB analyzed in this research, the human agency CAP dimension was the one that resonated more significantly with PEB, as it presented moderating relationships with all the PEB considered in the research. The capability approach literature highlights that individuals can be agents of change, capable of transforming their surroundings if they have enough opportunities to do so (SEN, 2010, 2013). Interestingly, however, our findings indicate that the opportunities to develop oneself worked as a barrier rather than an opportunity in the PEB analyzed. This result contradicts the affluence hypothesis (DUROY, 2008) and previous assumptions in the capability approach literature (LESSMANN; MASSON, 2015, SEN, 2013). These negative effects could be explained by the increase in the difficulty of optimizing choices when individuals have more options to opt for (Schwartz,

2004). Thus, even though individuals might have a moral willingness to perform a PEB, they might opt for a less environmentally friendly option that becomes available due to an increase in their abilities. For example, an individual might have the moral motivation to avoid driving a car to go to work, but knowing how to drive and having a driving license might increase the predisposition to drive to work. Considering that it is not reasonable to reduce individuals' autonomy (capabilities) from the capability approach perspective (SEN, 2013), it will be important to examine under which circumstances certain capabilities dimensions work as such a barrier rather than an opportunity for promoting PEB.

5.5.1 THEORETICAL IMPLICATIONS

The findings of the present research have several theoretical implications, especially in relation to Hypothesis 3. First, relying solely on an aggregated measure of capabilities does not seem to address the extent to which capabilities can strengthen or weaken the relationship of important motivational factors, such as personal norms within the plethora of PEB. Hence, the complexity of the role of capabilities might not be captured by operationalizing it as an aggregated construct. The literature using the capability approach in relation to PEB should therefore acknowledge, use, and further develop the dimensional structure of capabilities.

Furthermore, the theoretical assumptions, such as the affluence hypothesis (DUROY, 2008), which have been popular in the human development literature (MILFONT; MARKOWITZ (2016), seem not to provide a sufficient understanding of how capabilities can explain the (lack of) performing different types of PEB. In particular, our findings show that, in contrast to the affluence hypothesis, human development could actually constrain the adoption of PEB. Consequently, next to the positive influence of capabilities on performing PEB, the human development literature should consider and further understand the barriers that increasing capabilities can create to perform PEB as well. Such knowledge will help to design ways to mitigate these negative side-effects without constraining human development as a whole.

Finally, popular normative theories in relation to explaining PEB, such as the norm activation theory (SCHWARTZ, 1977), or, its extension, the value-belief-norm theory (STERN, 2000), often do not acknowledge the importance of specific barriers and opportunities that can strengthen or weaken the relationship between normative motivations and PEB. Our results show that, under some circumstances, human capabilities can offer such specific barriers or opportunities. Therefore, normative theories could benefit from

incorporating capabilities within their theoretical framework to further understand such barriers and opportunities.

5.5.2 Practical and policy implications

The human development literature has found positive relationships between human development and sustainability (e.g., FURLAN; MARIANO, 2022; LIMA et al., 2022). However, our findings show that, within the PEB context, these relationships are more complex than expected. That is, some specific capabilities might offer barriers for the adoption of PEB rather than opportunities. These findings can offer a new perspective on work that has recently been done by policy makers. For example, the United Nations Development Programme has been testing a new version of the Human Development Index adjusted by carbon dioxide emissions per person and material footprint per capita (i.e., Human Development Index adjusted for Planetary Pressures (PHDI); HDR, 2023). These adjustments were made to consider human pressure on the environment, with the aim of incentivizing a sustainable transformation. Further variations of this index could include analysis based on specific dimensions of human development (e.g., health, education) and environmental subjects (e.g., waste generation, sustainable transportation).

Developing countries, such as Brazil, are in a process of increasing their level of economic and human development. This development entails a process of expanding individuals' capabilities. Because capabilities do not only result in opportunities to adopt PEB (hence, a growth in “environmental” development), but may also trigger certain barriers to adopting them, initiatives should be developed and evaluated to optimize these opportunities while simultaneously minimizing the barriers. Special attention should be given to the human agency aspect of capabilities, as our findings show that this capability dimension is most likely to function as a barrier to performing PEB. In this way, environments that play a vital role in expanding individuals' agency capabilities (i.e., individuals' intellectual, cognitive and technical development), such as technical schools, universities, and workplaces should facilitate and highlight the importance of PEB, not only to be performed within these places, but to stimulate the adoption of these behaviors in other places and on other occasions.

5.5.3 Limitations and future research

The present study presents some limitations. The first limitation relates to our operationalization and measurement of capabilities. The research only relied on a self-developed instrument for measuring capabilities dimensions based on face and concurrent validity, because there is no formal validated three-dimensional operationalization of human capabilities as yet. Although these items were not developed through an extensive validating process, they seemed sufficient for this study, because the study merely aimed for a first exploration of whether it is useful to distinguish these dimensions. Indeed, the results strongly suggest that the three-dimensional distinction in capabilities seem to be more useful than operationalizing capabilities as an aggregated construct only when related to boundary conditions of normative psychological factors and PEB. Thus, future research could benefit from the development and further refinement of a measurement instrument to measure the three general dimensions of human capabilities.

The second limitation concerns our sample. The respondent sample considered in this research presents relatively high levels of income and education compared to the Brazilian average, and these variables are correlated to capabilities (LORGELLY et al., 2015). Thus, the research probably covered individuals with high levels of capabilities, that is, the “affluent” population within the affluence hypothesis. Individuals with lower levels of capabilities face more restrictions, i.e., have less opportunities/freedom, such as a lack of adequate sanitation and other basic services. In this way, the elasticity of capabilities may not be the same as those compared to individuals with higher capabilities, that is, an increase of one unit of capabilities would have more effect in lower levels than in higher levels (ANAND; SEN, 2000). Thus, the effect sizes of the direct and moderating relationship of capabilities on individuals with lower capabilities might be higher than for higher levels of capabilities. Future studies could analyze a sample with a different profile covering a wider-range of capabilities levels, especially the lower levels that were largely not present in this research.

The third limitation is related to our measurement of PEB. This research has only presented one general and two specific types of PEB (i.e., household waste PEB and citizenship PEB), which were employed for validating purposes. These behaviors were selected because they encompass the different sets of physical, social, and contextual factors to be performed. Yet, even among these differences, we found some similar results, especially considering the moderation role of human agency CAP on the personal norms and PEB

relationships, which support the validity of our findings. The other results, those that present differences according to the type of PEB, indicate that the relationship between capabilities and PEB are context dependent, that is, vary according to the PEB. Therefore, future research should consider more specific types of PEB (e.g., water and energy saving behavior, sustainable transportation, and biodiversity conservation) and structure the dimensions of these types of PEB (e.g., cognitive, physical, and financial effort; impact of the behavior; and capacity for change, KNEEBONE et al., 2020; SELINSKE et al., 2020), in order to establish what types of behavioral contexts capabilities could be a useful addition to explain PEB.

The fourth limitation includes the explorative nature of the present study. That is, our study was correlational in nature, which means that no causal inferences can be made (i.e., PLS-SEM is based only on factor analysis and regression and, therefore, is unable to detect causal relationships). In order to understand the plausibility of the directions of our hypothesized relationships, we relied solely on the causality of directions implied by existing literature and theories about human capabilities and PEB. Future studies could apply less explorative methods, such as randomized control trials (commonly applied in health sciences) or differences in differences (an econometric method), to enable scholars to more fully understand the causality of the relationships.

Our final limitation concerns the measurement of personal norms. In the present study personal norms were measured towards general PEB and not (also) towards the two specific types of PEB (i.e., household waste and recycling and environmental citizenship). Based on past research (e.g., STEG et al., 2011), personal norms that are more strongly specified towards the specific behavioral context show stronger relationships with PEB. Although the main goal of this study was to examine the relationship of personal norms on general PEB, the other two behaviors being included for validating purposes, future research relying on the capability approach should specify personal norms towards the specific PEB.

5.6. Conclusion

The present research tested the assumption that expanding human capabilities, i.e., opportunities in life, would be related to PEB within a framework integrating the capability approach with personal norms, which is one of the main predictors of PEB. To achieve this goal, the research relied on two approaches to measure human capabilities: capabilities as an aggregated construct and capabilities as a multidimensional construct. The findings suggest

that capabilities have, under some circumstances only, a positive relationship with PEB and a capacity to enhance or diminish the relationship between personal norms and PEB. These results contradict and further extend the theoretical assumptions in the human development literature which suggests that increasing human capabilities always has a positive relationship with PEB. In particular, our results suggest that the direction and strength of the relationships between capabilities, personal norms and PEB strongly depend on the specific dimensions of capabilities and the type of PEB. Therefore, scholars could benefit from adding the capability approach in their (normative) theoretical frameworks to better understand PEB, as long as they acknowledge the complexity of dimensions of capabilities in relation to the specific behavioral context of the PEB.

2.7 ARTICLE

This article was published in the *Journal of Cleaner Production* under the title “More than moral motivations: the moderating role of human capabilities on the relationship between personal norms and pro-environmental behavior” with the following authorship:

1. **Pedro Augusto Bertucci Lima:** Leading author, Conceptualization, Methodology, Formal analysis, Writing - Original Draft, Writing - Review and Editing
2. **Octaviano Rojas Luiz:** Conceptualization, Methodology, Software, Formal analysis, Writing - Review and Editing.
3. **Fernanda Pereira Sartori Falguera:** Conceptualization, Methodology, Formal analysis. Writing - Review and Editing.
4. **Marcelo Furlan:** Methodology, Software, Formal analysis, Writing - Review and Editing.
5. **Enzo Barberio Mariano:** Supervision, Writing - Review and Editing.
6. **Judith Irene Maria de Groot:** Methodology, Validation, Supervision, Writing - Review and Editing.

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*“And in the end, the love you take
is equal to the love you make”*

John Lennon and Paul McCartney

6. CONCLUSION

The main goal of this thesis is to present new perspectives and insights to the VBN theory to explain different types of PEB. In order to achieve this goal, this thesis was composed of 4 articles, each one of them with specific features and objectives. The first article presented a systematic literature review of the intersection between VBN in the green advertising field. The second article analyzed the relationship between individual values and in conservation messages with values appeals, and the effectiveness of these messages (i.e., attitude towards the message and behavior intention). The third article considered a circular economy context by analyzing the relationships with reported recycling behavior and purchasing behavior of recycled products with the intention to buy specific products made of recycled materials, considering the moderating effect of an extended NAM framework. Finally, the fourth article analyzed the direct effect of human capabilities on the adoption of PEB, and its moderating effect on the relationship between personal norms and PEB.

The systematic literature review presented in the first article has the main implication of highlighting the opportunities of the VBN theory in the green advertising domain, whose main objective is to promote different kinds of PEB. The review provided a mapping of the current literature, discussing the main methods and variables employed in the studies. The research also pointed to research opportunities in the field, such as the combination of different approaches and variables (e.g., human development, cultural values, social norms, affective variables) within the VBN and advertising domain. Thus, the theoretical framework developed in this article offered subsidies for the interaction relationships analyzed in the subsequent articles. These variables can work as moderators in the relationship between the fully VBN or its isolated components and PEB. Thus, the first article, which is one of the few systematic literature reviews about green advertising, supplies researchers with a robust theoretical background and avenues for new studies, while also providing practitioners with insights that can be applied in the development of environmental related campaigns.

The second article analyzed the relationship between individual values and values framed messages in two conservational contexts: the interaction between human and marmosets in Bauru, Brazil; and the presence of the wild boar in the Metropolitan Region of Barcelona, Spain. The findings indicate that, although biospheric and altruistic framed messages increased the interaction of altruistic and biospheric values with the message efficiency (attitude toward the message and behavior intention) in the Brazilian case, the direct effect of the message was only present in the control version of the message, i.e.,

informative communication. The Spanish case supports the importance of the informative version, as it was the only one that positively moderated the relationship between altruistic and biospheric values with the message effectiveness. Moreover, both cases have an inherent practical implication of presenting undergraduate students about conservation behaviors in their own surroundings, especially in the Brazilian case, where only 36% of the sample have heard about issues involving the marmoset. The results of the studies can support the development of conservation messages, especially in the own university of the authors (after publication, the article will be sent to the universities and the Botanic Garden of Bauru, which is strongly engaged with conservation messages).

The third article analyzed the relationships between reported recycling and purchasing behavior of recycled products with the intention of purchasing specific products made of recycled materials. The research included an extended version of the NAM framework (i.e., awareness of consequence, outcome efficiency, personal norms, social norms, and attitude) to check the direct effect of the variables on purchasing intention and the moderating effect of them in the relationship between reported behavior and behavior intention. Including a sample from Brazil and Spain, the findings indicated that reported purchasing behavior presents a strong positive relationship with purchasing intention, while reported recycling behavior presented very few relationships with behavior intention. Moreover, the extended NAM variables presented a strong positive relationship with behavior intention, but only few moderating effects in the relationship between reported behavior and behavior intention. Considering a circular economy context, in which the adequate disposition of waste (e.g., recycling) is not necessarily related to the acquisition intention of circular products (e.g., products made of recycled materials). The weak moderating effect of the extended NAM variables indicate that other variables and strategies should be considered in order to increase the relationship between reported and behavior intentions in the circular behavior context, specially considering garment and other products bought with fewer frequency than products cheaper and bought with more frequency, such as detergents.

The fourth article analyzed the relationship of human capabilities with PEB and the moderating effect that they can have on the relationship between personal norms and PEB. This article is one of the first attempts to include human capabilities at the individual level in the PEB domain. The results indicate the positive relationship between personal norms and the adoption of PEB. The findings also demonstrate how specific dimensions of capabilities present positive relationships with the adoption of specific kinds of PEB and also how human capabilities can straighten or diminish the interaction between personal norms and specific

kinds of PEB. The findings highlight the necessity to analyze specific dimensions of capabilities rather than relying solely on an aggregated measurement. The article also presents an instrument to measure dimensions of human capabilities, which can be further improved in order to become an even more robust measurement of capabilities.

In conclusion, the four articles developed in this thesis present several contributions for the VBN theory and for a better understanding on the determinants of PEB. The first and main contribution is the interaction (moderating effect) between VBN variables and other aspects: contextual variables and human development as presented in the theoretical framework combining VBN with information processing steps stimulated by persuasive messages, i.e., green advertisements (article 1), the interaction of persuasive messages in the relationship between individual values and effectiveness of the message, i.e., attitudes toward the message and behavior intention (article 2), the moderating effect of an extended NAM framework on the relationship between past behavior and behavior intention (article 3), and the moderating effect of human capabilities on the relationship between personal norms and PEB (article 4), which might help explaining and support the development of better strategies by considering the inclusion of moderating variables to increase the number and frequency of PEB. A second contribution is the application of the VBN theory on different contexts: green advertising (article 1), conservation ecology (article 2), circular economy (article 3), and human development (article 4), which highlights the theory's flexibility and multidisciplinary potential necessary for dealing with sustainability issues. A third contribution is the comparison of the results in a developing (Brazil) and a developed (Spain) country (articles 2 and 3), which is relevant to analyze contextual and structural differences among distinct places. It is expected that the present thesis stimulates the development of research considering new interacting variables in the relationship between VBN variables and PEB.

Besides the contribution related to the VBN theory, this thesis also provided several other contribution on other fields as: a review of the literature in the green advertising field (article 1), which is something yet scarce besides the importance of subject and the amount of published articles about green advertising with different perspectives; the increase in the awareness about conservation issues in Bauru and Barcelona (article 2), which is relevant to support the well being of individuals and animals; the finding of a weak relationship between recycling behavior and intention to purchase products made of recycled materials and a strong relationship between reported purchasing behavior of recycled products and the intention to purchase specific recycled products (article 3), which is particularly relevant considering the necessity of closing materials and energy loops through the acquisition of

recycled products and the adequate waste disposal practices; and the development of a first version of a short instrument to measure dimensions of human capabilities, which contributes to the incipient body of research in measuring individual capabilities through surveys and also the inclusion of human capabilities on PEB analysis (article 4).

One important limitation worth mentioning concerns the sample used in articles 2, 3, and 4. Articles 2 and 3 relied on a sample of undergraduate students from Brazil and Spain, while article 4 used the snowball technique to gather a sample that was not representative of the Brazilian population, as the sample was overrepresented by high income and educational level. Although this reduces the generalizability of the findings, the main goal of the research was to analyze internal validity among the variables of interest, and the use of a convenience sample allowed for a bigger sample size, which is advantageous for increasing the statistical power of the analysis. This approach is commonly employed in the PEB literature.

Finally, some research opportunities are important to remark on. The first one concerns the theoretical framework proposed in article 1, which can support the development of empirical studies to test the relationships presented in the framework. A second research opportunity is the test of different appeals (i.e., positive and negative) on conservation messages in the same case study, differently to what was employed on article 2. A third research opportunity is the analysis of the relationships between different types of circular behavior, e.g., sharing, reuse, reduce. A fourth research opportunity is related to the improvement of the measurement instrument adapted to measure dimensions of capabilities, as well as the application of more studies analyzing the relationship between human capabilities and PEB at the individual level.

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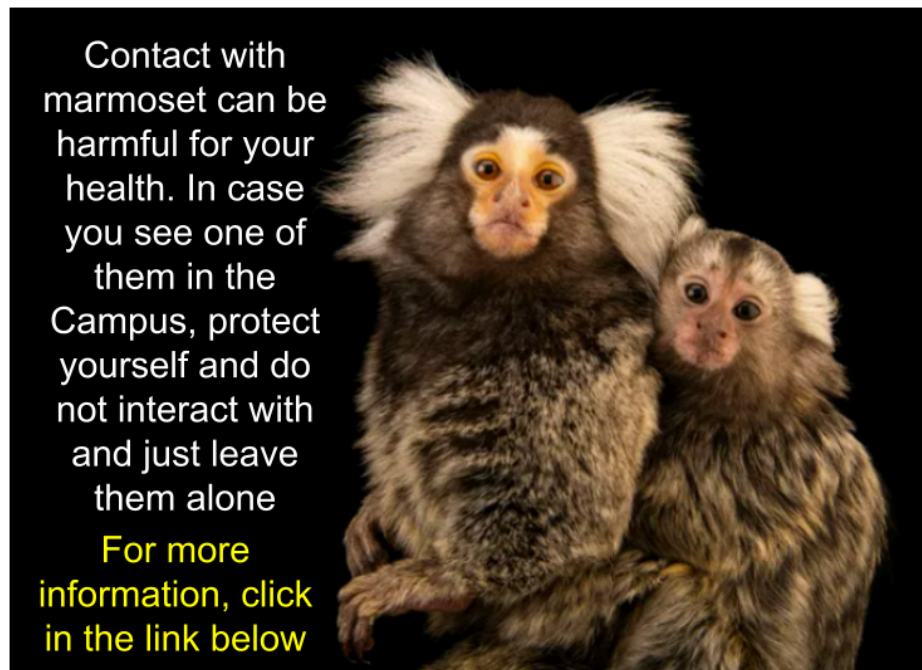
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APPENDICES

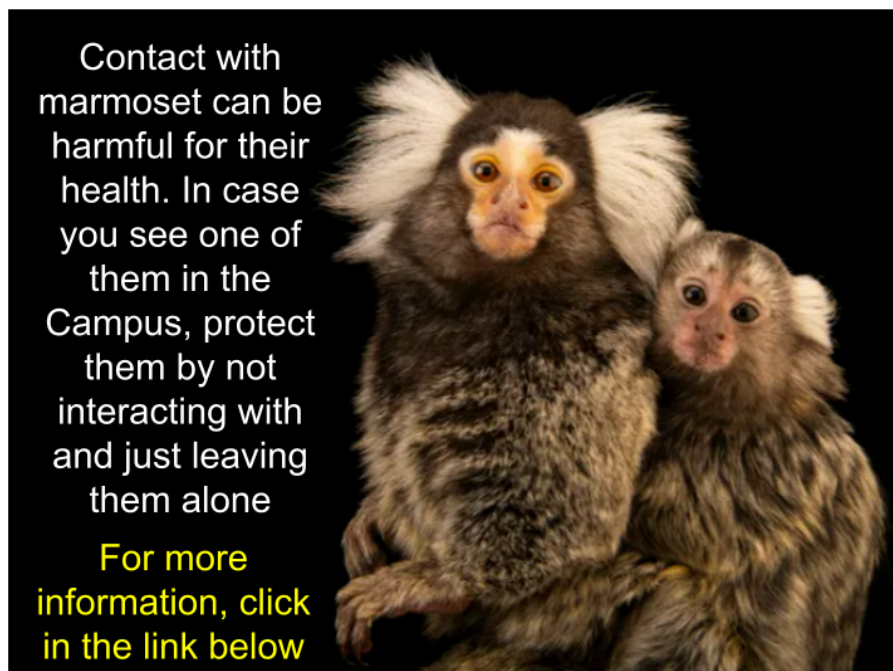
APPENDIX 1 - Appendix from Article 2

Figure A1 - Marmoset conservation advertisement with the egoistic appeal



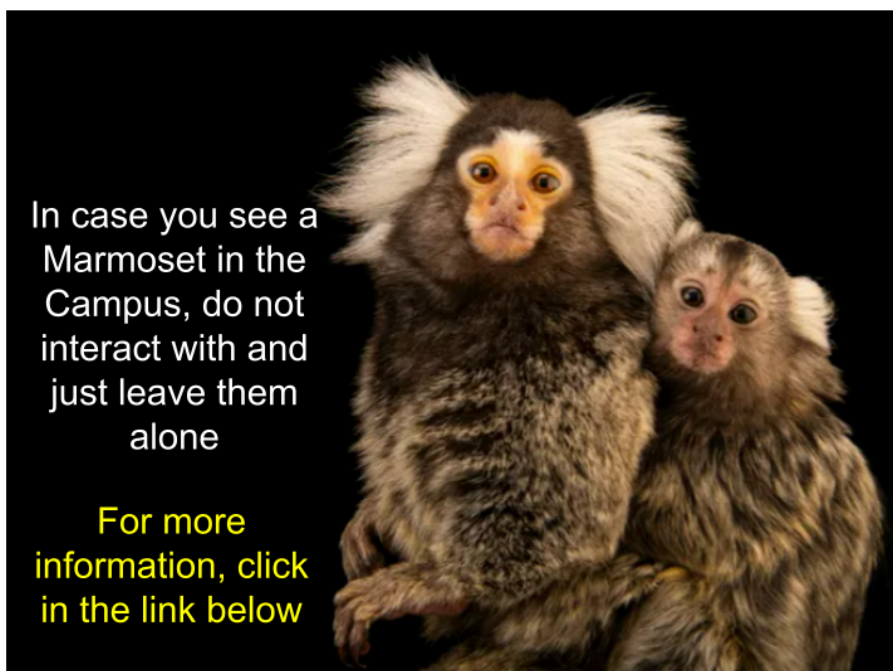
Source: Developed by the authors

Figure A2 - Marmoset conservation advertisement with the biospheric appeal



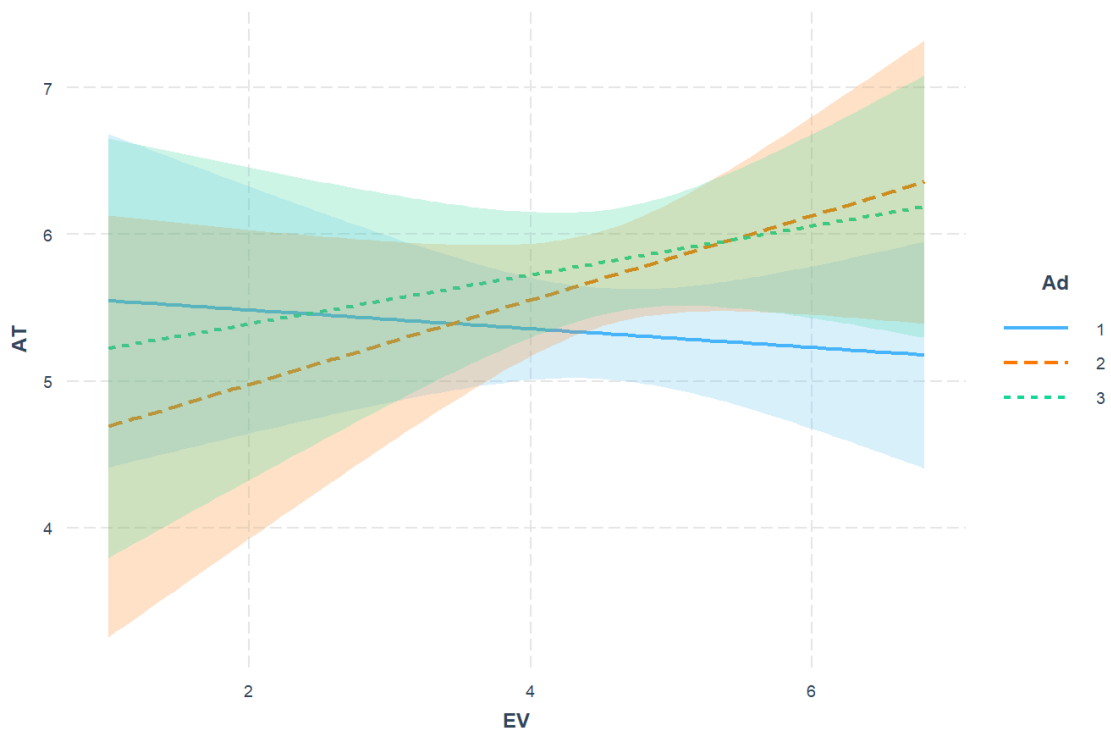
Source: Developed by the authors

Figure A3 - Marmoset conservation advertisement with the control appeal



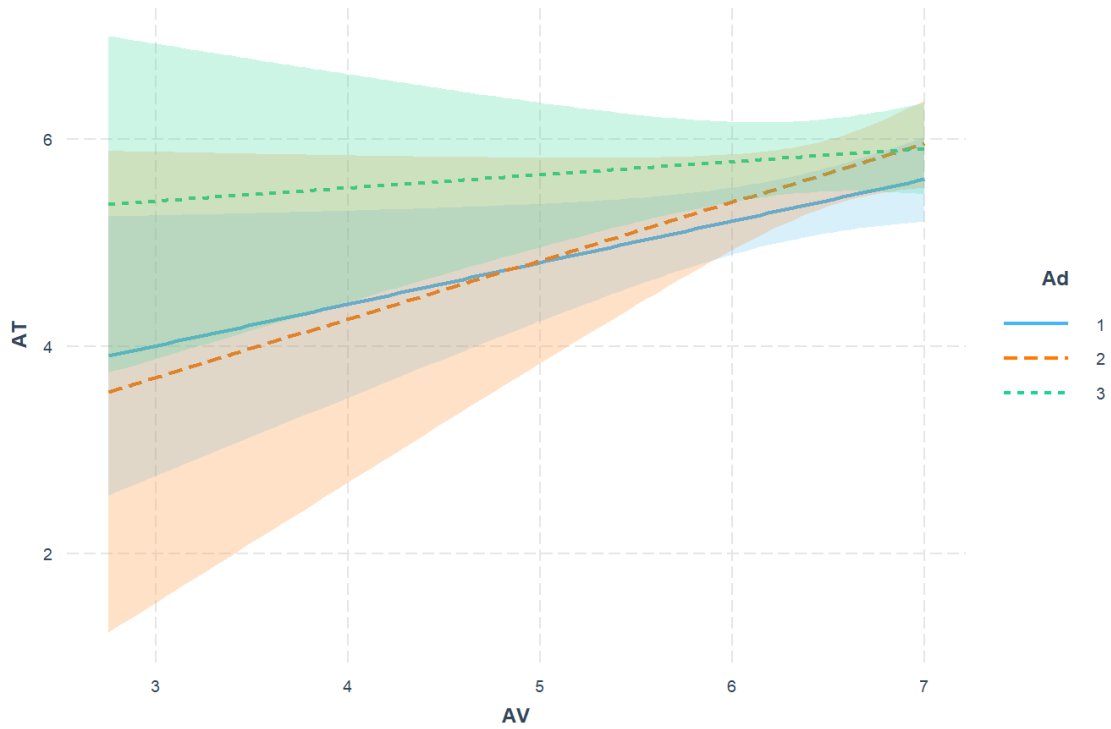
Source: Developed by the authors

Figure A4 - Slope analysis of the interaction of the message version (Ad1 = biospheric version, Ad2 = egoistic version, Ad3 = control version) in the relationship between egoistic values (EV) and attitude towards the message (AT) for the marmoset case in Brazil.



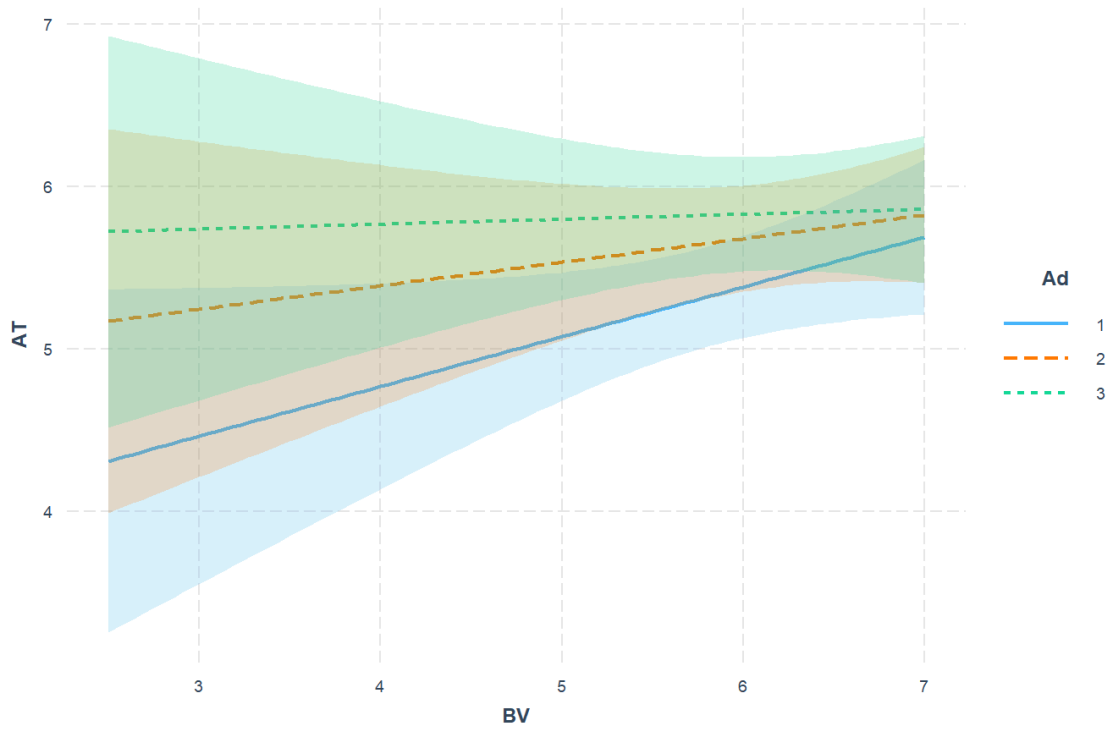
Source: Developed by the authors

Figure A5 - Slope analysis of the interaction of the message version (Ad1 = biospheric version, Ad2 = egoistic version, Ad3 = control version) in the relationship between altruistic values (AV) and attitude towards the message (AT) for the marmoset case in Brazil.



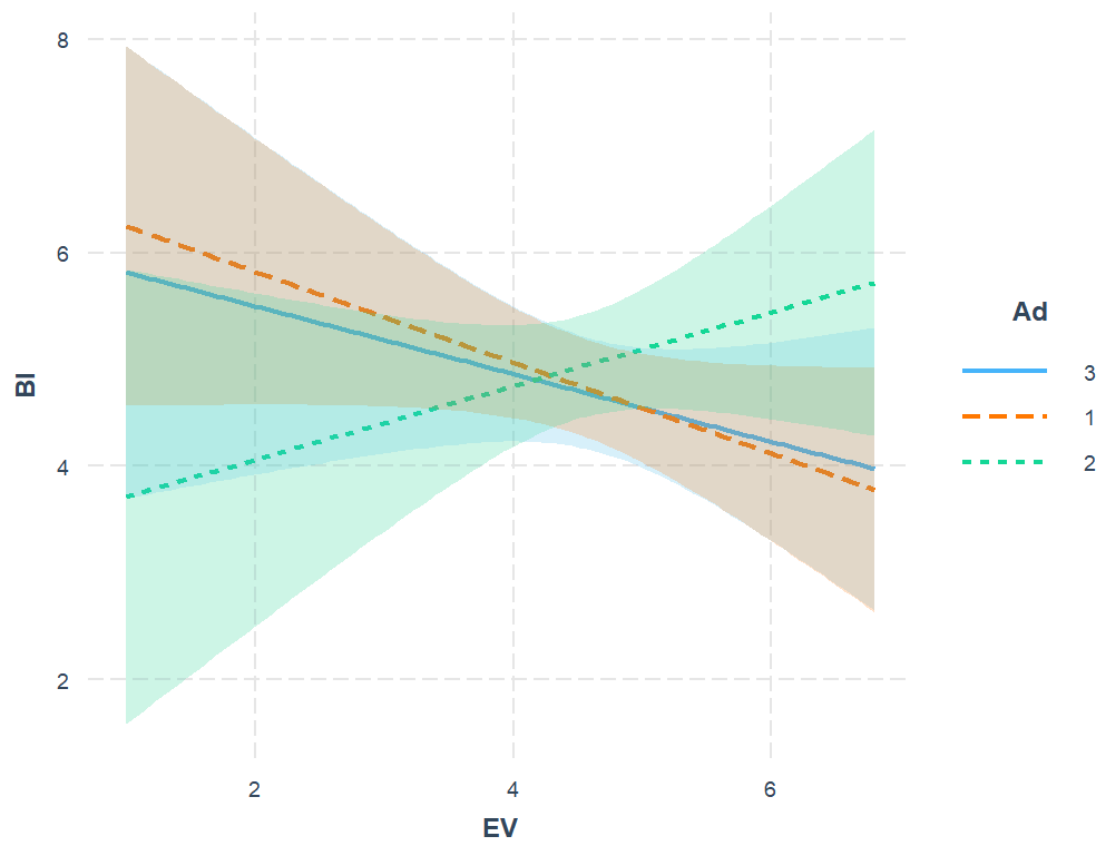
Source: Developed by the authors

Figure A6 - Slope analysis of the interaction of the message version (Ad1 = biospheric version, Ad2 = egoistic version, Ad3 = control version) in the relationship between biospheric values (BV) and attitude towards the message (AT) for the marmoset case in Brazil.



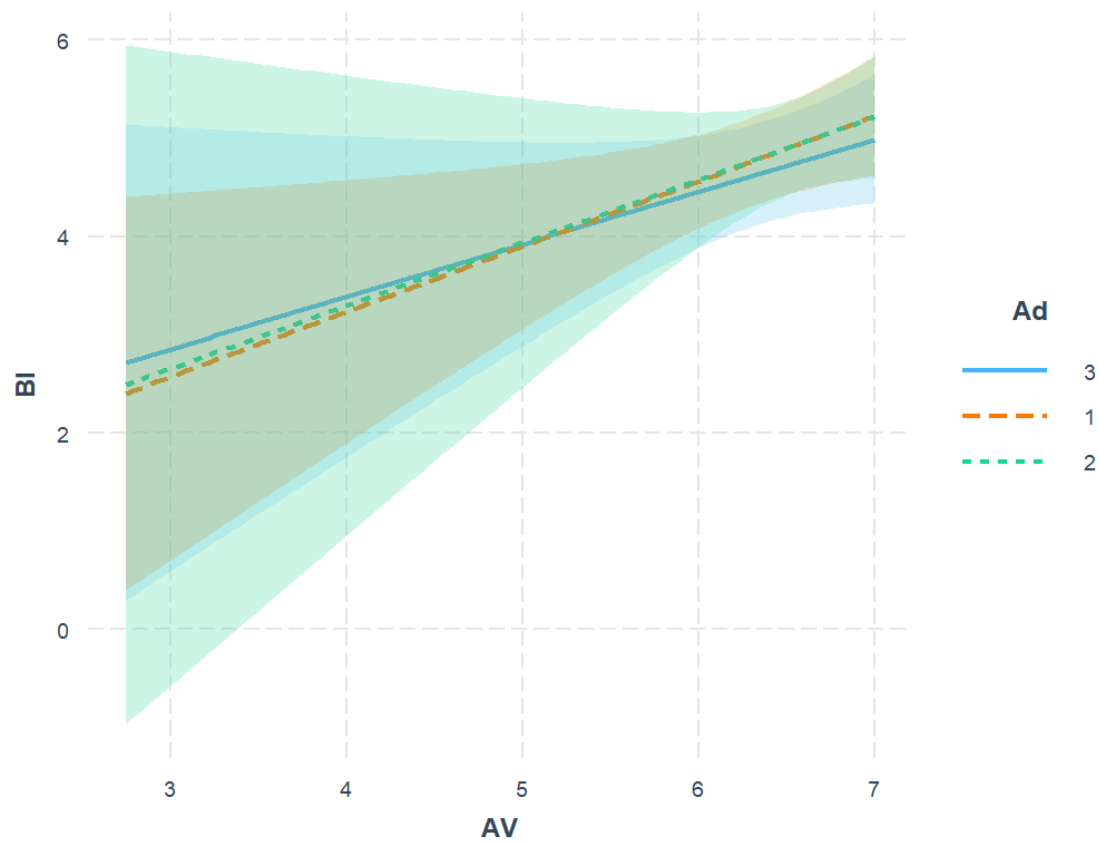
Source: Developed by the authors

Figure A7 - Slope analysis of the interaction of the message version (Ad1 = biospheric version, Ad2 = egoistic version, Ad3 = control version) in the relationship between egoistic values (EV) and behavior intention (BI) for the marmoset case in Brazil.



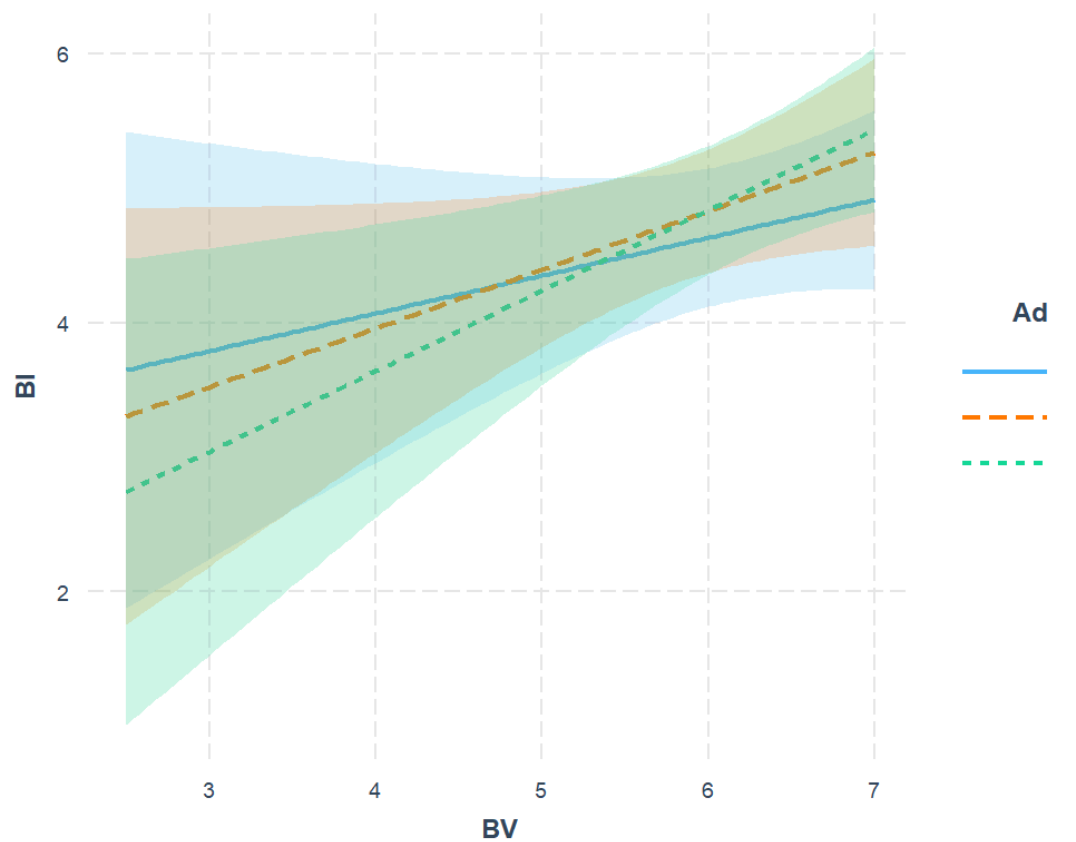
Source: Developed by the authors

Figure A8 - Slope analysis of the interaction of the message version (Ad1 = biospheric version, Ad2 = egoistic version, Ad3 = control version) in the relationship between altruistic values (AV) and behavior intention (BI) for the marmoset case in Brazil.



Source: Developed by the authors

Figure A9 - Slope analysis of the interaction of the message version (Ad1 = biospheric version, Ad2 = egoistic version, Ad3 = control version) in the relationship between biospheric values (BV) and behavior intention (BI) for the marmoset case in Brazil.



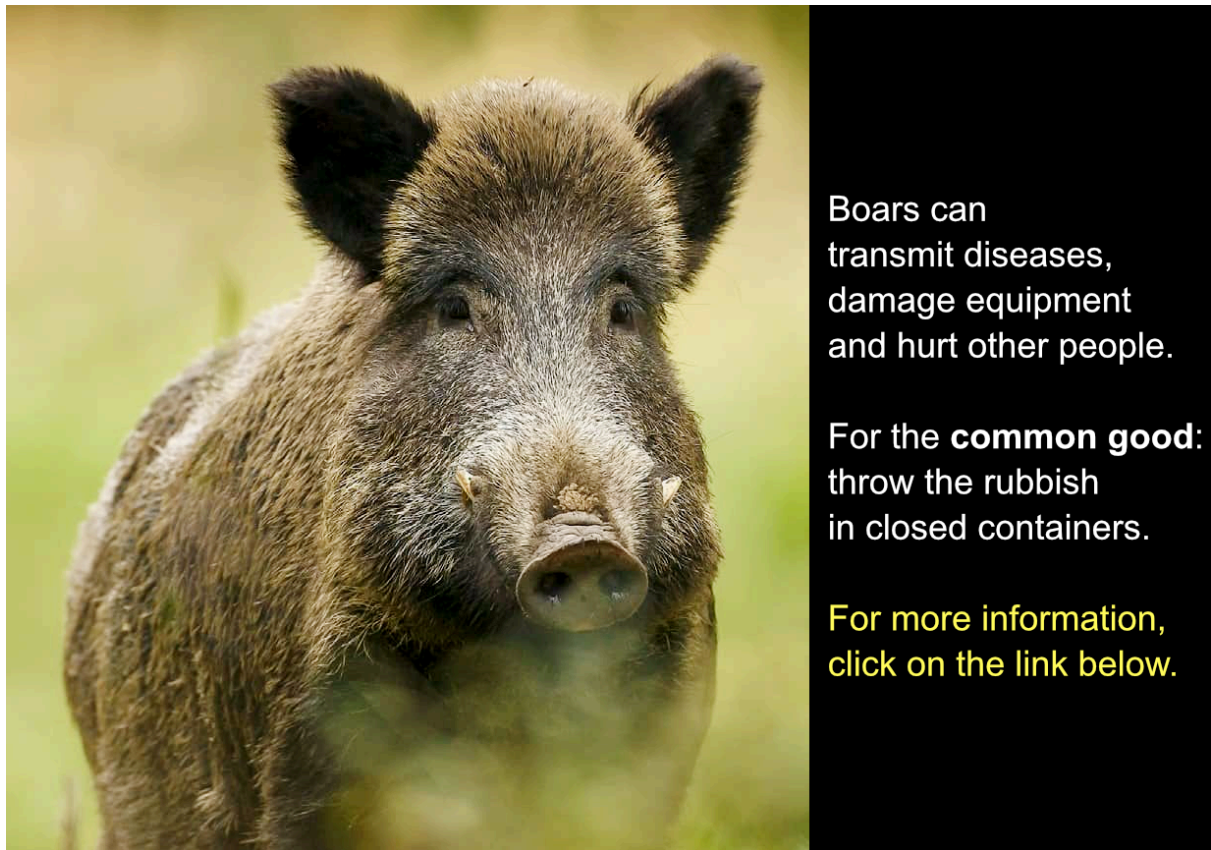
Source: Developed by the authors

Figure A10 - Wild boar conservation advertisement with an egoistic appeal



Source: Developed by the authors

Figure A11 - Wild boar conservation advertisement with an altruistic appeal



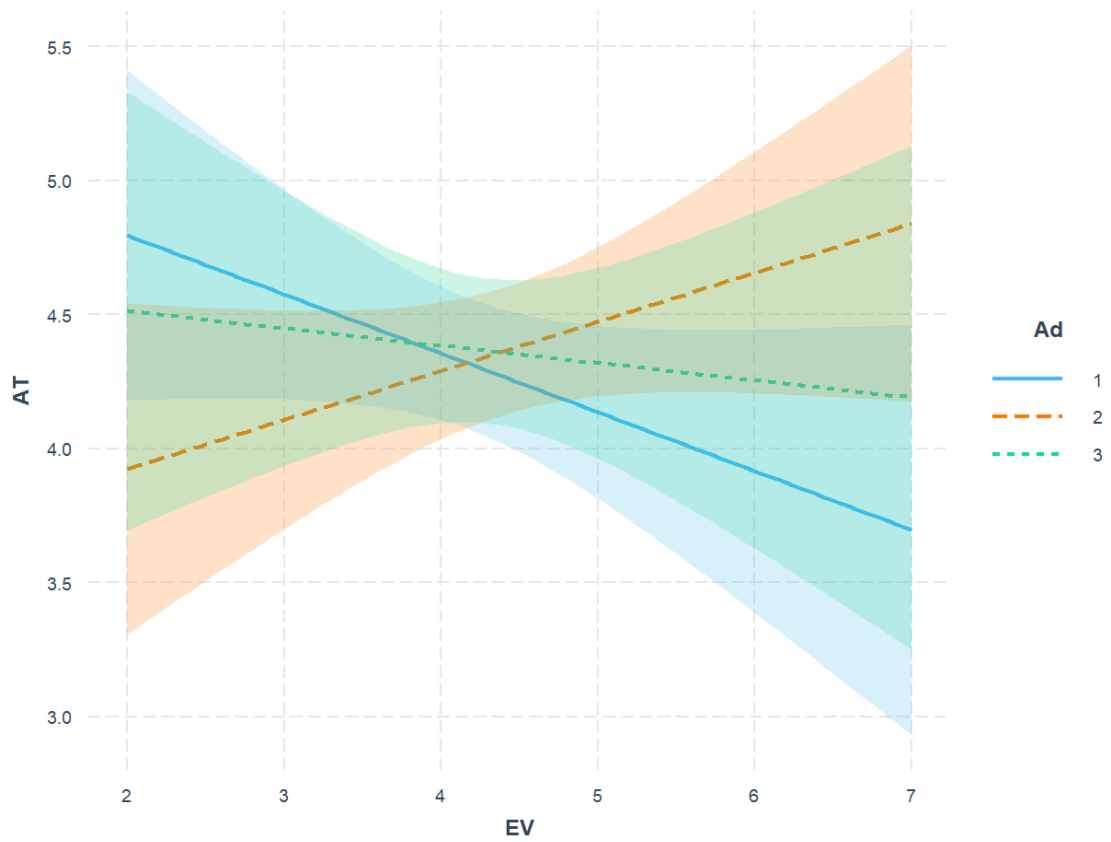
Source: Developed by the authors

Figure A12 - Wild boar conservation advertisement with a control appeal



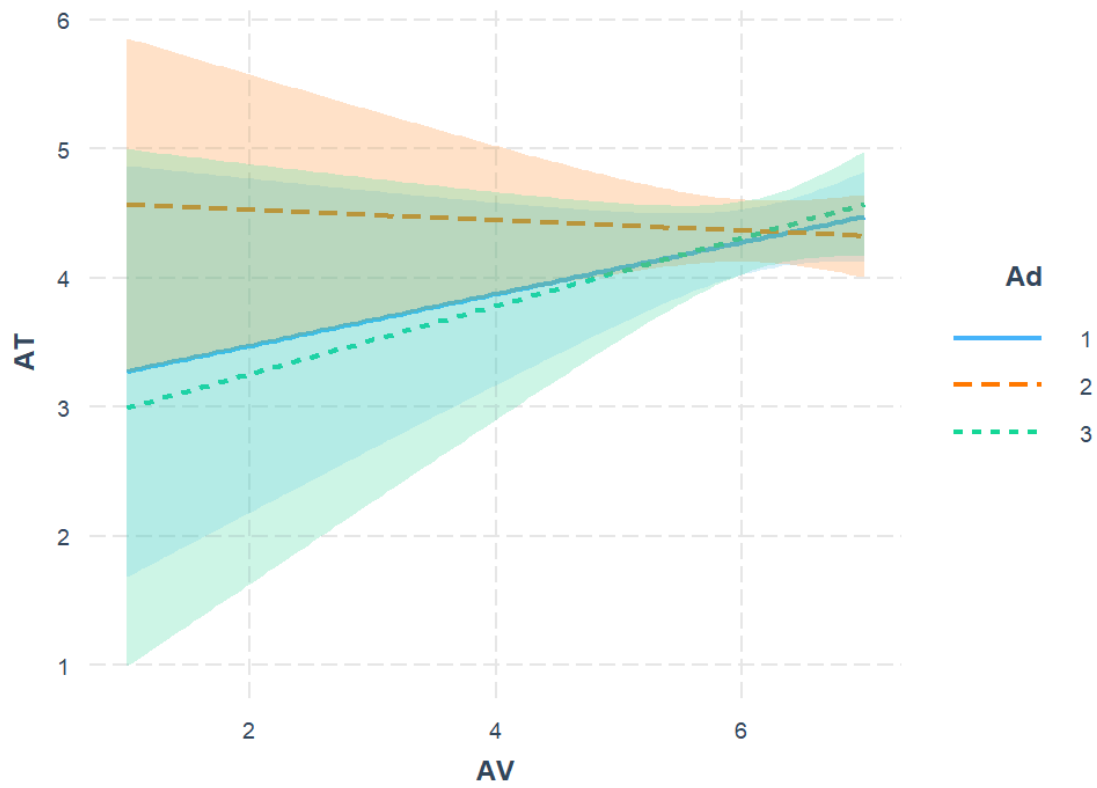
Source: Developed by the authors

Figure A13 - Slope analysis of the interaction of the message version (Ad1 = altruistic version, Ad2 = egoistic version, Ad3 = control version) in the relationship between egoistic values (EV) and attitude towards the message (AT) for the wild boar case in Spain.



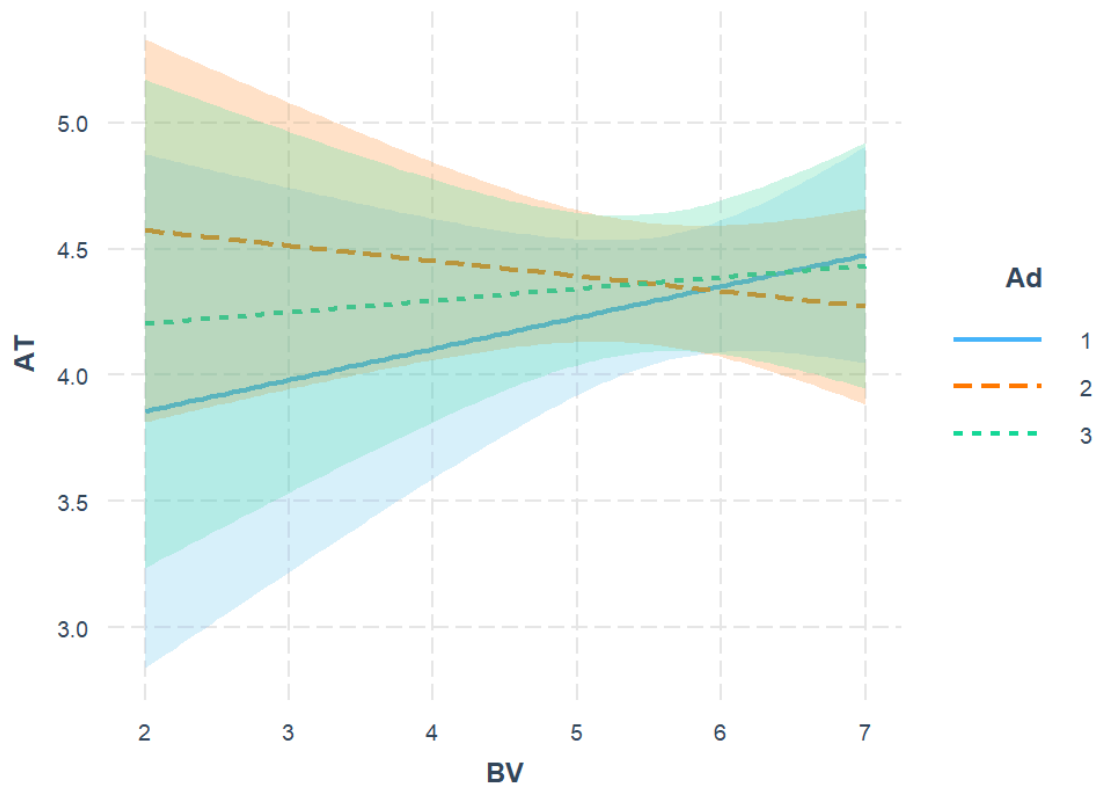
Source: Developed by the authors

Figure A14 - Slope analysis of the interaction of the message version (Ad1 = altruistic version, Ad2 = egoistic version, Ad3 = control version) in the relationship between altruistic values (AV) and attitude towards the message (AT) for the wild boar case in Spain.



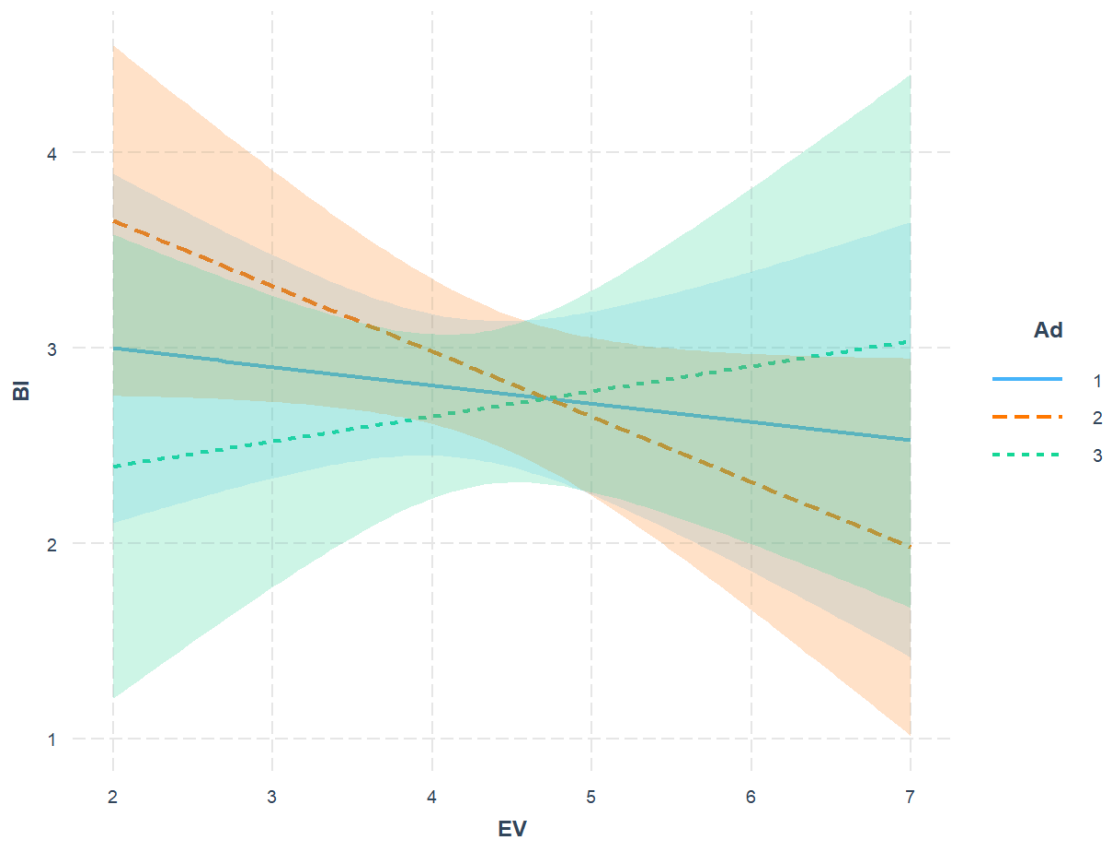
Source: Developed by the authors

Figure A15 - Slope analysis of the interaction of the message version (Ad1 = altruistic version, Ad2 = egoistic version, Ad3 = control version) in the relationship between biospheric values (BV) and attitude towards the message (AT) for the wild boar case in Spain.



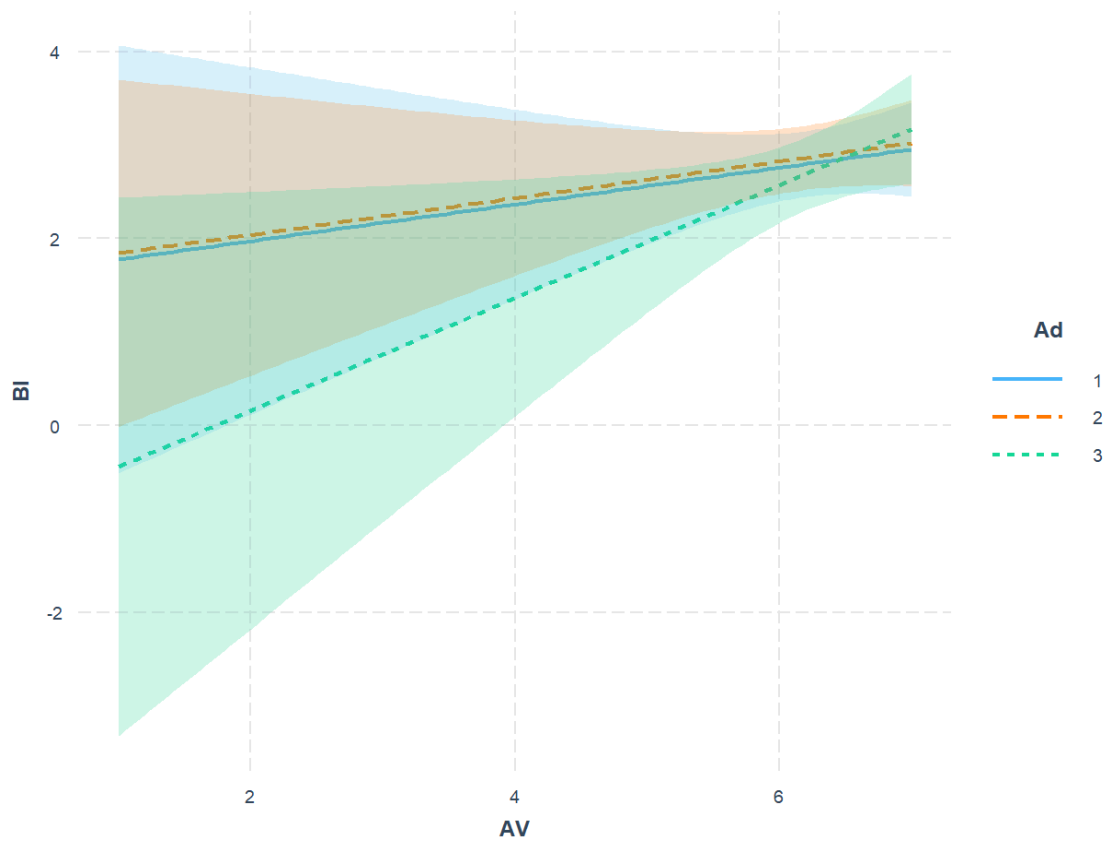
Source: Developed by the authors

Figure A16 - Slope analysis of the interaction of the message version (Ad1 = altruistic version, Ad2 = egoistic version, Ad3 = control version) in the relationship between egoistic values (EV) and behavior intention (BI) for the wild boar case in Spain.



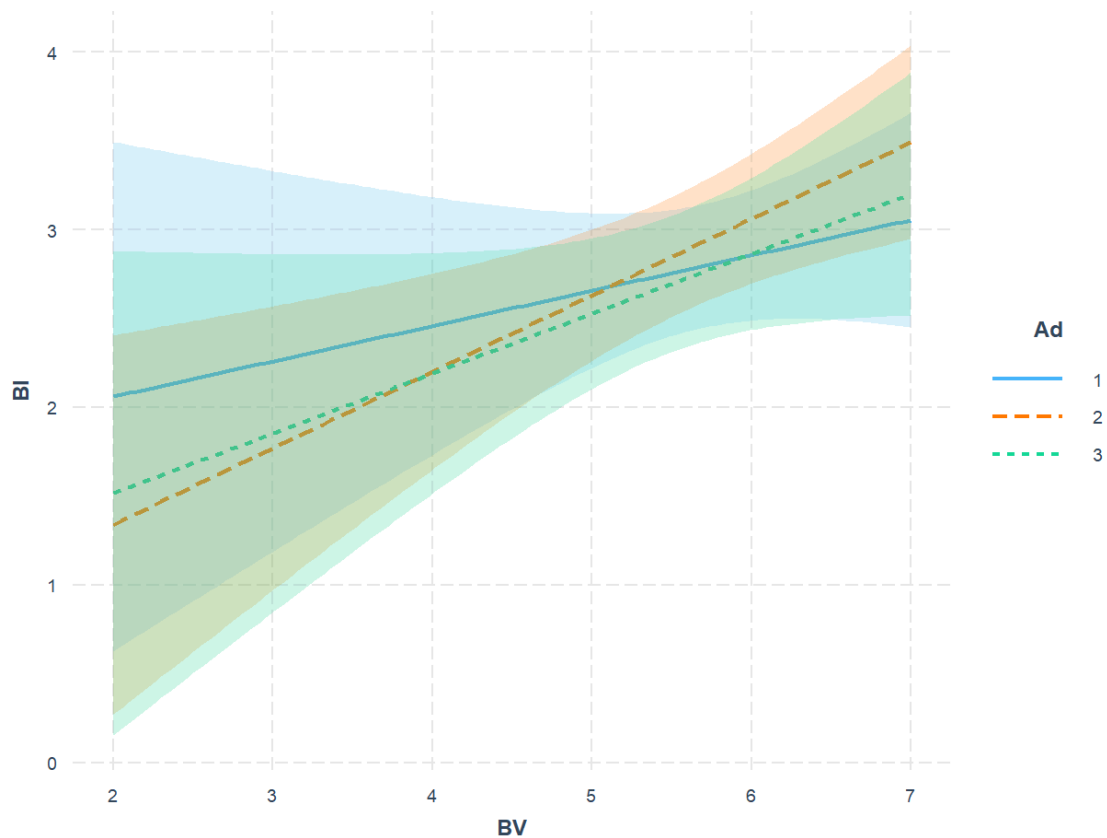
Source: Developed by the authors

Figure A17 - Slope analysis of the interaction of the message version (Ad1 = altruistic version, Ad2 = egoistic version, Ad3 = control version) in the relationship between altruistic values (AV) and behavior intention (BI) for the wild boar case in Spain.



Source: Developed by the authors

Figure 18 - Slope analysis of the interaction of the message version (Ad1 = altruistic version, Ad2 = egoistic version, Ad3 = control version) in the relationship between biospheric values (BV) and behavior intention (BI) for the wild boar case in Spain.



Source: Developed by the authors

Table A1 - Full questionnaire

Variable	Question	Reference
Individual Values	Please rate the importance of the following values as a guiding principle in your life. Answer each question according to a scale from 1 (Not importante for my values) to 7 (Extremely important for my values). Please, avoid considering more than two values as being extremely important.	De Groot and Steg (2008)
	Social power: control over others, dominance 1 = Not important to my values	De Groot and Steg (2008)

2 = Hardly important to my values
3 = Little important to my values
4 = Somehow important to my values
5 = Important to my values
6 = Very important to my values
7 = Extremely important to my values

Wealth: material possessions, money

1 = Not important to my values
2 = Hardly important to my values
3 = Little important to my values
4 = Somehow important to my values
5 = Important to my values
6 = Very important to my values
7 = Extremely important to my values

De Groot and Steg (2008)

Authority: the right to lead or command

1 = Not important to my values
2 = Hardly important to my values
3 = Little important to my values
4 = Somehow important to my values
5 = Important to my values
6 = Very important to my values
7 = Extremely important to my values

De Groot and Steg (2008)

Influential: having an impact on people and events

1 = Not important to my values
2 = Hardly important to my values
3 = Little important to my values
4 = Somehow important to my values
5 = Important to my values

De Groot and Steg (2008)

6 = Very important to my values
7 = Extremely important to my values

Ambitious: hard-working, aspiring

1 = Not important to my values
2 = Hardly important to my values
3 = Little important to my values
4 = Somehow important to my values
5 = Important to my values
6 = Very important to my values
7 = Extremely important to my values

De Groot and Steg (2008)

Equality: equal opportunity for all

1 = Not important to my values
2 = Hardly important to my values
3 = Little important to my values
4 = Somehow important to my values
5 = Important to my values
6 = Very important to my values
7 = Extremely important to my values

De Groot and Steg (2008)

A world at peace: free of war and conflict

1 = Not important to my values
2 = Hardly important to my values
3 = Little important to my values
4 = Somehow important to my values
5 = Important to my values
6 = Very important to my values
7 = Extremely important to my values

De Groot and Steg (2008)

Social justice: correcting injustice, care for the weak

De Groot and Steg (2008)

1 = Not important to my values
2 = Hardly important to my values
3 = Little important to my values
4 = Somehow important to my values
5 = Important to my values
6 = Very important to my values
7 = Extremely important to my values

Helpful: working for the welfare of others

1 = Not important to my values
2 = Hardly important to my values
3 = Little important to my values
4 = Somehow important to my values
5 = Important to my values
6 = Very important to my values
7 = Extremely important to my values

De Groot and Steg (2008)

Preventing pollution:
protecting natural resources

1 = Not important to my values
2 = Hardly important to my values
3 = Little important to my values
4 = Somehow important to my values
5 = Important to my values
6 = Very important to my values
7 = Extremely important to my values

De Groot and Steg (2008)

Respecting the Earth:
Harmony with other species

1 = Not important to my values
2 = Hardly important to my values
3 = Little important to my values
4 = Somehow important to my values

De Groot and Steg (2008)

	5 = Important to my values 6 = Very important to my values 7 = Extremely important to my values
	Unity with nature: fitting into nature 1 = Not important to my values 2 = Hardly important to my values 3 = Little important to my values 4 = Somehow important to my values 5 = Important to my values 6 = Very important to my values 7 = Extremely important to my values
	Protecting the environment: preserving nature 1 = Not important to my values 2 = Hardly important to my values 3 = Little important to my values 4 = Somehow important to my values 5 = Important to my values 6 = Very important to my values 7 = Extremely important to my values
Advertisement	Next you are going to see one piece of communication, followed by a link that you can check if you want (not mandatory to conclude your answer) and a few questions about the advertisement. [advertisement image] <i>Link to the website</i>
Questions about the marmoset/wild boar	Have you ever fed a marmoset/wild boar? 1 = Yes

	2 = No	
	Have you ever had any problem with marmosets/wild boars?	
	1 = Yes	
	2 = No	
	Have you ever heard of any negative issue related to the marmoset/wild boar?	
	1 = Yes	
	2 = No	
	Please, rate the credibility in the advertisement that you have just seen based on a scale from 1 (Completely disagree) to 7 (Completely agree)	MacKenzie and Lutz (1989)
	The allegations presented in this ad are true	
	1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	MacKenzie and Lutz (1989)
Advertisement Credibility	This ad is unbiased	
	1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	MacKenzie and Lutz (1989)
	I believe the claims presented in this ad	
	1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	MacKenzie and Lutz (1989)
Attitude toward the ad	Please, rate it aspect of the advertisement that you have	MacKenzie and Lutz (1989)

	just seen based on the presented the scale	
	In a scale from 1 (bad) to 7 (good) what do you think of the advertising	
	1 = bad 2 = 3 = 4 = 5 = 6 = 7 = good	MacKenzie and Lutz (1989)
	In a scale from 1 (unpleasant) to 7 (pleasant) what do you think of the advertising	
	1 = unpleasant 2 = 3 = 4 = 5 = 6 = 7 = pleasant	MacKenzie and Lutz (1989)
	In a scale from 1 (unfavorable) to 7 (favorable) what do you think of the advertising	
	1 = unfavorable 2 = 3 = 4 = 5 = 6 = 7 = favorable	MacKenzie and Lutz (1989)
Behavior intention	Please, rate the probability that you would engage in one of the following behaviors in the future using a scale from 1 (Totally unlikely) to 7 (Totally unlikely)	Markle (2013) and Kaiser and Wilson (2004)
	In the future, how likely are you to talk to your college friends about how to properly interact with marmosets? / In the future, how likely are you to talk to your college friends about not feeding wild boars or to properly manage food waste?	Markle (2013) and Kaiser and Wilson (2004)
	1 = Totally unlikely 2 = Partially unlikely 3 = Somewhat unlikely	

Socio demographic questionnaire		4 = Neither unlikely, nor likely 5 = Somewhat likely 6 = Partially likely 7 = Totally likely	Markle (2013) and Kaiser and Wilson (2004)
		In the future, how likely are you to talk to your friends outside university about how to properly interact with marmosets? / In the future, how likely are you to talk to your friends outside university about not feeding wild boars or to properly manage food waste?	
		1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	
		In the future, how likely are you to talk to your family about how to properly interact with marmosets? / In the future, how likely are you to talk to your family about not feeding wild boars or to properly manage food waste?	
		1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	
Socio demographic questionnaire		How old are you?	
		What is your gender?	
		1 = Female 2 = Male 3 = I do not identify as female nor male 4 = I prefer not to answer	
		How would you describe yourself?	
		1 = White 2 = Black 3 = Pardo (Brazilian connotation for multiracial individuals)	

4 = Indigene (Indigenous person) 5 = Yellow (East asians) 6 = I prefer not to answer
What is the amount of money you can spend each month (shopping, food, housing, etc)
Do you currently live with your parents?
1 = Yes 2 = No
What course are you currently enrolled in?
Which semester are you currently enrolled in? (in case you are not in an specific semester, try to inform to most close to it)
Have you done or begun another undergraduate course before the current one? 1 = Yes 2 = No
In case yes, which one?

APPENDIX 2 - Questionnaire from Article 3

Table A2 - Full questionnaire

APPENDIX 3 - Questionnaire from Article 4

Table A4 - Questions from the article's 4 questionnaire

Construct	Items	Adapted from
General capabilities	How often does your health in any way limit your daily activities, compared to most people of your age?	
	1 = Never	
	2 = Rarely, in less than 10% of the time	Luiz (2022); Simon et al. (2013)
	3 = Occasionally, in about 30% of the time	
	4 = Sometimes, in about 50% of the time	
	5 = Frequently, in about 70% of the time	
	6 = Almost always, in about 90% of the time	
	7 = Always	
	How often are you able to meet socially with friends or relatives?	
	1 = Never	
General capabilities	2 = Rarely, in less than 10% of the time	Luiz (2022); Simon et al. (2013)
	3 = Occasionally, in about 30% of the time	
	4 = Sometimes, in about 50% of the time	
	5 = Frequently, in about 70% of the time	
	6 = Almost always, in about 90% of the time	
	7 = Always	
	In the past 4 weeks, how often have you lost sleep over worry?	
	1 = Never	
	2 = Rarely, in less than 10% of the time	Luiz (2022); Simon et al. (2013)
	3 = Occasionally, in about 30% of the time	
	4 = Sometimes, in about 50% of the time	
	5 = Frequently, in about 70% of the time	
	6 = Almost always, in about 90% of the time	
	7 = Always	
General capabilities	In the past 4 weeks, how often have you been able to enjoy your recreational activities?	
	1 = Never	
	2 = Rarely, in less than 10% of the time	Luiz (2022); Simon et al. (2013)
	3 = Occasionally, in about 30% of the time	
	4 = Sometimes, in about 50% of the time	
	5 = Frequently, in about 70% of the time	
	6 = Almost always, in about 90% of the time	
	7 = Always	
	How suitable is your accommodation for your current needs?	
	1 = Totally unsuitable	
General capabilities	2 = Partially unsuitable	Luiz (2022); Simon et al. (2013)
	3 = Somewhat unsuitable	
	4 = Neither unsuitable nor suitable	
	5 = Somewhat suitable	
	6 = Partially suitable	
	7 = Totally suitable	
	Please indicate how safe you feel walking alone in the area near your home:	Luiz (2022); Simon et al. (2013)

1 = Totally unsafe 2 = Partially unsafe 3 = Somewhat unsafe 4 = Neither unsafe nor safe 5 = Somewhat safe 6 = Partially safe 7 = Totally safe	
Please indicate how likely you believe it to be that you will be assaulted in the future (including sexual and domestic assault):	
1 = Totally unlikely 2 = Partially unlikely 3 = Somewhat unlikely 4 = Neither unlikely, nor likely 5 = Somewhat likely 6 = Partially likely 7 = Totally likely	Luiz (2022); Simon et al. (2013)
How likely do you think it is that you will experience discrimination (including discrimination for your race, religion, gender, sexual orientation, age, or health/disability)?	
1 = Totally unlikely 2 = Partially unlikely 3 = Somewhat unlikely 4 = Neither unlikely, nor likely 5 = Somewhat likely 6 = Partially likely 7 = Totally likely	Luiz (2022); Simon et al. (2013)
I am able to influence decisions affecting my local area.	
1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Luiz (2022); Simon et al. (2013)
If I want, I can express my opinions without constraints, such as my political and religious opinions	
1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Luiz (2022); Simon et al. (2013)
In my life, I have many opportunities to be in contact with nature.	
1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Luiz (2022); Simon et al. (2013)
I respect, value and appreciate people around me.	Luiz (2022); Simon et

		al. (2013)
	1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	
	I find it easy to enjoy the love, care and support of my family and friends.	
	1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Luiz (2022); Simon et al. (2013)
	I am free to decide for myself how to live my life.	
	1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Luiz (2022); Simon et al. (2013)
	I have opportunities to use my imagination and to express myself creatively (e.g., through art, literature, music, etc.).	
	1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Luiz (2022); Simon et al. (2013)
	I have access to interesting forms of activity (or employment).	
	1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Luiz (2022); Simon et al. (2013)
	My biological and physical needs are fulfilled (Human needs CAP)	
Capabilities related to biological and physical human needs	1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Self-developed
Capabilities	I have autonomy to develop myself in the areas that I desire (Human agency CAP)	Self-developed

related to fundamental interests of a human agent	1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	
Capabilities related to fundamental interests of a social being	I am integrated into society as much as I would like (Social being CAP) 1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Self-developed
	I try to act in a pro-environmental way as much as I can (General PEB1) 1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Obery and Bangert (2017)
General PEB	When I have the chance to make a more environmentally-friendly choice, I tend to do so (General PEB2) 1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Self-developed
	I do things to help conserve the environment (General PEB3) 1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Obery and Bangert (2017)
	I always think about how my actions affect the environment before doing them (General PEB4) 1 = Totally disagree 2 = Partially disagree 3 = Somewhat disagree 4 = Neither disagree, nor agree 5 = Somewhat agree 6 = Partially agree 7 = Totally agree	Obery and Bangert (2017)

Household Waste and recycling	How often do you use returnable shopping bags? (Household waste PEB1)	
	1 = Never	
	2 = Rarely, in less than 10% of the time	Kaiser and Wilson
	3 = Occasionally, in about 30% of the time	(2004)
	4 = Sometimes, in about 50% of the time	
	5 = Frequently, in about 70% of the time	
	6 = Almost always, in about 90% of the time	
	7 = Always	
	How often do you separate used paper for recycling? (Household waste PEB2)	
	1 = Never	
	2 = Rarely, in less than 10% of the time	Kaiser and Wilson
	3 = Occasionally, in about 30% of the time	(2004)
	4 = Sometimes, in about 50% of the time	
	5 = Frequently, in about 70% of the time	
	6 = Almost always, in about 90% of the time	
	7 = Always	
	How often do you bring empty bottles to a recycling bin? (Household waste PEB3)	
	1 = Never	
	2 = Rarely, in less than 10% of the time	Kaiser and Wilson
	3 = Occasionally, in about 30% of the time	(2004)
	4 = Sometimes, in about 50% of the time	
	5 = Frequently, in about 70% of the time	
	6 = Almost always, in about 90% of the time	
	7 = Always	
	How often do you avoid buying single-use items? (Household waste PEB4)	
	1 = Never	
	2 = Rarely, in less than 10% of the time	Ribeiro-Rodrigues et
	3 = Occasionally, in about 30% of the time	al. (2021)
	4 = Sometimes, in about 50% of the time	
	5 = Frequently, in about 70% of the time	
	6 = Almost always, in about 90% of the time	
	7 = Always	
	How often do you buy products in bulk or with minimal packaging? (Household waste PEB5)	
	1 = Never	
	2 = Rarely, in less than 10% of the time	Ribeiro-Rodrigues et
	3 = Occasionally, in about 30% of the time	al. (2021)
	4 = Sometimes, in about 50% of the time	
	5 = Frequently, in about 70% of the time	
	6 = Almost always, in about 90% of the time	
	7 = Always	
	How often do you put dead batteries in the garbage? (Household waste PEB6)	
	1 = Never	Kaiser and Wilson
	2 = Rarely, in less than 10% of the time	(2004)
	3 = Occasionally, in about 30% of the time	
	4 = Sometimes, in about 50% of the time	

	5 = Frequently, in about 70% of the time 6 = Almost always, in about 90% of the time 7 = Always	
	How often do you reuse plastic or glass packaging, such as jelly jars? (Household waste PEB7) 1 = Never 2 = Rarely, in less than 10% of the time 3 = Occasionally, in about 30% of the time 4 = Sometimes, in about 50% of the time 5 = Frequently, in about 70% of the time 6 = Almost always, in about 90% of the time 7 = Always	Ribeiro-Rodrigues et al. (2021)
	How often do you buy products that have reusable packaging? (Household waste PEB8) 1 = Never 2 = Rarely, in less than 10% of the time 3 = Occasionally, in about 30% of the time 4 = Sometimes, in about 50% of the time 5 = Frequently, in about 70% of the time 6 = Almost always, in about 90% of the time 7 = Always	Ribeiro-Rodrigues et al. (2021)
	How often do you boycott companies with an unecological background? (Citizenship PEB1) 1 = Never 2 = Rarely, in less than 10% of the time 3 = Occasionally, in about 30% of the time 4 = Sometimes, in about 50% of the time 5 = Frequently, in about 70% of the time 6 = Almost always, in about 90% of the time 7 = Always	Kaiser and Wilson (2004), and Markle (2013)
Environmental citizenship	How often do you talk to others about their environmental behavior? (Citizenship PEB2) 1 = Never 2 = Rarely, in less than 10% of the time 3 = Occasionally, in about 30% of the time 4 = Sometimes, in about 50% of the time 5 = Frequently, in about 70% of the time 6 = Almost always, in about 90% of the time 7 = Always	Kaiser and Wilson (2004), and Markle (2013)
	How frequently do you read or watch television programs, movies, or internet videos about environmental issues? (Citizenship PEB3) 1 = Never 2 = Rarely, in less than 10% of the time 3 = Occasionally, in about 30% of the time 4 = Sometimes, in about 50% of the time 5 = Frequently, in about 70% of the time 6 = Almost always, in about 90% of the time 7 = Always	Kaiser and Wilson (2004), and Markle (2013)
	How often do you contribute money to an environmental, conservation, or wildlife protection group? (Citizenship PEB4) 1 = Never	Kaiser and Wilson (2004), and Markle (2013)

-
- 2 = Rarely, in less than 10% of the time
 - 3 = Occasionally, in about 30% of the time
 - 4 = Sometimes, in about 50% of the time
 - 5 = Frequently, in about 70% of the time
 - 6 = Almost always, in about 90% of the time
 - 7 = Always
-

How often do you buy organically grown fruits and vegetables?
(Citizenship PEB5)

- 1 = Never
 - 2 = Rarely, in less than 10% of the time
 - 3 = Occasionally, in about 30% of the time
 - 4 = Sometimes, in about 50% of the time
 - 5 = Frequently, in about 70% of the time
 - 6 = Almost always, in about 90% of the time
 - 7 = Always
-

Kaiser and Wilson
(2004),
and Markle (2013)

How often do you buy food or products with eco-labels?
(Citizenship PEB6)

- 1 = Never
 - 2 = Rarely, in less than 10% of the time
 - 3 = Occasionally, in about 30% of the time
 - 4 = Sometimes, in about 50% of the time
 - 5 = Frequently, in about 70% of the time
 - 6 = Almost always, in about 90% of the time
 - 7 = Always
-

Ribeiro-Rodrigues et
al. (2021)

Figure A13 - Scatterplot of the relationship between the composite index created with the capabilities dimensions questionnaire and the Oxford capabilities questionnaire-Mental Health (OxCAP-MH)

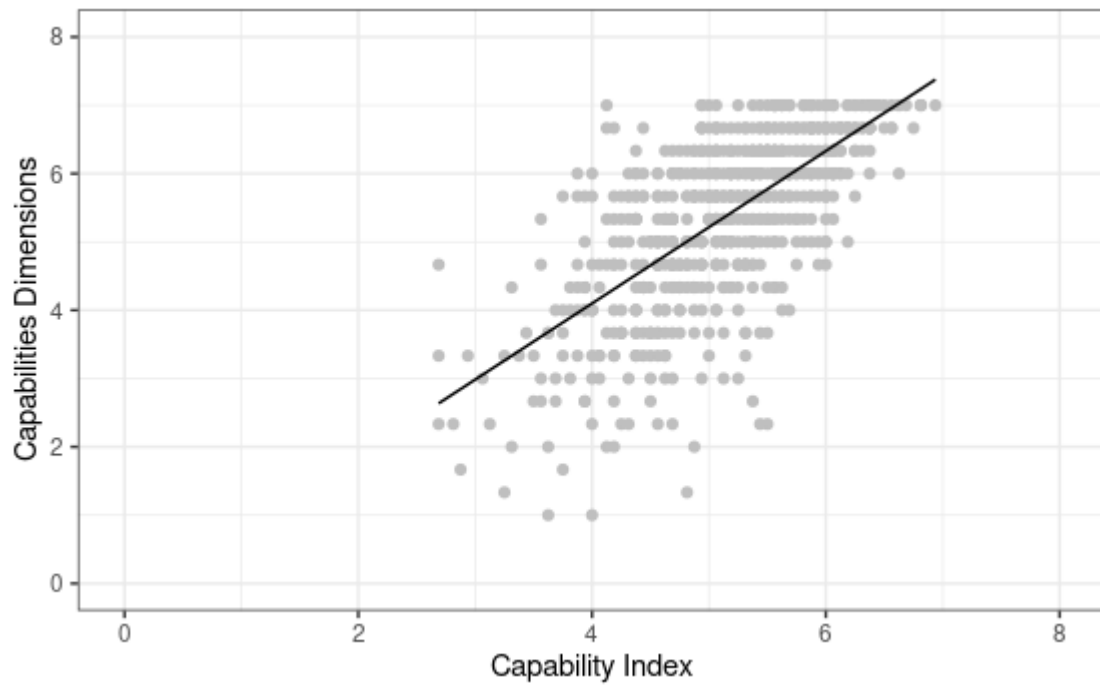


Figure A14 - Scatterplot of the relationship between the composite index created with the capabilities dimensions questionnaire and the Quality of Life

