Gamified environmental interpretation as a strategy for improving tourist behavior in support of sustainable tourism: The moderating role of psychological distance

Dolores M. Frías-Jamilena, M. Lina Fernández-Ruano, Ana I. Polo-Peña *

Dpt. Marketing and Market Research, University of Granada, Granada, Spain

ABSTRACT

This study aims to identify whether gamified environmental interpretation may contribute to improving the sustainability of tourist destinations. It seeks to establish whether gamified environmental interpretation exerts a greater effect on tourists, in terms of their pro-environmental knowledge, attitude, and behavior, than a non-gamified version; whether these variables are affected by the psychological distance; and whether psychological distance moderates the effect of environmental interpretation (gamified vs. non-gamified) on the tourist. Using a quasi-experimental design, a gamified vs. non-gamified environmental interpretation experience is manipulated and the comparative results analyzed. The results show that the effect of environmental interpretation on tourists differs according to psychological distance; this effect is more marked when the participant perceives the destination to be near. However, in the case of gamified environmental interpretation, regulatory construal fit is detected, which intensifies the effect on pro-environmental knowledge, attitude, and behavior among those for whom the psychological distance is greater.

1. Introduction

Environmental sustainability is a key factor for destination competitiveness (Pulido-Fernández, Cárdenas-García, & Espinosa-Pulido, 2019) and it helps stimulate continued touristic activity (Scott, Hall, & Gössling, 2019). Researchers and professionals in the sector continue to search for solutions and strategies that may contribute to mitigating the negative effects of tourists' interaction with the chosen destination (Becken, Whittlesea, Loehr, & Scott, 2020; Hall, 2019). A key option that can help alleviate these negative effects is a change in tourist behavior, toward more environmentally-aware conduct (Dolnicar, 2020; Juvan & Dolnicar, 2017).

Environmental interpretation is one strategy that has been shown to be effective in promoting pro-environmental behaviors (Ardoin, Wheaton, Bowers, Hunt, & Durham, 2015). Environmental interpretation has been linked to a possible improvement in participants' responses on three levels: cognitive, affective, and behavioral (Roberts, Mearns, & Edwards, 2014; Weiler & Ham, 2010). However, the results of the environmental interpretations analyzed in the literature have shown that they do not consistently deliver the desired effect (Ardoin et al.,

2015; Lee, Jan, & Chen, 2021), perhaps because there are so many influences that shape pro-environmental tourist conduct (Gössling, 2018a; Wicker & Becken, 2013). A better understanding of the factors that may play a role in the impact and effectiveness of interpretation activities is thus required (Ballantyne, Hughes, Lee, Packer, & Sneddon, 2021; Powell, Vezeau, Stern, Moore, & Wright, 2018). The present study therefore seeks to contribute to our understanding of some of these factors.

Among other factors, design considerations and, related to these, the particular characteristics of the target public both influence the impact of any environmental interpretation endeavor (Powell, Kellert, & Ham, 2009). Regarding the design dimension, information and communications technologies (ICTs) hold the potential for highly-engaging formats that can prove enriching and supportive of sustainable development. One such example is gamification, which can be offered at different stages of the tourist stay (Gössling, 2021). The literature has raised certain doubts regarding just how useful gamification may be in terms of stimulating the adoption of pro-environmental behaviors (e.g., Aguiar-Castillo; Rufo-Torres, Saa-Pérez and Pérez-Jiménez, 2018). But there are also studies that suggest it may be effective in encouraging

* Corresponding author. Dpt. Marketing and Market Research, University of Granada, Faculty of Economics and Business Administration, Campus Cartuja, s/n, 18071, Granada, Spain.
   E-mail addresses: dfrias@ugr.es (D.M. Frías-Jamilena), linaf@correo.ugr.es (M.L. Fernández-Ruano), apolo@ugr.es, ftorres@ugr.es (A.I. Polo-Peña).

change toward more environmentally-aware behaviors (Douglas & Brauer, 2021; Gössling, 2018b; Johnson, Horton, Mulcahy, & Foth, 2017; Ouariachi, Li, & Elving, 2020) because it can directly enhance the visitor experience (Xu, Buhalis, & Weber, 2017). This indicates that gamification may be a suitable strategy for improving environmental interpretation results. A participatory experience can be elevated by gamification so that it proves truly motivating and enjoyable for the individual (Huotari & Hamari, 2012, 2017). Furthermore, applying gamification to environmental interpretation—following the systematic design specifications recommended by the literature and taking into account the participants' perspective on the experience or its effects on their behavior—contributes to addressing the gaps of interest identified by the literature.

Turning to the characteristics of the target public, here it is important to consider that a destination is visited by both domestic and international tourists, each of whom will feel a different sense of connection to that destination. With regard to how tourists *experience* environmental interpretation, psychological distance is a critical variable that shapes and differentiates their preferences (Le, Scott, & Wang, 2021; Trope, Liberman, & Wakslak, 2007). This means that, under identical circumstances, a stimulus that is perceived to be psychologically near leads to a more positive response than one perceived to be psychologically distant. In the tourism context, for example, the literature identifies that psychological distance influences variables associated with pro-environmental behavior, such as intention to adopt pro-environmental behavior, pro-environmental attitude, environmental threat perception, or commitment to the environment (Chang, Zhang, & Xie, 2015; Jones, Hine, & Marks, 2017).

Among the approaches that can contribute to destination sustainability, then, is to identify strategies that can trigger a change in tourist behavior toward more environmentally-aware conduct (Dolnicar, 2020; Juvan & Dolnicar, 2017). Taking into account the gaps detected in the literature on this question, the aim of the present study is to contribute to improving the sustainability of a destination using gamified environmental interpretation to enhance pro-environmental knowledge, attitude, and behavior among tourists. In addition, the moderating effect of the tourist's psychological distance from the destination is tested. The study endeavors to determine whether a *gamified* environmental interpretation experience has a greater effect on the participant's pro-environmental knowledge, attitude, and behavior than a non-gamified version; whether these three variables are influenced by the participant's perception of the destination, in terms of its psychological distance or nearness; and whether psychological distance moderates the effect of (gamified vs. non-gamified) environmental interpretation on these three variables.

This paper is organized as follows. First, we present the conceptual framework and a review of the relevant literature that supports the proposed hypotheses, regarding the effect of *gamified* environmental interpretation on participants' pro-environmental knowledge, attitude, and behavior; the moderating effect of psychological distance; and regulatory construal fit. We then describe the quasi-experiment undertaken, analyze its results, and discuss their implications in terms of testing the research hypotheses. Finally, we discuss our conclusions and the managerial implications of the findings, along with the limitations of the study and potential directions for future research.

2. Literature review

2.1. Environmental interpretation and its impact on tourist behavior in support of sustainable tourism

Sustainability is positioned as a primary factor in destination competitiveness, a joint vision embracing all economic, social, and environmental variables must be adopted to achieve a symbiosis between tourism and sustainability (Pulido-Fernández et al., 2019).

To help alleviate these negative consequences and work toward a more sustainable tourism sector, UNWTO (2017) notes that a change in policies, business practices, and tourist behavior can contribute to the sustainable development of countries. On the question of how to change tourist behavior, previous research points to the use of an informational strategy geared to enhancing the knowledge and attitude of recipients and, in turn, modifying their behaviors (Delmas, Fischlein and Asensio, 2013). Information-provision is one of the most widely-used strategies (Abrahamse & Matthies, 2018). For example, informational strategies may constitute an important element in the implementation of structural strategies such as legal regulations (Steg & Vlek, 2009).

However, information alone is not enough to change behavior. It needs to be accompanied by a solid justification so that the behavioral change occurs effectively and is maintained over time, and this can be achieved in an educational context (Lehman & Geller, 2004). Fernández and Ramos (2015) observe that environmental education "consists of that which is aimed at resolving concrete problems. It means that individuals … clearly perceive the problems hindering individual and collective well-being, identify their causes and determine the means of resolving them". Yet, despite the importance of environmental education, there has been little research on the impact that tourist knowledge may have on the environmental sustainability of destinations, with the exception of some studies dealing with the use of environmental interpretation (Gössling, 2018a).

Ham (1992) defines environmental interpretation as the translation of the technical language of a natural science or related area into terms and ideas that non-scientists can easily understand, delivered in a way that is entertaining and interesting for participants. According to this author, it aims to blend entertainment with the conservation of the resources of the natural environment.

Environmental interpretation can be an effective strategy for encouraging tourists to adopt behaviors that contribute to a destination's sustainability objectives (Lee, 2009). Although the use of environmental interpretation continues to predominate in relation to protected areas and other natural areas, it is beginning to be applied in other contexts that also need to be conserved and environmentally respected (Ardoin et al., 2015; Coghlan & Kim, 2012). For example, it has been used to educate tourists on the protection of the general environment, fauna, and wildlife in zoos and aquariums (Ballantyne et al., 2021; Ballantyne, Hughes, Lee, Packer, & Sneddon, 2018), on a cruise expedition (Walker & Moscardo, 2014), in a coastal area rich in geological resources (Kim, 2012), in maritime settings (Ballantyne, Packer, & Falk, 2011; Hofman, Walters, & Hughes, 2021), in nature parks and national parks (Powell et al., 2018; Xu, Cui, Ballantyne, & Packer, 2013), and in an eco-resort (Lee et al., 2021), among other contexts.

Environmental interpretation offers many advantages compared to other environmental sustainability strategies (Moscardo & Benckendorff, 2015). For example, while its primary purpose is to contribute to the protection of the environment by encouraging more pro-environmental behavior among visitors, it also has the capacity to improve the participants' experience, increasing their satisfaction and enjoyment (Huang, Weiler, & Assaker, 2015). These factors render environmental interpretation an ideal approach for the tourism sector.

To measure the effectiveness of environmental interpretation in terms of fulfilling its purpose, scholars have turned to the Theory of Planned Behavior (Ajzen, 1985) according to which attitudes are mental dispositions to respond favorably or unfavorably to an object or event and are determined by salient beliefs about that object, as knowledge might influence these beliefs and attitudes and, in turn, intentions and behaviors (Jacobs & Harms, 2014). Based on this, attention has primarily been paid to analyzing the effects of interpretive tools on pro-environmental knowledge and attitudes (Derrien & Stokowski, 2017). Thus, the literature establishes a relationship between the three variables, such that improved knowledge of environmental conservation issues would contribute to a positive attitude toward the environment that could subsequently lead to behavior modification (Powell et al.,

2018; Wang, Zhang, Yu, & Hu, 2018). This link is well established in the literature (Bradley, Waliczek, & Zajicek, 1999; Gao, Mattila, & Lee, 2016).

However, although previous studies have shown that interpretation is a highly effective tool for enhancing tourists' environmental knowledge, pro-environmental attitudes, and environmental behaviors (Ardoin et al., 2015; Ballantyne et al., 2011; Cheung & Fok, 2014; Coghlan, Ruth Fox, Prideaux, & Lück, 2011; Powell & Ham, 2008), the research results have not always been able to verify its positive impact (Ardoin et al., 2015; Lee et al., 2021). The literature indicates that this may be due to the fact that there are so many factors that can affect pro-environmental behavior (Gössling, 2018a; Wicker and Becken (2013), which calls for a deeper understanding of the factors that may intervene in the effectiveness of this tool (Ballantyne et al., 2021; Powell et al., 2018).

Complementing prior research, this study therefore aims to specifically explore the effects of the design of environmental interpretation, on the one hand, and the characteristics of the tourist on cognitive, affective, and behavioral results, on the other. Hence, in the present study, we opted to analyze one particular characteristic of environmental interpretation—namely, the format, comparing a gamified vs. a non-gamified version. This distinction is important, given that environmental interpretation needs to generate certain psychological effects in order to be impactful: participant enjoyment, autonomy, competence, and relatedness. The combined achievement of these effects is what gives rise to a so-called "gameful experience" (Huotari & Hamari, 2012, 2017). Such an environmental interpretation experiences that trigger emotions are more effective at stimulating pro-environmental intentions as it triggers emotions, as demonstrated in the studies conducted by Jacobs and Harms (2014) and Hofman et al. (2021), and/or enjoyment (Powell & Ham, 2008). In line with these previous contributions, it is of interest to investigate further the effect that a gameful experience may achieve among participants.

The literature points to the use of ICTs to build gamification into the design of the experience (Douglas & Brauer, 2021; Gössling, 2018b; Johnson et al., 2017; Ouariachi et al., 2020). However, the scholarship to date has not considered the use of gamification in environmental interpretation design, how to measure the participant's experience of such an approach, or how it affects tourist behavior. Existing studies touch only briefly on the inclusion of different games in the interpretation experience (Ballantyne et al., 2021) or link game literature and interpretation to theoretical frameworks on gamification (Coghlan & Carter, 2020). Furthermore, when it comes to designing effective interpretive materials, a comprehensive understanding of participants is essential, since information about the target audience needs to inform all design decisions if the interpretation is to truly connect the visitor to a given location or experience (Xu et al., 2013). In line with other research that finds that the results of environmental interpretation are influenced by various characteristics of tourists (Ballantyne et al., 2011, 2021; Xu et al., 2013), it is therefore important to look into the psychological antecedents of the results of environmental interpretation. To approach this, we took into account how perceived psychological distance affects knowledge, attitude, and behaviors. The aim here is to contribute to a behavioral model for sustainable tourism development.

Scholars agree that psychological distance plays a significant role in individuals' evaluation and decision-making mechanisms and that it can have a major impact on their behavior (Lee et al., 2021; Trope et al., 2007). On this premise, it is also likely that the design of the environmental interpretation experience needs to be sensitive to the different perceptions of distance that tourists from different cultures and countries will bring—that is, the design needs to be adapted to fit the target audience if it is to be effective. This perspective—the impact of environmental interpretation experiences on pro-environmental consumer behavior, taking into account the psychological distance of the target audience from the destination—has not been analyzed in the literature to date.

Addressing these lacunae, the present research a) creates a *gamified* environmental interpretation experience using ICTs to design specific features and b) analyzes the role of psychological distance in tourists' response to the interpretation experience.

2.2. The effect of gamified environmental interpretation on tourists

The earliest academic research to deal with the concept of gamification was published in 2011. The purely systemic perspective originally taken by scholars was later criticized by some authors for its omission of the participant experience or the 'gameful' experience (Huotari & Hamari, 2017). It is now acknowledged that the experiential aspect of games—the end-user perspective—must be taken into account when measuring the effectiveness of gamification. Researchers are now also beginning to examine the effects of gamification in spheres such as sustainable tourism, where it may help to reduce the environmental harm caused by tourists to the destination, through the use of games designed to incentivize the desired environmentally-friendly behavior while, simultaneously, enhancing visitors' enjoyment of their holiday (Dolnicar, 2020).

However, how the gamification is perceived (and, therefore, its effectiveness) may be influenced by the characteristics of the participants themselves, such as age (Polo-Peña, Frías-Jamilena, & Fernández-Ruano, 2020) or experience with games (Landers & Armstrong, 2017), among others. Perceptions of the gamification may also be shaped by participants' experience in the context of application (Koivisto & Hamari, 2019), in this case, the context of sustainability and, more specifically, the search for more sustainable behavior.

Although gamification has proven itself to be beneficial in different spheres (Douglas & Brauer, 2021; Gössling, 2018b; Johnson et al., 2017; Ouariachi et al., 2020), it is not without its critics. Aguiar-Castillo, Rufo-Torres, De Saa-Pérez, and Pérez-Jiménez (2018), for instance, refer to it as "gamipulation"—the manipulation of individuals into displaying pro-environmental behaviors by means of a game—and highlight its abuse of extrinsic motivators and the need for motivation to be intrinsically-driven. Indeed, this criticism and the need to address intrinsic motivations are frequently addressed by the literature (Hanus & Fox, 2015; Luo, 2021, pp. 1–25).

Intrinsic motivations are particularly important in the context of environmental interpretation. According to the model developed by Ham (1992), for such an experience to be successful, it must fulfill four key criteria: it must be enjoyable, relevant, organized, and thematic (captured in the mnemonic "EROT"). Ham (2013) subsequently modified the sequence of this model, shifting from EROT to TORE—that is, putting the theme first and then ensuring this is organized into impactful sub-themes. In this way, Ham emphasized the importance of engaging participants with a strong theme embedded within the interpretation experience, as this fosters a positive effect on positive effect on their behaviors. Gamification can make interpretation fun (Kim & Hall, 2019) and, what is more, it can also—if it generates an intrinsically-motivating experience—render it more relevant, as it will deepen the participants' commitment and make their motivation last longer (Xu et al., 2017).

While achieving a gameful experience is considered essential for the design and use of gamification features (Hamari, Koivisto and Sarsa, 2014), there is no consensus on its dimensions, nor on how to measure it (Eppmann, Bekk and Klein, 2018; Huotari & Hamari, 2017). However, there is concordance between some authors' work on measurement scales, such as Eppmann, Bekk, and Klein (2018) and Liu, Wang, Huang, and Tang (2019), who concur that a specific dimension to capture participants' enjoyment is essential. Liu et al. (2019) also note that gamification should stimulate the intrinsic motivation of participants if it is to be considered a truly gameful experience.

Intrinsic motivation is determined by three basic psychological needs—autonomy, competence, and relatedness—according to Self-Determination Theory, which is commonly used in gamification research (Seaborn & Fels, 2015). When these needs are satisfied, the

subject's intrinsic motivation increases (Deci & Ryan, 1985). Autonomy refers to the sense of being able to choose whether or not to perform a task and to choose how to go about it (Burgers, Eden, Van Engelenburg, & Buningh, 2015); competence refers to the feeling of possessing the ability to perform the task and achieve objectives (Xu et al., 2017); and relatedness refers to the desire to feel connected to other people, with a sense of recognition and acceptance (Koivisto & Hamari, 2019). Hence, participation in a gamified experience can satisfy people's basic needs when that experience is supported by a system of 'affordances'—inherent motivational elements that encourage specific actions among participants.

Enjoyment, in gamification terms, is understood as spontaneity in users' interaction with the gamified system (Hamari & Koivisto, 2015a; Martocchio & Webster, 1992) and the exploratory, creative behaviors that interaction generates (Hamari & Koivisto, 2015a). Enjoyment is important not least because it helps the participant persevere with the longer-term behaviors being encouraged by the gamification experience (Wu & Liu, 2007). It also affects how consumers respond to a product innovation (Aroean, 2012) and heightens their interest in making discoveries and exploring new concepts or products (Hoffman & Novak, 1996).

In short, participation in well-designed gamification has been found to generate a gameful (motivating and enjoyable) experience (Huotari & Hamari, 2017). The positive effects of gamification on environmental sustainability have been proven in terms of the adoption of pro-environmental behaviors (Douglas & Brauer, 2021; Gössling, 2018b; Johnson et al., 2017; Ouariachi et al., 2020). In the sustainable tourism realm, there are studies analyzing the techniques and applications that are most relevant when gamification is used to address a conservation problem in destinations specializing in sustainable tourism (e.g. Souza, Marques, & Veríssimo, 2020). However, in the gamification literature, no studies to date have applied gamification to tourist environmental interpretation in tourist destinations, captured the participant's perspective when measuring the gameful experience, or provided empirical evidence of the possible superior effect of a *gamified* tourist environmental interpretation experience vs. a non-gamified version on the variables pro-environmental knowledge, attitude, and behavior, all of which are essential in achieving environmental sustainability.

In short, gamification can make environmental interpretation more effective, especially if it follows the EROT and TORE frameworks developed by Ham (1992, 2013) which will help generate the psychological outcomes of enjoyment, autonomy, competence, and relatedness. Studying a gamified environmental interpretation from this perspective will enable us to contribute to the literature and advance the understanding of the factors that affect the results of environmental interpretation in terms of the participants' pro-environmental knowledge, attitude, and behavior (Ballantyne et al., 2021; Powell et al., 2018).

In light of the present literature review, a gamified environmental interpretation experience is expected to achieve superior results in terms of these three variables compared to a non-gamified experience. The following hypothesis is therefore proposed:

H1. The effects of environmental interpretation, when gamified, on (a) pro-environmental knowledge, (b) pro-environmental attitude, and (c) pro-environmental behavior are significantly more positive than when it is non-gamified.

2.3. The effect of the tourist's psychological distance

The notion of 'psychological distance' was first used by Lewin (1951) (cited in Van Boven, Kane, McGraw, & Dale, 2010). It has been defined as the "subjective experience that something is close or far away from the self, here, and now" (Trope & Liberman, 2010). Psychological distance is determined by a person's perception of how near or distant a given stimulus—object, place, or event—is from their direct experience. It takes into account temporal distance (*when* that stimulus presents

itself), spatial distance (*where* it presents itself), social distance (in relation to *whom* it presents itself), and hypothetical distance (the probability that it *will* present itself). Even if the stimulus conveys equivalent information to different people, individuals will represent it as psychologically near or distant, depending on the perceived distance from their personal experience (Miao & Mattila, 2013). At the same time, according to Trope and Liberman (2010), the aforementioned dimensions of psychological distance—spatial, temporal, social, and hypothetical—are interrelated, such that whatever influences one dimension can also influence the rest (Bar-Anan, Liberman, Trope, & Algom, 2007; Stephan, Liberman, & Trope, 2010).

The main theoretical basis for the concept of psychological distance is construal level theory, which positions psychological distance as being related to the construction of mental conceptualizations of perceived reality (Liberman & Trope, 2014; Trope, Ledgerwood, Liberman, & Fujita, 2021). Depending on how the individual perceives the stimulus, it will seem safe or uncertain, familiar or strange, similar or different—that is, near or distant. And this psychological distance will significantly influence their decisions and behaviors (Lee et al., 2021).

Previous research indicates that a close psychological distance improves attitude toward environmental issues (Carmi & Kimhi, 2015; Cheng, Ao, Mao, & Xu, 2021; Jones et al., 2017) as well as pro-environmental behavioral intention (Carmi & Kimhi, 2015; Jones et al., 2017; Schill & Shaw, 2016). Psychological distance has been identified as a key factor in purchase decision-making relating to environmentally-friendly products (Chang et al., 2015), perceived risk of climate change (Jones et al., 2017), and perception of environmental threats (Carmi & Kimhi, 2015), among other related issues. Against this backdrop, and considering that one of the foundational principles of interpretation is that it should be tailored to meet different participant profiles (Ballantyne et al., 2021), we expect the effect of an environmental interpretation strategy on pro-environmental knowledge, attitude, and behavior to differ, depending on the psychological distance of the destination (the stimulus), as perceived by the consumer. The following hypothesis is therefore proposed:

H2. Consumers for whom the stimulus is psychologically near will achieve significantly greater (a) pro-environmental knowledge, (b) pro-environmental attitude, and (c) pro-environmental behavior than those for whom it is psychologically distant.

2.4. The moderating effect of psychological distance on the effectiveness of gamified environmental interpretation among tourists

When a good match is achieved between the stimulus and the individual's mindset, this increases the positive effects of environmental interpretation on the adoption of pro-environmental behaviors (Chou & Lien, 2012; Grazzini, Rodrigo, Aiello and Vigilia 2018; Jin & He, 2013; Lee and Oh, 2014). One way to achieve this match is through 'regulatory construal fit', which involves creating a good fit between the individual's regulatory focus and the level at which they construe information (Lee, Keller, & Sternthal, 2010).

According to regulatory focus theory (Higgins, 1997), people will act in pursuit of a goal from one of two focuses, promotion vs. prevention, with each focus being driven by distinct underlying concerns. People with a promotion focus tend to be concerned with progress, growth, and achievements (gains) in the quest to reach their goals, while those with a prevention focus are more concerned with their protection, their safety, and their responsibilities (the avoidance of losses) (Higgins et al., 2001).

Returning to construal level theory, a low-level construal is activated when the stimulus is psychologically near; and, conversely, a high-level construal is activated when it is psychologically distant and thus demanding of a greater cognitive effort (Trope & Liberman, 2010). The different levels are determined by various characteristics (Trope et al., 2021). Individuals for whom the stimulus is psychologically near construe it in a specific, detailed, and subordinate way (a low-level

construal), while those for whom it is psychologically distant will construe it in abstract, general, and superordinate terms (a high-level construal) (Kim, Kim, Kim, & Magnini, 2016; Shin, Chung, Kang, & Koo, 2016; Tan, 2018).

On this premise, regulatory construal fit can be achieved (Lee et al., 2010) when a promotion focus is matched by a high-level construal or a stimulus that is psychologically distant, or when a prevention focus meets a low-level construal or a perception of psychological proximity. There are many studies exploring the connection between construal level theory and regulatory focus theory (Chou & Lien, 2012; Lee & Higgins, 2009; Lee and Oh, 2014; Lermer, Streicher, Sachs, Raue, & Frey, 2015). These works link regulatory focus to the construal level, taking into account the characteristics of the stimuli to which people are exposed. Individuals with a promotion focus will endeavor to ensure success and will mentally construct their goals in an abstract way and in global terms, while those with a prevention focus will seek to avoid setbacks and will represent their goals in specific and localized terms (Aaker & Lee, 2006; Lee & Higgins, 2009). Furthermore, the promotion focus is associated with an ideal vision of oneself (desirability and high-level construal) while the prevention focus is associated with a personal sense of duty or obligation (convenience or feasibility and low-level construal) (Liberman & Trope, 1998).

Regarding the characteristics of the regulatory focus, an environmental interpretation experience with a non-gamified design can be more strongly associated with the 'prevention' focus because such experiences primarily emphasize the costs, losses, or detrimental consequences of failing to take (pro-environmental) action as well as participant safety (Coghlan et al., 2011; Roberts et al., 2014; Tan & Law, 2016). By contrast, a gamified environmental interpretation experience can be more strongly associated with the 'promotion' focus because the reward system inherent in gamification motivates participants to strive toward recompense for the progress they make (Lee & Higgins, 2009). Therefore, it may be that a good regulatory construal fit is achieved among those individuals for whom the destination is psychologically near and who are exposed to a non-gamified version of the environmental interpretation experience and among those for whom it is psychologically distant and who are exposed to a gamified version.

In view of these postulations, it is of value to *jointly* analyze the effect of the design type of the environmental interpretation experience (gamified vs. non-gamified) and of the participant characteristics in terms of their psychological distance from the destination (near vs. distant). A joint examination of the two factors would indicate whether it is possible to achieve a good regulatory construal fit between them. On the basis of this finding, we expect that, if there is a regulatory construal fit between the design type (gamified vs. non-gamified) and the psychological distance of the individual relative to the destination (near vs. distant), this will exert a positive effect on pro-environmental knowledge, attitude, and behavior. An environmental interpretation experience with a gamified design is expected to achieve regulatory construal fit among tourists for whom the destination (stimulus) is psychologically distant. The following hypotheses are therefore proposed:

H3. Psychological distance moderates the effect of environmental interpretation type on pro-environmental knowledge.

H3a. When the stimulus is psychologically distant, the effect on pro-environmental knowledge is greater in the case of a gamified environmental interpretation experience than a non-gamified version.

H4. Psychological distance moderates the effect of environmental interpretation type on pro-environmental attitude.

H4a. When the stimulus is psychologically distant, the effect on pro-environmental attitude is greater in the case of a gamified environmental interpretation experience than a non-gamified version.

H5. Psychological distance moderates the effect of environmental interpretation type on pro-environmental behavior.

H5a. When the stimulus is psychologically distant, the effect on pro-environmental behavior is greater in the case of a gamified environmental interpretation experience than a non-gamified version.

However, when the stimulus is psychologically near, the information and characteristics conveyed by a gamified environmental interpretation experience are fundamentally the same as in any other environmental interpretation. This is because the gamification provides important features that participants who perceive a lesser distance from the stimulus—those with a prevention-focused regulatory orientation—most desire. This is because the gamified design shows them how to fulfill their obligations and emphasizes safety. Equally, the gamified design is also valued by users who present a greater psychological distance—those who are promotion-focused—because participation enables them to fulfill their ideals and emphasizes the quest to achieve certain goals. According to Huotari and Hamari (2012, 2017), a gamified offer comprises a core service plus an enhanced service incorporating affordances that deliver a gameful experience. As the enhanced service supports the core service—not vice-versa—the effect on participants for whom the stimulus is psychologically near will not be affected by the environmental interpretation type (gamified vs. non-gamified) to which they are exposed. Therefore, the following hypotheses are proposed:

H3b. When the stimulus is psychologically near, the effect on pro-environmental knowledge will not be affected by environmental interpretation type.

H4b. When the stimulus is psychologically near, the effect on pro-environmental attitude will not be affected by environmental interpretation type.

H5b. When the stimulus is psychologically near, the effect on pro-environmental behavior will not be affected by environmental interpretation type.

3. Methodology

3.1. Sample and procedure

Spain was selected as the basis of the sample because there are several issues that put the sustainability of the Spanish tourism sector—and its profitability—at risk in the long term (Ministry of Industry, Commerce and Tourism, 2019). It is also one of the destinations most vulnerable to climate change (Scott et al., 2019). These challenges are set against a backdrop of Spain's traditional international popularity as a destination (UNWTO, 2020a,b).

Regarding the sample subjects, first, they had to fulfill two basic criteria to be able to participate in the experiment: to be of legal age and to have never visited Spain before (to ensure there was no possible effect of past experience of the destination on the dependent variable). As the United Kingdom and the United States (US) are representative nationalities for Spain (INE, 2020), the present sample population comprised British and US tourists who were potential first-time visitors to Spain. In line with other studies that deal with more than one nationality, the chosen study population comprised British and American tourists who were potential first-time visitors to Spain (Pike, Pontes, & Kotsi, 2021). Their shared language, English, was the language used in the quasi-experiment (both gamified and non-gamified versions of the environmental interpretation). In terms of building the sample, an external research company was used to recruit the Internet users and ensure sample representativeness for the study.

Potential participants were contacted by email. Those who chose to click on the URL contained in the message were redirected to a secure site where the questionnaires and the experimental stimulus were hosted. The survey procedure comprised three stages. Stage 1: participants were presented with an initial questionnaire relating to their prior image of Spain, their self-perceived level of environmental concern, and

subjective norms. Stage 2: each person was randomly assigned to one of the two treatments (gamified vs. non-gamified multimedia environmental interpretation experience). Stage 3: the participants were exposed to the relevant stimulus, and the minimal exposure time in both treatments was controlled. Finally, in stage 4, they responded to the second questionnaire, which covered the dependent variables, manipulation checks, psychological distance, and socio-demographic variables (gender, age, and employment status).

The fieldwork was conducted in June 2018. The final sample comprised 314 valid subjects; the control group comprised 156 subjects (exposed to the non-gamified version), and the experimental group comprised 158 subjects (exposed to the gamified version). The demographic profile of the sample and the sample distribution were therefore largely aligned with the general profile of British and US tourists (IndexMundi, 2019a,b; Koema, 2018a, 2018b) (see Table 1).

3.2. Quasi-experimental design

The quasi-experiment involved a control group and a post-test measure (Zikmund, 1998). The design was based on one treatment variable (environmental interpretation type), three dependent variables (pro-environmental learning, attitude, and behavior), and one moderating variable (psychological distance). Quasi-experimental designs offer external validity, meaning that the variables can be manipulated in natural settings where this would otherwise be virtually impossible (Zikmund, 1998). Despite their advantages, quasi-experimental designs also present certain limitations. For example, they are more vulnerable to selection biases—that is, the treatment group may differ from the control group in characteristics that are correlated with the results under study, thereby distorting the impact results; and they can also produce some difficulties in terms of how to rule out variables other than the independent variables as explanations for the evidence produced. Every effort was made to overcome this challenge for all the differences observed (see control variables listed in section 3.2.2).

3.2.1. Independent variables

Environmental interpretation type. Two alternative environmental interpretation experiences needed to be created: non-gamified (multimedia format only) (Appendix 1) vs. gamified (multimedia gamification format designed to generate a gameful experience) (Appendix 2). The two versions provided an equivalent *core* environmental interpretation service and shared homogeneous information, word-count, and images (Fig. 1), only differing in their respective design features.

The format selected for the non-gamified version was a multimedia tourism leaflet. This was divided into three sections, one for each of three types of tourism ('Beaches', 'Historical & Cultural Heritage', and 'Natural Resources'). The format for the gamified version was, logically, more interactive. First, participants could select from a menu of avatars to represent them in the game. Next, they were presented with an interactive map of Spain featuring icons representing the aforementioned three types of tourism, and they were able to select the order in which they clicked on the three scenarios to access the information therein. To challenge them to reflect on the content they had just read,

they were presented with three questions and were awarded 5 points for every correct answer (winning up to a maximum of 15 points per tourism type and 45 for the whole game). The minimum exposure time for both treatments, including video, was 4 min 8 s.

Psychological distance. This variable was measured using a survey, which the literature has acknowledged as a valid means to capture motivations and perceptions (Hernández-Ortega, 2018) when such factors (psychological distance, in this case) are not directly observable. All three dimensions—spatial, social, and temporal distance—were measured on a 2-item, 7-point Likert scale (Appendix 3), as previously used by other authors (Chang et al., 2015). The scale presented adequate reliability and validity (Appendix 4), which meant that the mean value of the items could be used. The median was then used as a reference to divide the sample into two groups: one for those participants with a value lower than the median (lesser psychological distance) and one for those presenting a higher value (greater psychological distance). The final split of the resulting four groups was as follows: Non-gamified environmental interpretation—psychologically near; Non-gamified environmental interpretation—psychologically distant; Gamified environmental interpretation—psychologically near; and Gamified environmental interpretation—psychologically distant.

3.2.2. Dependent variable and other variables

The literature review identified that there are measurement scales previously validated by other studies that were appropriate for this context of application. The scales in question were therefore examined to corroborate their suitability and, if necessary, adapt their phrasing (Appendix 3). In all cases, a 7-point Likert scale was used, with the exception of 'prior destination image', for which a 7-point semantic differential scale was selected.

Dependent variables. The dependent variables were pro-environmental knowledge, attitude, and behavior (Appendix 3). For pro-environmental learning, a scale developed by Hamari et al. (2016) was used to measure the learning acquired as a result of the interpretation experience, according to the participant's subjective perception. Pro-environmental attitude was measured on a 7-point scale previously used by Ballantyne et al. (2011). Finally, pro-environmental behavior was measured on the scale developed by Cheung and Fok (2014), which indicates pro-environmental behavioral intention and thus provides an immediate gauge of the effects of the environmental interpretation experience.

Experimental manipulation check. To make sure that the factor manipulation had been correctly performed and test that the gamified environmental interpretation had, indeed, delivered a gameful experience (Perdue & Summers, 1986), a scale was validated to measure this construct that covered both intrinsic motivation and enjoyment. For intrinsic motivation, the scales employed by Lieberoth (2015) were used to measure three dimensions: autonomy, competence, and relatedness. To measure enjoyment, the scale developed by Van der Heijden (2004) and later used by Hamari and Koivisto (2015a) was applied (see Appendix 3).

Control variables. The control variables 'prior destination image', 'environmental concern', and 'subjective norms' (Malhotra, 2010) were used to link the factors manipulated in the experiment to the dependent variable. The three control variables were measured prior to participant exposure to the treatments, as recommended (Keppel, 1991; Kirk, 1995; Perdue & Summers, 1986). Prior destination image was measured using an approach similar to that of other studies (Beerli & Martín, 2004; Frías-Jamilena, Rodríguez-Molina, & Castañeda-García, 2008). To measure participants' environmental concern, a scale previously applied by other authors (Chang et al., 2015) was used. Finally, subjective norms were measured based on the approach taken in previous studies (Hamari & Koivisto, 2015b) (see Appendix 3).

Socio-demographic variables. The socio-demographic variables included in the questionnaire covered gender, age, and employment status, among other factors. Four age intervals and two categories were
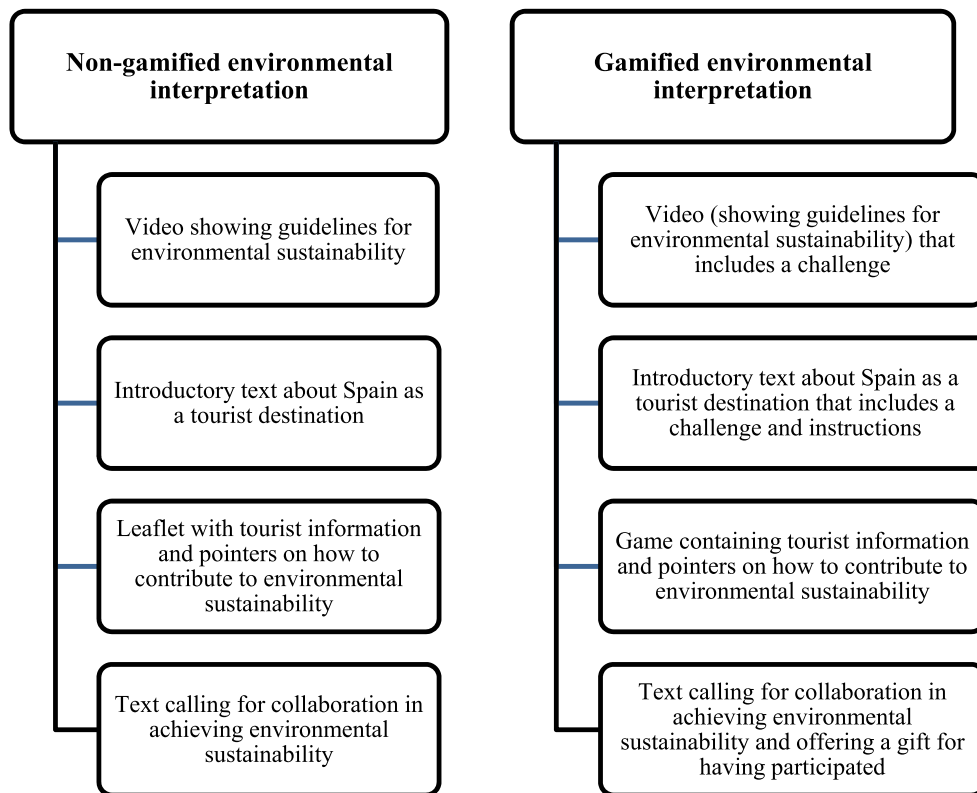
Table 1
Socio-demographic profile of the final sample.

	Non-gamified version	Gamified version	n (%)
Valid subjects	156	158	314
Female	93	91	184 (59%)
Male	63	67	130 (41%)
18–29 years old	25	28	53 (17%)
30–44 years old	34	40	74 (24%)
45–65 years old	61	60	121 (38%)
>65 years old	36	30	66 (21%)
In employment	89	88	177 (57%)
Not in employment	67	70	137 (43%)

Fig. 1. Structure of non-gamified vs. gamified environmental interpretation experience.

created to capture employment status: in employment and not in employment.

4. Results analysis

To test our proposed hypotheses, we conducted a variance analysis (ANOVA) using SPSS V.25 software. In this analysis, pro-environmental learning, attitude, and behavior were the dependent variables, and 'environmental interpretation type' and 'psychological distance' the independent variables. Prior to this, however, we had to check the validity and reliability of the scales and verify that there was no selection bias in the sample.

4.1. Scale reliability

Given that the scales used in the present research presented an acceptable degree of reliability and validity (see Appendix 4), it was decided that the value of each of these variables could be calculated on the basis of the sum value of its items (Hair, Black, Babin, & Anderson, 2009, pp. 126–7).

4.2. Sample selection bias

In quasi-experiments, subjects are not randomly assigned to groups, hence it is essential to ensure that there is no selection bias present (D'Agostino, 1998). To check this, we analyzed association using a set of covariates that, according to the literature, affect environmental interpretation: gender (Ballantyne et al., 2011; Kim, 2012), age (Ballantyne et al., 2011; Kim, 2012), and employment status (Cheung & Fok, 2014). Having performed association tests for the different groups and the covariates (age: $\chi^2 = 7.977$; df = 9; p-value = 0.536; employment: $\chi^2 = 12.038$; df = 18; p-value = 0.845; gender: $\chi^2 = 0.229$; df = 3; p-value = 0.973), we found no evidence of a significant level being reached and, thus, the absence of subject selection bias was confirmed. Further

verifying the results with other, more complex, techniques (Rosenbaum & Rubin, 1984; Zanutto, Lu, & Hornik, 2005) was therefore deemed unnecessary.

4.3. Manipulation check

To check that the manipulated factor produced the desired effects, we performed an ANOVA to compare the means for that factor. The mean differences for gameful experience were significant (M_gamified = 5.01; M_non-gamified = 4.73; p-value ≤0.05).

4.4. Concomitant variables

The effect of the factors on the dependent variable was controlled via the covariates 'prior destination image', 'environmental concern', and 'subjective norms'. The use of covariates is justified if 1) they are related to the dependent variable and 2) they are not related to the independent variables (Kirk, 1995). To verify the first criterion, we calculated the Pearson correlation between each of the three aforementioned variables and the dependent variables (pro-environmental learning, attitude, and behavior). There was a significant correlation in all cases—pro-environmental learning ($r_{image} = 0.396$, p-value ≤ 0.01; $r_{environmental\ concern} = 0.296$, p-value ≤ 0.01; and $r_{subjective\ norms} = 0.380$, p-value ≤ 0.01), pro-environmental attitude ($r_{image} = 0.359$, p-value ≤ 0.01; $r_{environmental\ concern} = 0.270$, p-value ≤ 0.01; and $r_{subjective\ norms} = 0.305$, p-value ≤ 0.01), and pro-environmental behavior ($r_{image} = 0.385$, p-value ≤ 0.01; $r_{environmental\ concern} = 0.278$, p-value ≤ 0.01; and $r_{subjective\ norms} = 0.275$, p-value ≤ 0.01). All the covariates therefore met the first criterion.

To check the second criterion, we performed an ANOVA for each covariate, using the covariate as the dependent variable and the four different groups as the independent variables, thus: Non-gamified—psychologically near; Non-gamified—psychologically distant; Gamified—psychologically near; and Gamified—psychologically distant. For

all three covariates, the results showed a significant relationship between the groups and the covariate (prior image: F = 8.85, p-value $\leq$ 0.00; environmental concern: F = 8.43, p-value $\leq$ 0.00; subjective norms: F = 4.75, p-value $\leq$ 0.00). The second requirement for being included as covariates was therefore not met.

4.5. Testing the hypotheses

In light of these results, we tested our hypotheses using an ANOVA, in which pro-environmental learning, attitude, and behavior were the dependent variables and 'environmental interpretation type' and 'psychological distance' were independent variables.

The main effect of environmental interpretation type on pro-environmental learning, attitude, and behavior (H1a, H1b, and H1c) was significant, the mean for the gamified environmental interpretation experience being greater than for the non-gamified version in all cases (Table 2). For pro-environmental learning, the gamified mean was higher (non-gamified M. = 4.93 vs. gamified M. = 5.34) and the difference between the two was significant (F = 5.90, p-value $\leq$0.01). For pro-environmental attitude, the gamified mean was also higher (non-gamified M. = 4.51 vs. gamified M. = 5.00) and, again, the difference was significant (F = 8.56, p-value $\leq$0.01). Finally, the gamified mean was higher for pro-environmental behavior (non-gamified M. = 4.18 vs. gamified M. = 4.62), the difference between both means being significant once again (F = 6.83, p-value $\leq$0.01). Therefore, there is empirical support for H1a, H1b, and H1c.

The main effect of psychological distance on the dependent variables (H2a, H2b, and H2c) was also significant, with the mean of psychological nearness being greater than that of psychological distance (Table 2). Individuals for whom the stimulus was psychologically near presented higher values for pro-environmental learning (M_near: 5.80; M_distant: 4.55), attitude (M_near: 5.44; M_distant: 4.14), and behavior (M_near: 4.99; M_distant: 3.88), the difference between the two means being significant for pro-environmental learning (F = 65.04, p-value $\leq$0.01), attitude (F = 71.33, p-value $\leq$0.01), and behavior (F = 47.86, p-value $\leq$0.01). Therefore, H2a, H2b, and H2c also obtain empirical support.

Finally, when interpreting the main effects, it is important to note that the interaction between environmental interpretation type and psychological distance is significant (Table 3). As proposed in H4 and H5, the participant's psychological distance moderates the effect of environmental interpretation type on attitude and pro-environmental behavior (p-value $\leq$ 0.01). In contrast, for pro-environmental learning, the interaction effect was not significant (p-value = 0.20), hence H3 received no empirical support. However, according to Wilcox (1987), it is helpful to perform the multiple-comparisons test to determine the differences between-groups that are undetectable with the F test. We conducted Tukey's test for this purpose, and the results indicated that pro-environmental learning was significantly higher among individuals for whom there was greater psychological distance when exposed to a gamified environmental interpretation vs. a non-gamified environmental interpretation (p-value $\leq$0.05), thus providing empirical support for H3a. The same was true in the case of pro-environmental attitude and behavior (p-value $\leq$ 0.01), confirming H4a and H5a. However, in this case, the result of Tukey's test indicated that, when

there is psychological nearness, a gamified environmental interpretation experience does not generate any significant differences in either learning (p-value = 0.91), attitude (p-value = 0.99), or behavior (p-value = 0.97) compared to a non-gamified version. This finding lends support to H3b, H4b, and H5b (Figs. 2–4).

Prior to performing the ANOVA, we ensured that the three fundamental conditions of independence, normality, and homoscedasticity were fulfilled (Ordaz, Melgar and Rubio, 2014). Independence was fulfilled as this was an inter-subject study; according to authors include Uriel (1995) and Hair et al. (2009), the F statistic would not be affected by a lack of normality in samples of a size similar to that of the present study (314 individuals); and homoscedasticity posed no issue, since the groups were approximately the same size (Uriel, 1995).

5. Discussion of results and conclusions

On the basis that the main objective of tourism managers is to maximize the competitiveness of their destinations, environmental sustainability is a key factor (Pulido-Fernández et al., 2019), not least because it is essential for the development of long-term tourism activity (Scott et al., 2019). Furthermore, tourists harm the environment in many different ways (Dolnicar, 2020; Gössling & Peeters, 2015; Juvan & Dolnicar, 2017), even to the extent that they may lead the local population to reject tourism activity altogether (Gössling, McCabe and Chen, 2020), Given the importance of sustainability for the maintenance of tourism activity over the long term, it is equally essential that destinations position sustainability at the center of their strategic focus as a means to achieve greater competitiveness (Gossling et al., 2020; Koens et al., 2020). The objective of this research was therefore to contribute to the literature by providing insights into whether the use of environmental interpretation implemented via ICTs and incorporating a gamified design may constitute an appropriate strategy for achieving improved results in terms of tourist pro-environmental knowledge, attitude, and behavior—all of which are key variables for the environmental sustainability of tourist destinations. The work also sought to determine whether this effect may be moderated by the psychological distance of the tourist.

First, our results indicate that a) environmental interpretation design type exerts a significant effect on pro-environmental learning, attitude, and behavior (as also found in previous studies). That is, the format of the interpretation experience influences the outcomes of that experience (Ardoin et al., 2015); and gamified environmental interpretation yields better results than the non-gamified version in terms of pro-environmental knowledge, attitude, and behavior. This finding is consistent with other studies that demonstrated the positive effect of gamification on pro-environmental behaviors such as recycling, using methods of transport that generate less pollution, and so on (Douglas & Brauer, 2021; Gössling, 2018b; Johnson et al., 2017; Ouariachi et al., 2020). The present results therefore constitute an advancement on the extant literature dealing with the promotion of sustainable tourism in destinations. The results also illuminate gamification from the participant's perspective via the measurement of the gameful experience and its effectiveness in achieving variables that are critical for achieving environmental sustainability of the tourist destination:

Table 2
ANOVA analysis results for Hypotheses 1 and 2.

H	Dependent variable	Sum of squares	Degrees of freedom	Mean squares	F	p-value	Hypothesis: empirical support?
Environmental interpretation type							
H1a	Pro-environmental learning	13.2	1	13.2	5.90	0.01	Yes
H1b	Pro-environmental attitude	18.92	1	18.92	8.56	0.00	Yes
H1c	Pro-environmental behavior	15.46	1	15.46	6.83	0.00	Yes
Psychological distance							
H2a	Pro-environmental learning	122.66	1	122.66	65.04	0.00	Yes
H2b	Pro-environmental attitude	131.74	1	131.74	71.33	0.00	Yes
H2c	Pro-environmental behavior	95.97	1	95.97	47.86	0.00	Yes

Table 3
ANOVA analysis results for Hypotheses 3, 4, and 5.

Interpretation type x psychological distance							
H	Dependent variable	Sum of squares	Degrees of freedom	Mean squares	F	p-value	Hypothesis: empirical support?
H3	Pro-environmental learning	2.98	1	2.98	1.60	0.20	Yes
H4	Pro-environmental attitude	10.14	1	10.14	5.70	0.01	Yes
H5	Pro-environmental behavior	16.89	1	16.89	8.78	0.00	Yes
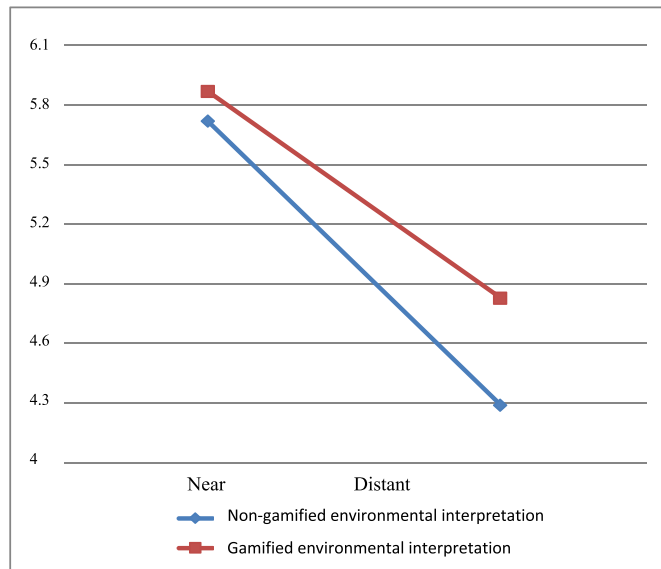
Fig. 2. Interaction effect of environmental interpretation design type and psychological distance on pro-environmental learning.
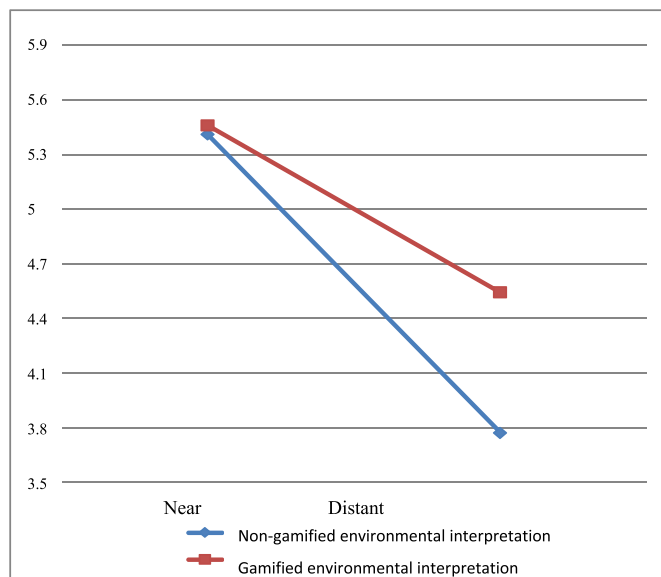
Fig. 3. Interaction effect of environmental interpretation design type and psychological distance on pro-environmental attitude.

pro-environmental learning, attitude, and behavior.

Moreover, the emotional link between gamification and tourists has been demonstrated through their gameful experience or, more specifically, through enjoyment and intrinsic motivations. Enjoyment is an emotional outcome of gamification (Koivisto & Hamari, 2019; Sigala, 2015), and numerous studies demonstrate the importance of emotions in the impact of environmental interpretation (Ballantyne et al., 2011;
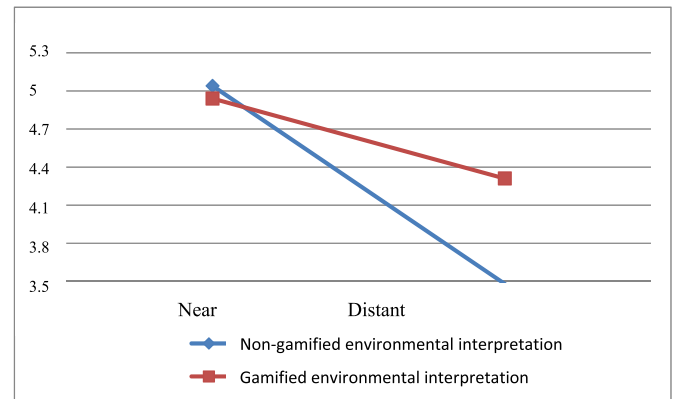
Fig. 4. Interaction effect of environmental interpretation design type and psychological distance on pro-environmental behavior.

Hofman et al., 2021; Jacobs & Harms, 2014). Given that intrinsic motivation comes from within—when an individual performs an activity for the mere satisfaction of performing the activity itself, and there are no external forces affecting their volition—intrinsically-motivated behaviors tend to lead to deep commitment (Hamari & Koivisto, 2015a; Xu et al., 2017). If gamification is successful in eliciting intrinsic motivations, then, pro-environmental behavior will be lasting and will not diminish even in the absence of external stimuli such as fines, rewards, or legal regulations.

Second, the results show that tourists for whom the destination is psychologically distant present inferior results in terms of pro-environmental learning, attitude, and behavior. For this tourist profile, the environmental interpretation experience will be less effective, regardless of design type. These results are in line with those obtained in previous studies that indicate that, in the case of low psychological distance, individuals will adopt a more pro-environmental attitude that will translate into more environmentally-proactive behavior; and, conversely, when there is greater psychological distance, they will consider environmental problems to affect other people or places, or will believe they represent only a remote, future risk (Cheng et al., 2021; Jones et al., 2017; Schill & Shaw, 2016). These results indicate the need to search for more effective strategies, particularly for tourists who present significant psychological distance.

Finally, our results confirm that psychological distance exerts a moderating effect on the relationship between gamification and pro-environmental learning, attitude, and behavior. When the individual presents a greater psychological distance, a gamified environmental interpretation experience generates a markedly greater effect on pro-environmental learning, attitude, and behavior than the non-gamified version. However, when they present psychological nearness, there are no significant differences between the gamified and non-gamified versions in terms of their respective effects on pro-environmental learning, attitude, and behavior. This may be explained by the fact that both types of environmental interpretation provide the same core service (Huotari & Hamari, 2012). This finding confirms the existence of a regulatory construal fit, and we therefore recommend gamification as an effective strategy for targeting tourists for whom the destination is psychologically distant. This is particularly relevant considering that

this collective presented inferior results in pro-environmental learning, attitude, and behavior. Our findings also demonstrate the effectiveness of gamification for both tourist profiles (psychologically near vs. distant). These insights add a valuable dimension to the many extant studies that show the importance of a fit between the stimulus and the individual's mindset (Avnet & Higgins, 2006; Cesario, Higgins, & Scholer, 2008; Chou & Lien, 2012; Grazzini, Rodrigo, Aiello, & Viglia, 2018).

Furthermore, our findings are relevant to the scholarship on gamification, psychological distance, and the possibilities of regulatory construal fit, as our study jointly analyzes the potential of a fit between the factors that shape the environmental interpretation experience (gamified vs. non-gamified) and those affecting the participants (psychologically near vs. distant). This analysis compares a gamified environmental interpretation experience (promotion focus and high construal level) with a non-gamified version (prevention focus and low construal level). Evaluating both scenarios, we achieved a regulatory construal fit that generated superior results for the environmental interpretation experience in terms of its impact on pro-environmental learning, attitude, and behavior. Although other authors have underscored that the effectiveness of one type of interpretation vs. another may be determined by the characteristics of participants, no study, to date, has jointly analyzed the factors that influence the interpretation experience itself (gamified vs. non-gamified) together with those that affect the participants (psychologically near vs. distant) and the potential fit between them.

5.1. Practical implications, limitations, and potential future research directions

From the practical perspective, the present results have several implications for both public entities and private firms operating in the tourism sector. The question of how to improve destination sustainability is now a matter of urgency on a worldwide scale (e.g., European Union, 2021; UNWTO, 2020a,b). This issue is not only relevant in terms of the continued conservation of the natural environment at tourist destinations, but is also essential for destinations to retain their appeal and their ability to attract tourists over the medium–long term.

As one of the fundamental pillars on which destination sustainability rests is tourist behavior (Pulido-Fernández et al., 2019), it is important to identify interventions that can generate positive behavioral change and encourage more pro-environmental conduct at the destination. To do this, those responsible for operations in the sector (such as DMOs and managers of private service-providers) must have effective strategies at their disposal that promote pro-environmental behavior among tourists and, at the same time, are well-suited to the characteristics of the sector and its different publics. The study shows that an environmental interpretation experience delivered via gamified online media may be one such highly effective strategy for increasing the pro-environmental knowledge, attitudes, and behaviors of potential tourists, which will ultimately translate into the improved environmental conservation of the destination.

Environmental interpretation is a strategy that has been harnessed by destinations and firms in the sector for several years, using traditional media. While tour guides play the role of information-source for tourists, as a mediator between tourists and local settings (Gao, Scott, & Ding, 2016), environmental interpretation is known to achieve better results when visitors are able to interact with tour guides (Ballantyne, Packer, & Hughes, 2009; Coghlan & Kim, 2012; Coghlan et al., 2011; Xu et al., 2013). The results of the present study indicate that it is advisable for the sector to use gamification via online media as an even more appealing and novel strategy for implementing environmental interpretation. Gamification enables tourists to explore the destination via an innovative, interactive, and personalized format (Xu et al., 2017). And it makes an even greater impact in the online environment (Hsu, Chen, Yang, & Lin, 2017), which can help mitigate the absence of the human

tour-guides who have always traditionally delivered environmental interpretation (Kim & Hall, 2019). While implementing gamified environmental interpretation is *especially* effective among tourists who perceive the destination to be distant, it is, overall, a highly beneficial and recommendable strategy.

This study also provides key design pointers for gamified environmental interpretation in online media. Destinations, institutions, and firms linked to the sector need to be mindful that gamification should not be approached as a set of mere game-like elements or systemic design features alone (Huotari & Hamari, 2017). We show that the design must take into account the specific objectives the gamification needs to fulfill and the context in which it will be applied, employing the appropriate affordances that enable the user to enjoy a truly gameful experience. It is also essential to determine whether the gamification has performed well in terms of producing the desired effects on the variables in question. The present study demonstrates that, when tourism-sector business owners seek to verify the suitability of the gamification strategy they have implemented, they should first evaluate the variables of intrinsic motivation (autonomy, competence, and relatedness) and enjoyment among their target publics.

The above findings indicate that a gamified environmental interpretation involves identifying and incorporating a carefully-structured combination of elements and changes to traditional environment interpretations. Some of the elements that can be incorporated are (a) posing environmental conservation *challenges* instead of environmental problems, (b) enhancing the user's sense of autonomy by including customization options in the environmental interpretation (such as the choice of personal avatar, specific objectives to be achieved, scenarios, etc., (c) fostering a sense of competition by including options to select the desired level of difficulty, receive continuous feedback on performance, achieve virtual trophies and/or badges, etc., and (d) providing opportunities for interaction with others, such as the option to connect with other participants who share a similar motivation toward environmental conservation, and opportunities to share the gamification via social media or to generate virtual events, etc.

Finally, our results highlight the need for destinations to adapt their market-oriented strategies according to consumers' psychological distance. Destination managers must therefore be mindful of the international nature of tourism and the need to appeal to diverse target audiences that will present different degrees of psychological distance. It is shown here that, the greater this distance, the more the effectiveness of measures designed to promote environmentally-responsible behaviors may be adversely affected. Hence, managers need to identify strategies specifically for reaching those tourists for whom the destination is psychologically distant. In this regard, the use of gamification (in this case, applied to environmental interpretation) has been found to constitute an effective strategy to target tourists who, based on their perceptions, feel psychologically distant from the destination, given its positive impact in terms of achieving greater pro-environmental learning, attitude, and behavior. However, our analysis revealed that gamification can also be effective among tourists for whom the destination is psychologically near, as both gamified and non-gamified versions of the experience were shown to deliver positive results among this group across these three dependent variables. In this case, destination managers can implement either strategy.

5.2. Limitations and future research directions

We now turn to certain limitations of the present study that could point to potential research themes for the future. First, we selected a single tourist destination for our analysis (albeit one that holds a leading position in incoming international tourism). The study could be replicated in different mature tourist destinations, to ascertain whether the use of environmental interpretation remains effective in a different geographical context. In the same vein, it could also be valuable for future studies to use different samples of tourists from other countries

and perhaps compare the effectiveness of the gamified environmental interpretation strategy with respect to domestic tourists.

Second, our study focused exclusively on one particular phase of the tourist experience (the pre-stay), so future research examining other phases (stay and post-stay, for instance) would be of interest as different factors would be at play. Similarly, there may be other influences that affect environmental interpretation and its outcomes, such as cultural differences among tourists.

Third, a quasi-experimental design was adopted in the present study, which made it possible to capture the immediate effect of participation in an environmental interpretation experience on the intention to adopt pro-environmental behaviors. For future research, it would be of interest to adopt other methodologies and approaches to measuring the effects of participation in an environmental interpretation when more time has elapsed and/or based on real behaviors performed by the participants.

Finally, the 'new normal' following the COVID-19 pandemic and its consequences constitute a particularly pertinent focus for scholarly research. In the tourist behavior context, research into behaviors that could help improve perceived destination safety would be extremely relevant, and here the study of the effectiveness of gamified environmental interpretation that is designed to achieve greater adherence to safety-aware conduct among visitors would be of particular interest.

Impact statement

Given the major contribution of the tourism industry to global GDP, coupled with its environmental impact on destinations, the study has important implications for sector professionals, destination marketing organizations (DMOs), the economy, and society.

Based on the results of this research, an environmental interpretation strategy is offered to DMOs, heads of tourism institutions, and tourism service-firm managers. The study provides pointers on achieving a gamified design via online media—the most effective strategy for improving (i) visitors' pro-environmental behaviors, supporting destination sustainability and (ii) long-term destination competitiveness. The proposed approach can also be implemented as a strategy for attracting international visitors, regardless of their psychological distance, meaning that it is ideal for the international tourism context.

Furthermore, the improved sustainability of destinations where tourists adopt pro-environmental behavior will be reflected in greater wealth and wellbeing for residents. This will encourage their harmonious coexistence with tourists, even in highly popular destinations.

Credit author statement

Dolores M. Frías-Jamilena: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – review & editing, Supervision, Project administration, Funding acquisition, Data curation, Visualization. **María Lina Fernández-Ruano:** Conceptualization, Methodology, Software, Formal analysis, Investigation, Data curation, Writing – original draft, Visualization. **Ana I. Polo-Peña:** Conceptualization, Methodology, Software, Formal analysis, Writing – review & editing, Supervision, Formal analysis, Investigation.

Declaration of competing interest

The authors declare that they have no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tourman.2022.104519.

APPENDIX 1

Experimental stimuli: Non-gamified environmental interpretation experience

Video showing guidelines for environmental sustainability: https://www.youtube.com/watch?v=JiOQop7TRwg.

Introductory text about Spain as a tourist destination.

Leaflet with tourist information and pointers on how to contribute to environmental sustainability.

Tourists visiting **Spain** will **find iconic hotels** that tell something of the country's history and exude the essence of its customs and culture. But visitors **can also find** hotels that will provide **an exotic experience** that transports them to another world. Staying at a **hotel is a safe and comfortable option** for tourists, but to minimize any negative impact of tourism on the destination **it's important to follow recommendations on sustainable management of water supplies.**

Encouraging clients to get involved in this effort is a highly effective and successful means for hotels to make a contribution. For example, if hotel clients leave their bath tap running unnecessarily, or if they demand their towels and bed linen be changed too often, this **level of water consumption is not sustainable.** And we all know that this will lead to increasing wastage of this vital resource that is in short supply in certain areas.

Next

Process

Historical and Cultural heritage

Granada's Alhambra is a **World Heritage** Site and the only remaining palatine city from the Islamic era in the world. It houses, among other treasures, the Palace of Charles V; the Royal Palace; the Comares Palace; the Hall of the Kings; the Hall of the Two Sisters; the Courtyard of the Lions; and the Alcazaba fortification. All these features make the Alhambra **one of the most-visited monuments in the world.** To **ensure its safekeeping** and also the **safety and security of its visitors,** certain **areas** have **limited access** and visitors have to follow a schedule of timed visits. Were such measures not taken, future generations would not be able to enjoy this unique gem. Again, **tourists can help** by cooperating fully, for example by **respecting the visiting times** noted on their entry ticket.

Tourism

The Basílica de la Sagrada Família (Basílica of the Holy Family) in Barcelona is an **architectural jewel**, crafted by the genius **Antonio Gaudí.** It is a singularly beautiful construction, known for its outstanding colours and use of light. It is considered a major spiritual centre and is **one of the most-visited** monuments in Spain (indeed, in the world). It is the city's emblem and **one of the features that most impresses visitors.** On the downside, tourists find the **noise level in Barcelona the most negative feature.** In the area surrounding the Sagrada Família, noise pollution is excessive, and the **tourists** themselves **contribute** to the general noise level in the city. If the tourist is not civically-minded and **respectful in their attitude,** for example when visiting **public places,** the noise level will continue to be one of the least favourable aspects of this wonderful city.

The Prado Museum in Madrid is known the world over, and, together with the Thyssen-Bornemisza Museum and the National Reina Sofía Museum, forms the so-called Golden Triangle of Art. Located close by, the three museums, between them, **attract millions of tourists each year.** The Prado houses the best and most extensive collections of painters such as **Velázquez, Goya, and El Bosco.** In addition, it not only employs security measures that **ensure the wellbeing of all its visitors and the safekeeping of its artworks,** but also makes an active **commitment to the environment.** In a pioneering move, it has installed **LED lighting,** which both provides better lighting for the exhibitions and also reduces **CO2 emissions. Tourists** can also **contribute** to such environmental initiatives, for example by carefully **choosing the best mode of transport** for their visit. Unsustainable forms of transport increase CO2 emissions (indeed, they are one of the main causes). Tourists can, however, choose to opt for **public transport** or are even recommended to discover the city by **bike.**

Next

Tourism

Process

Natural Resources

The Pyrenees, the mountain range in the north of Spain, offers an **extraordinary natural setting,** with its **'ibóns'–** glacial mountain lakes. With around 200 such lakes to choose from, visitors can enjoy a number of sporting activities, including, in particular, ice diving. However, **the Pyrenean 'ibóns' are suffering continual damage** as a result of the **actions of humans.** The rubbish that is discarded around the area, or thrown directly into the water, not only presents **a menace for divers** in terms of potential accidents, but also poses a **serious threat to the ecosystem. Safety measures** include a warning not to dive under layers of ice less than 20cm thick, and a request to visitors to take care of this wonderful place and **not leave their rubbish,** as it could be potentially hazardous.

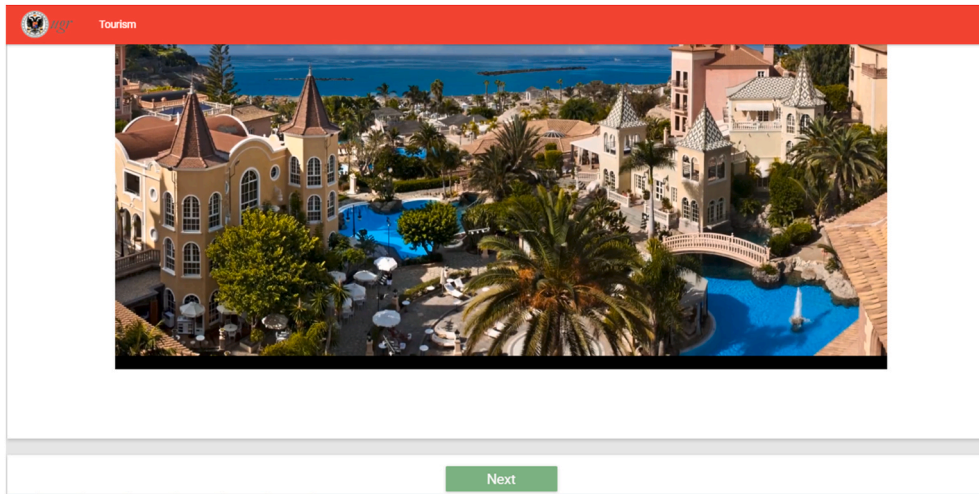Text calling for collaboration in achieving environmental sustainability.

APPENDIX 2

Experimental stimuli: Gamified environmental interpretation experience

Video (showing guidelines for environmental sustainability) that includes a challenge: https://www.youtube.com/watch?v=ZPNAppDYGBE.

Introductory text about Spain as a tourist destination that includes a challenge and instructions, avatar, travel map, and information panel.

Challenge

To ensure Spain as a destination is properly conserved, the participation of tourists is essential. Test your knowledge of sustainability, face the challenge, and become a traveller who is committed to environmental conservation. We need your help!

Instructions

First of all, select your avatar and then look at the map. You can choose 3 scenarios from different games: beaches; historical and cultural heritage; and natural resources. There will be 3 questions for each scenario and you will be awarded 5 points for each correct answer (up to a maximum total of 15 points per scenario). As you play, a badge will be unlocked that shows the level of skill you have acquired: beginner, intermediate, or expert. For example, you will be able to see if you are an environmental expert in beaches, or a beginner. Altogether you can win up to 45 points, and once the game is complete another badge will indicate the level you achieved in the game overall: green tourist, responsible tourist, or fully-committed tourist, depending on whether you achieved 0-15 points, 16-30, or 31-45. If you score in this highest range, you can be proud of being a tourist who is genuinely committed to the environment. You can keep checking your results via your profile, and, when the game is over, you can compare your level with that of other participants, thanks to the final classification table. The best players will receive a prize!

Game containing tourist information and pointers on how to contribute to environmental sustainability.

Tourism · Profile

Scores

Beginner · Intermediate · Expert

Total Score: 0

1 Question

Spain has the highest number of blue-flag beaches in the world – no fewer than 577! The blue flag is an environmental quality standard that certifies, among other factors, water quality, environmental management, beach safety and security, and services and facilities. To maintain this leading status, Spain needs the help of its tourist visitors. One way you can help is by:

> Always using the rubbish bins provided

> Wherever possible, separating glass, paper, and plastic

> Using the rubbish bins provided (but there is no need to separate-out the glass, paper, and plastic items)

> a and b are the correct answers

Tourism · Profile

Scores

Beginner · Intermediate · Expert

Total Score: 0

2 Question

In TripAdvisor's 2015 Travellers' Choice Beach Awards, Formentera's Ses Illetes was crowned the best beach in Spain, the second-best in Europe, and the fifth-best in the world. It was recognized for its crystal-clear waters and its stunning natural landscape. Despite offering a wide range of leisure facilities – from water sports to restaurants and sun-loungers – there is very little built development. This is not the case with other islands, where large-scale construction is problematic for both tourists and locals, causing excessive noise and large volumes of rubbish. How can tourists encourage more sustainable construction?

> By staying only at apartments

> By rewarding those destinations investing in sustainable construction with their business, choosing these destinations for their visit

> Tourists cannot make any such contribution

> None of the above.

Tourism — Profile

Scores

Beginner — Intermediate — Expert

Total Score: 0

3 Question

Tourists visiting Spain will find iconic hotels that tell something of the country's history and exude the essence of its customs and culture. But visitors can also find hotels that will provide an exotic experience that transports them to another world. Staying at a hotel is a safe and comfortable option for tourists, but to minimize any negative impact of tourism on the destination it's important to follow recommendations on sustainable management of water supplies. Encouraging clients to get involved in this effort is a highly effective and successful means for hotels to make a contribution. How can clients ensure their water consumption is sustainable and avoid wasting water – a vital resource that is in short supply?

> By turning off the tap when not in use

> By not demanding their towels be changed unnecessarily

> By not demanding their bed linen be changed, if not strictly needed

> All of the above

Tourism — Profile

Scores

Beginner — Intermediate — Expert

Total Score: 0

1 Question

Granada's Alhambra is a World Heritage Site and the only remaining palatine city from the Islamic era in the world. It houses, among other treasures, the Palace of Charles V; the Royal Palace; the Comares Palace; the Courtyard of the Lions; and the Alcazaba fortification. All these features make the Alhambra one of the most-visited monuments in the world. What guidelines should be followed in order to ensure its safekeeping and also the safety and security of its visitors, so that future generations can continue to enjoy it?

> Set a visiting schedule (but without a time limit, once inside)

> Just place a limit on length of visits

> The tourist must keep to the timings indicated on their entry ticket

> Only public bodies can support its conservation

Tourism   Profile

Beginner   Intermediate   Expert

Total Score: 5

2 Question

The Basílica de la Sagrada Família (Basilica of the Holy Family) in Barcelona is an architectural jewel, crafted by the genius Antonio Gaudí. It is a singularly beautiful construction, known for its outstanding colours and use of light. It is considered a major spiritual centre and is one of the most-visited monuments in Spain (indeed, in the world). It is the city's emblem and one of the features that most impresses visitors. On the downside, tourists find the noise level in Barcelona the most negative feature. In the area surrounding the Sagrada Família, noise pollution is excessive. Given that the tourists themselves contribute to the general noise level in the city, what can they do to reduce the level and thus help ensure that this issue ceases to attract among the worst ratings?

> Speak quietly during their stay in the city

> Be civically-minded and respectful in their attitude when visiting public places

> Not listen to music

> None of the above

Tourism   Profile

Beginner   Intermediate   Expert

Total Score: 10

3 Question

The Prado Museum in Madrid is known the world over, and, together with the Thyssen-Bornemisza Museum and the National Reina Sofia Museum, forms the so-called Golden Triangle of Art. Located close by, the three museums, between them, attract millions of tourists each year. The Prado houses the best and most extensive collections of painters such as Velázquez, Goya and El Bosco. In addition, it not only employs security measures that ensure the wellbeing of all its visitors and the safekeeping of its artworks, but also makes an active commitment to the environment. In a pioneering move, it has installed LED lighting, which both provides better lighting for the exhibitions and also reduces CO_2. How can tourists contribute to this environmental initiative and help reduce CO_2 emissions? Bearing in mind that transport is one of the main causes of carbon emissions, tourists could:

> Travel around the city by bike

> Opt for public transpor

> Take the bus rather than the car

> All of the above

Scores

Beginner | Intermediate | Expert

Total Score: 0

1 Question

The Pyrenees, the mountain range in the north of Spain, offers an extraordinary natural setting, with its 'ibóns' – glacial mountain lakes. With around 200 such lakes to choose from, visitors can enjoy a number of sporting activities, including in particular ice diving. However, the Pyrenean 'ibóns' are suffering continual damage as a result of the actions of humans – actions that can also cause accidents among divers. To reduce the likelihood of such risk, divers are recommended not to dive under layers of ice less than 20cm thick. But, in addition, to protect the wider ecosystem, what should visitors do?

> Avoid discarding rubbish in or around the water

> Use the lakes for fishing

> a and b are both correct

> Discarded rubbish poses no threat of danger to divers

Scores

Beginner | Intermediate | Expert
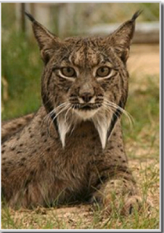
Total Score: 0

2 Question

The Doñana National Park is Europe's largest area of natural biodiversity. It is home to over 300 species of birds and 37 species of mammals, notably the Iberian lynx – considered to be the most at-risk feline species on the planet. It inhabits the few areas that remain well-conserved and at a safe distance from human activity. Its loss of habitat can be attributed to such catastrophes as forest fires or urban development of the natural environment. To avoid putting the habitat of this unique animal at great risk, and to ensure visitor safety, what are the recommendations?

> Other than not making fires, there are no further measures that need to be taken

> Visit the park on foot, using the official pathways

> Varisit the park using authorized vehicles belonging to the specialist companies operating there

> b and c are correct

Text calling for collaboration in achieving environmental sustainability and offering a gift for having participated.

APPENDIX 3

Measurement scales for the variables.

Construct name and source	Indicator	Survey item
Prior destination image (Beerli & Martín, 2004; Frías-Jamilena et al., 2008)	IMAP1	In general, the opinion I have of Spain is: Bad—Good
	IMAP2	In general, the opinion I have of Spain is: Unfavorable—Favorable
	IMAP3	In general, the opinion I have of Spain is: Negative—Positive
	IMAP4	In general, the opinion I have of Spain is that: I don't like it—I like it
Environmental concern (Chang et al., 2015; Kim & Choi, 2005)	ENVC1	I am extremely worried about the state of the world's environment and what it will mean for my future
	ENVC2	Mankind is severely abusing the environment
	ENVC3	When humans interfere with nature, it often produces disastrous consequences
	ENVC4	The balance of nature is very delicate and easily upset
	ENVC5	Humans must live in harmony with nature in order to survive
Subjective norms (Hamari & Koivisto, 2015b)	SUBN1	People who influence my attitudes would recommend treating the environment with respect when I visit a different country
	SUBN2	People who are important to me would think positively of me if I were to treat the environment with respect when I visit a different country
	SUBN3	People whom I appreciate would encourage me to treat the environment with respect when I visit a different country

(*continued on next page*)

(*continued*)

Construct name and source	Indicator	Survey item
	SUBN4	My friends would think my treating the environment with respect when visiting a different country is a good idea
Psychological distance (Chang et al., 2015; Nenkov, 2012)	CDESP1	I felt that the environmental awareness program for visitors was referring to:
		A place far from home—A place close to home
	CDESP2	I felt like I would be traveling to:
		A place far from home—A place close to home
	CDTEM1	I felt that the environmental awareness program for visitors would be relevant to me:
		In the distant future—In the near future
	CDTEM2	I felt that I would take the trip:
		In the distant future—In the near future
	CDSOC1	I felt that the environmental awareness program for visitors:
		Had nothing to do with me—Had everything to do with me
	CDSOC2	I felt that the trip:
		Would be undertaken by someone else—Would be undertaken by me
Autonomy (IMI, 1994; Lieberoth, 2015)	AUT1	I felt that I was doing this activity because I wanted to
	AUT2	I believe I had some choice about doing this activity
	AUT3	I felt like it was my own choice to do this activity
Competence (IMI, 1994; Lieberoth, 2015)	COM1	I think I am pretty good at this activity
	COM2	I think I did pretty well at this activity, compared to other participants
	COM3	After working on this activity for a while, I felt pretty competent
	COM4	I am satisfied with my performance in this task
	COM5	I was pretty skilled at this activity
Relatedness (IMI, 1994; Lieberoth, 2015)	REL1	I had the opportunity to compete and interact with others
	REL2	I felt I had the opportunity to share my experience with others
	REL3	I had the opportunity to share my achievements with others
Enjoyment (Hamari & Koivisto, 2015b; Van der Heijden, 2004)	ENJ1	I found the environmental awareness program for visitors enjoyable
	ENJ2	I found the environmental awareness program for visitors pleasant
	ENJ3	I found the environmental awareness program for visitors exciting
	ENJ4	I found the environmental awareness program for visitors interesting
Pro-environmental learning (Hamari et al., 2016)	PERL1	I felt I learned from the environmental awareness program for visitors
	PERL2	During the environmental awareness program for visitors, my environmental knowledge increased
	PERL3	The environmental awareness program for visitors helped me learn
Pro-environmental attitude (Ballantyne et al., 2011)	CHAN1	The environmental awareness program for visitors has made me more concerned about the well-being of the environment in general
	CHAN2	I feel more strongly about environmental concerns as a result of the environmental awareness program for visitors
	CHAN3	The environmental awareness program for visitors has made environmental issues more meaningful to me
	CHAN4	I have a better understanding of environmental issues because of the environmental awareness program for visitors
	CHAN5	Some of my beliefs have changed as a result of the environmental awareness program for visitors
Pro-environmental behavior (Cheung & Fok, 2014)	PEB1	Now that I have experienced the environmental awareness program for visitors, my lifestyle will change to become more environmentally friendly
	PEB2	Now that I have experienced the environmental awareness program for visitors, I am more concerned with nature and the environment and I will take action to protect it
	PEB3	Now that I have experienced the environmental awareness program for visitors, I will have a preference for environmentally-friendly products and services
	PEB4	Now that I have experienced the environmental awareness program for visitors, I will participate in voluntary work for environmental conservation

APPENDIX 4

Composite Reliability and Average Variance Extracted of the measurement scales.

Variable	Composite Reliability	Average Variance Extracted
Prior destination image	0.97	0.89
Environmental concern	0.94	0.74
Subjective norms	0.93	0.78
Autonomy	0.93	0.82
Competence	0.95	0.78
Relatedness	0.93	0.82
Enjoyment	0.95	0.84
Pro-environmental learning	0.96	0.89
Pro-environmental attitude	0.95	0.82
Pro-environmental behavior	0.91	0.77
Goodness-of-fit of the model: Global fit of the model: Normed chi-square = 2.12, RMSEA = 0.08; Incremental fit: CFI = 0.90, IFI = 0.90, TLI = 0.90.		

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María Lina Fernández-Ruano is working on his PhD in Tourism Marketing at the University of Granada. She obtained the Master in Economics Research at Spanish National University of Distance Education (UNED) and the Degree in Business Administration at the University of Granada. Hers research interests include hospitality marketing, online marketing strategies, gamification and branding.

Dolores M. Frías-Jamilena is a professor in the Department of Marketing and Market Research at the University of Granada. Her research interests are in the areas of online consumer behavioral, tourism and cross-cultural research. She has published in Tourism Management, Annals of Tourism Research, Journal of Travel Research, Journal of Destination Marketing & Management, Journal of Sustainable Tourism, International Journal of Hospitality Management, Cornell Hospitality Quartely, Psychology & Marketing, Journal Small Business Management, Electronic Markets, Internet Research, Online Information Review, and other scholarly journals.
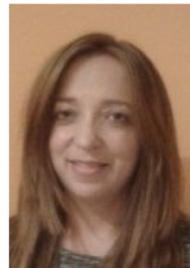
Ana I. Polo-Peña is a senior lecturer in the Department of Marketing and Market Research at the University of Granada. Her research interests are in the areas of consumer behavior, tourist marketing and rural tourism. She has published in Journal of Travel Research, Journal of Sustainable Tourism, Journal Small Business Management, Entrepreneurship and Regional Development, The Services Industries Journal, International Journal of Hospitality Management and other scholarly journals.