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Gamification and proenvironmental performance: could tourists return home with more sustainable habits?

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Abstract

Purpose – This study aims to demonstrate that gamification applied to an environmental behavior can create a habit. For this, it is necessary to determine the connection between traveler satisfaction and the different kinds of stimulus (extrinsic, intrinsic and internalized extrinsic).

Design/methodology/approach – Survey data was gathered from gamers invited to answer a questionnaire after using an app in field experimentation in pilot cities in France, Spain and Portugal designated by the UrbanWaste committee (European Project). All data were studied using path equation modeling in AMOS software to test the study's dimensions and proposed research model.

Findings – This study showed that, although gamification tools may be necessary to generate a habit in the first phase, these tools are superfluous when this habit is internalized.

Originality/value – This study's originality lies in the relationship between traveler satisfaction with gamification and the generation of an environmental practice that also contributes to forming a positive image of the host destination.

Keywords Motivation, Habit cycle, Destination reputation, Altruism

Paper type Research paper

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游戏化与环保行为表现：游客能否带着更环保的行为习惯回家？

摘要

研究目的 – 本研究旨在证明游戏化在环境行为中的应用可促使环保习惯的形成。因此，了解游客满意度和不同种类刺激（外在的、内在的和内化的外在的）的关系十分重要。

研究设计/方法/途径 – 在UrbanWaste委员会（欧洲项目）指定的法国、西班牙和葡萄牙的试点城市进行现场实验后，研究小组从受邀答题的玩家中收集调查数据。所有数据都使用Amos软件中的路径方程建模进行研究，以此来测试研究的维度和先前提出的研究模型。

研究发现 – 本研究表明，尽管游戏化工具可能在第一阶段是形成环保习惯所必需的，但当这种习惯被内化时，这些游戏化工具是多余的。

研究原创性/价值 – 本研究的独创性在于了解游客游戏化满意度与环保行为产生的关系。这种环保行为同时有助于景区建立正面积极的形象。

关键词 动机，习惯周期，景区声誉，利他主义

文章类型 研究型论文

Introduction

Waste management is an essential factor in the sustainability of a tourism destination and directly affects the visitor's perception of the destination. In places with collaborative accommodation, the visitor must collaborate directly with waste collection assistance (Mendes *et al.*, 2013). In this sense, the need to know the area's waste management policies can affect tourists' recycling behavior (RB) and using gamification to motivate this behavior can be helpful (Gaggi *et al.*, 2020; Souza *et al.*, 2020).

In the frame of The European project UrbanWaste (2016-2019) [1], IDeTIC developed a gamified mobile application (WasteApp) to stimulate RB in visitors to tourist cities with high seasonality, concluding that it managed to encourage RB and improve the reputation of the destination when implemented (Guillen *et al.*, 2021; Aguiar-Castillo *et al.*, 2019).

This paper is structured as follows. First, some ideas on sustainability and tourism are presented. Next, the connection between user satisfaction (US) and the habit cycle is raised. Under this heading, some notions about the application that gave rise to this study, WasteApp, are given. Subsequently, the whole theory of the habit cycle is presented. Then, the habit cycle model proposal in its first phase is made. The research methodology, data analysis and results continue. Considering the proposed model's results, a new model that explains that the sample is in a more advanced phase of the cycle is conducted. Finally, in the discussion and conclusion section, some theoretical implications are presented, including a definition of gamification for a sustainable environment, implications for practitioners, limitations and future studies.

Gamification and sustainable tourism

Sustainable destinations should be self-sustaining and immersed in the process of permanent evolution. Therefore, visitors must be encouraged to adopt environmentally friendly behavioral habits. Gamification can assist in motivating and retaining tourists, and it can help visitors to see beyond their well-being and take action to achieve the destination's sustainability goals. Gamification techniques can boost the feeling of altruism. Tourists develop this behavior because they receive benefits in return. They do well for humanity in a purely altruistic sense and obtain what is helpful for themselves, an impure altruistic feeling, such as presenting a good image to their contacts (Gandullia *et al.*, 2021).

Gamification makes people accept behavior change and helps educate citizens about sustainability and biodiversity (Wee and Choong, 2019; Ali *et al.*, 2020). On the other hand, Negruşa *et al.* (2015) claimed that gamification could raise visitors' awareness of resource

use and expenditure and indoctrinate them into responsible spending habits. The main objective of this study is to promote the adoption of new habits and increase destination reputation (DR) through traveler satisfaction and commitment to the destination itself. According to these researchers, the intrinsic incentives from gamification provide them with self-esteem and social recognition and extrinsic incentives support intrinsic incentives.

On the other hand, status rewards have the most significant effect in the future and are the most appreciated by users, and recognition, appreciation and prosocial incentives are the most valued rewards (Paharia, 2013; Zichermann and Linder, 2013). Recognition and appreciation can be reciprocated with feedback through badges and levels and social interaction with peer recognition.

User satisfaction and habit cycle

This research has been founded on the self-determination theory (SDT) (Ryan and Deci, 2017). SDT states that humans are inclined toward cooperative and altruistic behaviors without social factors thwarting such tendencies. People are more inclined to assimilate prosocial values and standards when autonomously motivated. Thus, gamification has fostered sensible and moral behavior toward the environment (Negruşa *et al.*, 2015).

Furthermore, although tourists support sustainable practices, their proenvironmental conduct while traveling, in general, could enhance. The reason could be that individuals, during their trip, relax their behavior and they do not want to feel the burden of daily duties. Therefore, it is difficult to dissuade them from actions perceived as obligations (Negruşa *et al.*, 2015). Hence, the relevance of introducing stimuli that guide tourists to discover and use the recycling spots. The WasteApp application was developed with this intention.

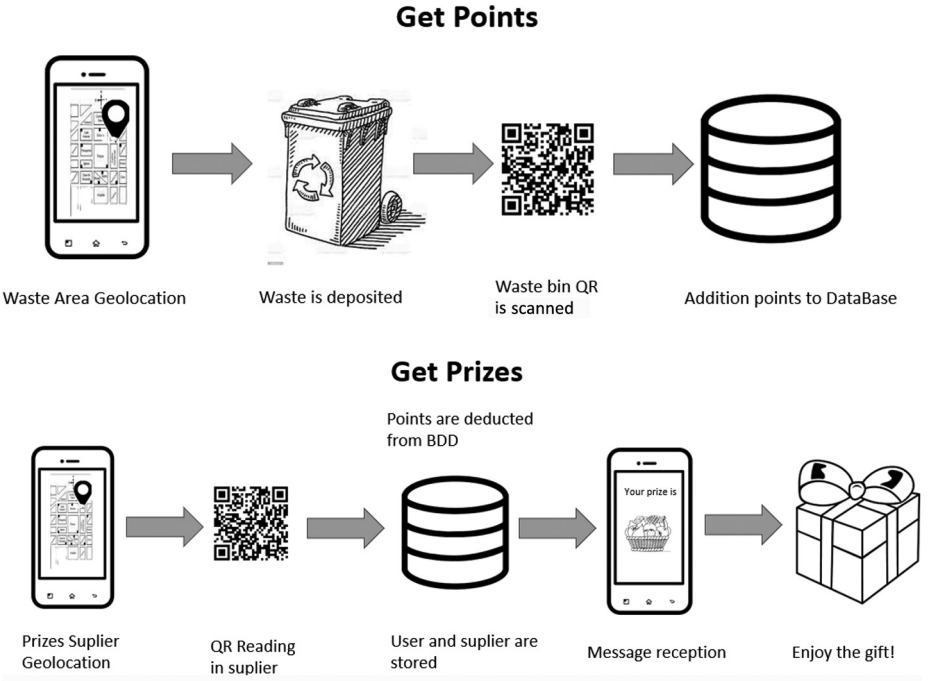
WasteApp

WasteApp is a mobile application informing travelers about European cities' waste areas. In addition, it was used to promote local businesses offering prizes. A design based on gamification strategies was followed. The process was based on the acquisition of points redeemable for prizes in the pilot cities of the UrbanWaste consortium (2016). Points were obtained by decoding QR codes attached to the recycling bins and disseminating the observations on social media with the hashtag UrbanWaste. The bins were geolocated and presented on the app via a map. Once users earned enough points, they located the prize they wanted in the app, went to the provider's location, scanned a QR code, received a validation message, showed it to the provider and received their prize (Figure 1).

The application was designed using the Mechanics, Dynamics and esthetics paradigm (Hunicke *et al.*, 2004). The design was based on the implementation of layers. The first layer (Mechanics) deals with algorithmic developments and their relation to the data structure. The second (Dynamics layer) uses the Mechanics layer and interacts with the internal system of the game. Finally, the Aesthetics layer refers to the sensations and emotions that the game arouses in the player. In this case, the objectives focus on the implicit reward of contributing to the sustainability of the place visited, the scoring of points and the physical reward achieved.

The application was designed to run on most distributed operating systems. The feelings evoked in the user ranged from usefulness and challenge to social and ecological awareness. The mechanisms implemented in the application included information on waste collection on an interactive map, QR codes on waste bins to earn points, a list of prizes for each city and eco-tips after reading the QR code.

In terms of security, privacy was ensured because the app did not ask for personal data to avoid problems and to comply with national and European data protection rules.



Source: Authors own creation

Figure 1. Operation of wasteapp

The application was used by 3,325 tourist visitors in the pilot cities. The Portuguese cities Lisbon and Punta Delgada, with 1,817 downloads, used it the most; Santander and Tenerife followed with 497; and in Florence and Syracuse, 353 visitors downloaded it (Aguiar-Castillo *et al.*, 2018).

After using WasteApp

After studying the opinion of users (Aguiar-Castillo *et al.*, 2019), it is revealed that, according to the basic principles of TAM, it is concluded that the ease of use and the perceived usefulness (PU) of the application positively and significantly influence US. Nevertheless, ease of use indirectly affects satisfaction via PU (Kim and Chang, 2007).

On the other hand, what is expected from awards is to positively affect the PU but not the behavior pursued by the app. This result could be explained because these rewards should enable the internalization of extrinsic motivation. In other words, the awards should promote the destination's ecology or be sensed as relevant to travelers involved in sustainability. Additionally, this factor negatively affects US with the application. Tourists who downloaded the application feel that the physical rewards are contrary to their conscience, and that is, they have intrinsic motivation (Ryan and Deci, 2017; Werbach and Hunter, 2012).

Outcomes show that US and RB emerge from advising the application. It may be because tourists assume the application as support for proenvironmental behavior and want to show their behavior to their acquaintances and friends to show a benevolent aspect of themselves.

Finally, the destination's image will benefit from the behavior promoted and originated using WasteApp (Figure 2) (Aguiar-Castillo *et al.*, 2019).

Habit cycle

A relevant result of the work was to find a link between tourists' satisfaction and the generation of behavioral habits. The more pleased the travelers are and the more they like to advise the application, the more recycling conduct is encouraged. It has been found that the satisfaction-promoted behavior association occurs repeatedly. On the one hand, gamification strategies cause the visitor to a state of flow that induces him to replicate proenvironmental conducts (intrinsic motivation); that is to say, a pattern is generated. This flow state is compatible with US and proenvironmental behaviors because of the close relationship between both constructs (Ghani and Deshpande, 1994). US comes from the extrinsic motivators produced by gamification that give the traveler feedback on the development of their behaviors, consolidating the promoted conduct and increasing the self-confidence that causes tourists to like to exhibit their recycling conduct to their contacts. Likewise, gaming tools increase tourist satisfaction when they are regularly notified of their advancement; constant feedback is transferred to them regarding the goals they are accomplishing. This fact fosters the sense of high individual execution that supports recycling conduct (Park and Kim, 2003); thus, an internalized extrinsic motivation is created. The individual understands these external stimuli as self-regulating elements instead of external obligations. This self-regulation looks so much like internal motivation that it resembles it. This fact is added that the repetition of the behavior, in this case of recycling, ensures future maintenance when the gamification tools disappear (extrinsic motivation). Thus, self-regulation triggered by internalized extrinsic motivation makes reward superfluous over time (von Krogh *et al.*, 2012).

On the other hand, it has been established that the repetition of behaviors is transformed into new habits. If this repetition is significant, travelers commit to the habit, even without gamification strategies (Phillips and Gardner, 2016). This long-run behavior modification will only occur if people repeatedly perform a proenvironmental behavior and internalize it (Judah *et al.*, 2013). Finally, the traveler maintains the demeanor without the need for stimuli. The final success is because of the satisfaction with the application that emanates from the mixture of tourist motivations. The consequence is a good habit for tourists who show a good image to their contacts, improving the destination's image. The final objective of the study would be for the fostered conduct to evolve into a habit to be maintained over time by internalizing extrinsic motivation (Figure 3).

Proposed habit cycle model

Starting from the previous model, formerly tested (Aguiar-Castillo *et al.*, 2019), a new model is proposed to explain the habit cycle within smart tourism. First, the negative relationship

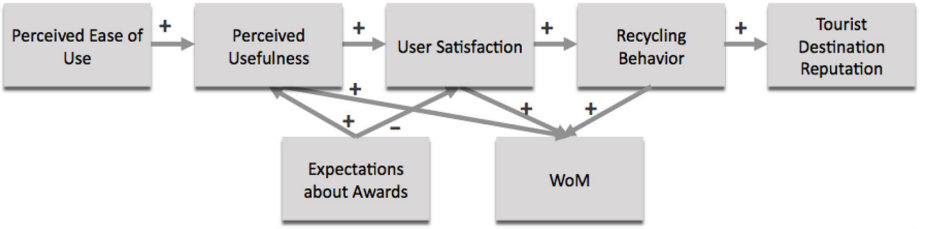
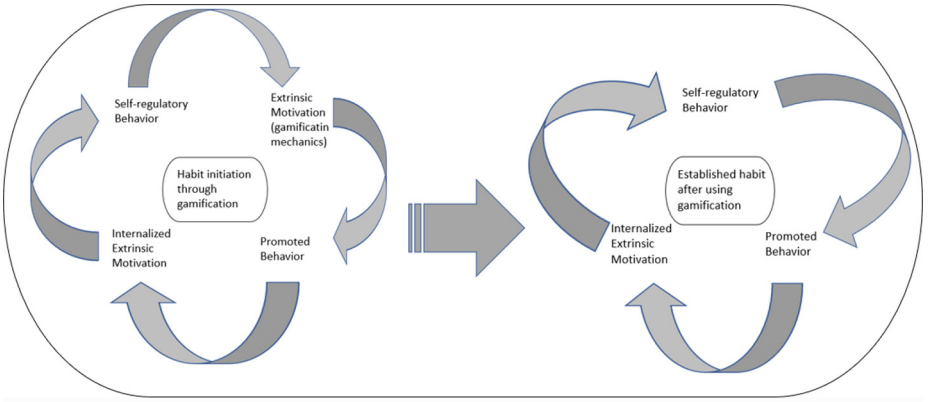


Figure 2.
Results of operating wasteapp

Source: Authors own creation



Source: Authors own creation

Figure 3.
Habit cycle

between the expected rewards and US can be because the reward must be perceived as beneficial for RB and, therefore, improving the tourist's self-esteem. This process would correspond to the traveler's self-regulatory behavior and the expectations about rewards with extrinsic motivation (*H1* and *H2* of the model). The approach focuses on the desire of people to make their behavior visible, spread these private behaviors, such as recycling practices, and give a good image to their contacts, who would otherwise go unnoticed. In the area of sustainability, it has been demonstrated that the recognizability of personal conduct simulates the "intention to recommend" (WoM) (Salvi, 2015).

The improvement in social status may be one of the reasons for recommending the application. The recycling conduct emanates from the user's satisfaction. It produces a sense of altruism that drives the individual to advise the application as a sort of exhibition in the presence of companions and contacts (Kim *et al.*, 2009; Arica *et al.*, 2022). Therefore, recycling patterns will affect the suggestion of using the application.

Furthermore, the recognizability of the conduct caused by the suggestion of using the application can influence the functional benefits. The positive image that the tourists disseminate of themselves allows them to receive prompt compensation. In the long run, visitors enhance the conditions where they temporarily dwell as a condition of altruism; this phase would correspond to internalized extrinsic motivation (Song and Kim, 2019; Salvi, 2015). Therefore, it is pointed out that the purpose of advising the application, which induces behavioral visibility, positively affects the PU of the gamified application (*H5* in Figure 4). The rest of the hypotheses are widely developed by Aguiar-Castillo *et al.* (2019).

Research methodology

Sample Procedure and Survey data were gathered from 141 players invited to respond to a questionnaire after operating the app in field experimentation in some pilot cities from France, Spain and Portugal fixed by the UrbanWaste panel. The experiment has been implemented under controlled conditions by severe European data protection and privacy regulations. The survey was accomplished in 2018, using a convenience sample where their approachability and closeness to researchers selected tourists. As detailed in Table 1, 75 (53.2%) of the interviewees were female and 65 (46.1%) were male; 92 (46.1%) of the participants were ≤24 years of age and 49 were >24 years of age. The most significant

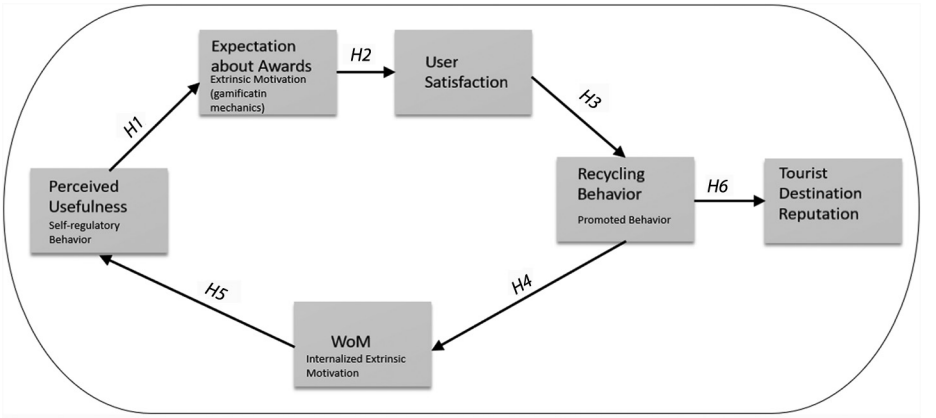


Figure 4.
Initial phase of the habit cycle

Source: Authors own creation

Characteristics	Frequency	%
Gender		
Male	65	46.1
Female	75	53.2
Other	1	0.7
Age		
≤	92	65.3
>	49	34.7
Social Rank		
Lower	4	2.8
Lower middle	15	10.7
Middle	25	17.7
Upper middle	81	57.5
Upper	16	11.3
Total	141	100

Table 1.
Sample features

Source: Authors own creation

players had an upper-middle social rank (81, 57.5%), next to the middle rank (25, 17.7%). Every item was estimated employing scales from earlier studies (Aguiar-Castillo *et al.*, 2019).

All the variables were measured using scales adapted from previous studies (Table 2). Items were measured on a seven-point Likert scale, in which 1 = strongly disagree and 7 = strongly agree.

The research model is composed of the following variables:

Data analysis and results

Measuring model

All data were examined employing path equation modeling in AMOS software. Path analysis is a multivariate technique that verifies the adjustment of causal models and determines the

Table 2.
Variables and items

Variable	Items	References
Perceived usefulness	1. "I think the application is useful to encourage recycling behavior" 2. "I think it is easy to find the closest recycling bin on the application map" 3. "I think the information about the recycling areas is correct on the application" 4. "I find the application useful when I travel"	Davis (1989); Kim and Chang (2007)
Expectation about awards	1. "I would like the prize to be useful" 2. "I would like the prize to be valuable" 3. "I would like the prize to be easy to obtain" 4. "I would like the prize to be nice"	Anderson (1998)
User satisfaction	1. "I think it is worth using this application" 2. "I think the application covers my expectations over the applications" 3. "I like using the application during a trip" 4. "I would use the application frequently on a trip"	Kim and Chang (2007); Spreng and Olshavsky (1993)
Recycling behavior	1. "I think the application encourages recycling behavior" 2. "I think the use of the application promotes measures that produce a cleaner destination" 3. "I think the application can change the behavior towards the recycling of some people"	Ajzen (1991)
Tourist destination reputation	1. "In my opinion, the apps improve the city's image" 2. "I think the cities that use the application will attract more tourists" 3. "I think the application increases the satisfaction of my experience in a city" 4. "I would repeat the journey to a city that uses this application"	Kumar (2013); Lee (2009)
WoM	1. "I would recommend WasteApp to my friends" 2. "I would recommend WasteApp to my neighbors" 3. "I would recommend WasteApp to my acquaintances aware of the environmental" 4. "I would recommend WasteApp to my acquaintances unaware of the environmental"	Marchiori *et al.* (2010)

Source: Authors own creation

direct and indirect contributions, whereby a set of independent variables explain the variability of dependent variable. Construct validity and the measurement model's reliability were assessed based on a confirmatory factor study. Composite reliability and Cronbach's α were greater than 0.7. The index reliability was evaluated founded on the standard that loading should be higher than 0.7 and that every loading below 0.4 should be eliminated. All loadings were higher than 0.7 and statistically significant at 0.01, demonstrating good indicator reliability for the instrument (Table 3). The validity test was examined employing the average variance extracted (AVE), and all constructs were greater than 0.5. All constructs of the square root of AVE were more elevated than the correlation between other variables. Discriminant validity was confirmed (Table 4).

Hypothesis testing

The adjustment assessment seeks to resolve whether the connections between the variables of the estimated model sufficiently recollect the correlations observed in the data. There are three kinds of adjustment goodness statisticians:

Items	Cross loading	Composite reliability	AVE	Cronbach's α
Perceived usefulness				
PU1	0.804	0.860	0.609	0.755
PU2	0.856			
PU3	0.740			
PU4	0.713			
Expectation about awards				
EaA1	0.952	0.967	0.879	0.951
EaA2	0.928			
EaA3	0.946			
EaA4	0.926			
User satisfacion				
US1	0.862	0.959	0.855	0.943
US2	0.956			
US3	0.955			
US4	0.923			
Recycling behavior				
RB1	0.937	0.969	0.913	0.951
RB2	0.966			
RB3	0.964			
Tourist destination reputation				
TDR1	0.846	0.947	0.817	0.921
TDR2	0.913			
TDR3	0.936			
TDR4	0.919			
WoM				
WoM1	0.955	0.953	0.835	0.934
WoM2	0.943			
WoM3	0.891			
WoM4	0.865			

Table 3.
Descriptive analysis

Source: Authors own creation

(1) those that value the absolute adjustment (square chi) are found;

(2) those comparing the adjustment concerning another model are relative adjustments [comparative fit index (CFI)]; and

(3) those using parsimonious adjustment consider the fitting according to the number of used parameters [normed-fit index (NFI)].

None of these parameters supply all the required knowledge to estimate the model, so some of them are used simultaneously. Furthermore, the variance-covariance matrix was employed to test the research model. Before confirming the hypotheses, the fit of the path model was confirmed. As illustrated in Table 5, all the fitness indexes [X^2/df = 1.490, NFI = 0.968, Tucker–Lewis index (TLI) = 0.982, CFI = 0.989, root mean square error of approximation (RMSEA) = 0.059] pointed out a satisfactory model fit.

The outcomes of the study are displayed in Table 6. The PU ($\beta = 0.566$, $p < 0.001$) had statistically significant influences on the Expectations about Awards (EaA). Therefore, *H1* was supported. The connection between EaA and US was not statistically significant; therefore, *H2* was rejected. US affected RB significantly ($\beta = 0.510$, $p < 0.01$), so *H3* was supported. The RB had statistically significant impacts on the intention of recommending the

Variables	1	2	3	4	5	6
PU	*0.780*					
EaA	0.556	*0.938*				
US	0.114	−0.069	*0.924*			
RB	0.141	0.043	0.499	*0.955*		
TDR	0.085	0.051	0.471	0.827	*0.904*	
WoM	0.226	0.107	0.509	0.799	0.685	*0.914*

Notes *Diagonal elements (italic) show the square root of the average variance extracted (AVE)
Source: Authors own creation

Table 4. Test of discriminant validity

Fit index	X^2	X^2/df	NFI	TLI	CFI	RMSEA
Criterion	$p \geq 0.05$	≤3	≥0.9	≥0.9	≥0.9	≤0.08
Research model	13.411($p = 0.145$)	1.490	0.968	0.982	0.989	0.059

Source: Authors own creation

Table 5. Model fit for structural model test

Path		Estimate	S.E.	Sig.	*H*-test
H1	Perceived usefulness → Perceived quality Awards	0.566	0.047	0.000	Supported
H2	Perceived quality awards → User satisfaction	−0.127	0.088	0.148	Rejected
H3	User satisfaction → Recycling behavior	0.510	0.074	0.003	Supported
H4	Recycling behavior → WoM	0.803	0.051	0.000	Supported
H5	WoM → Perceived usefulness	0.254	0.085	0.000	Supported
H6	Recycling behavior → Destination reputation	0.827	0.047	0.000	Supported

Source: Authors own creation

Table 6. Hypothesis test

application (WoM) ($\beta = 0.803$, $p < 0.001$). As a consequence, *H4* was supported. Moreover, WoM influenced PU ($\beta = 0.254$, $p < 0.001$), so *H5* was supported. Ultimately, the impact of RB was significant on tourism DR ($\beta = 0.827$, $p < 0.001$); therefore, *H6* was supported (Figure 5).

After analyzing the data from the European project UrbanWaste as a first approximation, the model that advocates the cycle of habit in the environment through gamification tools in the environment of sustainable tourism still needs to be fulfilled.

However, if the link that breaks the chain of actions is examined, it is seen that it is the connection between award expectation and US that induces the observation of the characteristics of the sample. This sample could be in the second phase of the habit cycle; they are in the one where stimuli are no longer needed to promote environmental behavior. In this situation, it was decided to conduct a second analysis with the same test group, assuming they were in this second phase, where the awards were not considered. As a result, it was found that this theory was supported.

The test group, made up of people very close to the ideals of sustainability, would already be in the second phase, as we see in the following results.

Hypothesis testing of aware sample

The same analysis system was used: a path equation modeling in AMOS Software. The previous analyses regarding the validity of the constructs and the discriminant validity are equally valid since the same sample has been maintained. Regarding the adjustment of the path model, it was confirmed. As illustrated in Table 7, every fitness index (X^2/df = 1.147, NFI = 0.993, TLI = 0.997, CFI = 0.999, RMSEA = 0.032) pointed out a good model adjustment.

The outcomes of the study are shown in Table 8. US affected RB significantly ($\beta = 0.284$, $p < 0.1$), so *H1'* was supported. The RB had statistically significant impacts on the intention of recommending the application (WoM) ($\beta = 0.763$, $p < 0.001$). Therefore, *H2'* was supported. Moreover, WoM influenced US ($\beta = 0.329$, $p < 0.01$), so *H3'* was supported. Ultimately, the impact of RB was significant on tourism DR ($\beta = 0.827$, $p < 0.001$); therefore, *H4'* was supported (Figure 6).

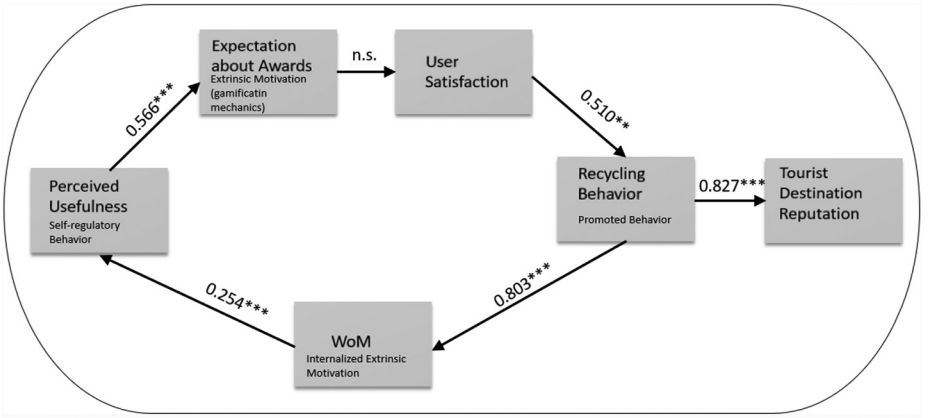


Figure 5.
Result model

Notes: *Probability < 0.10; **probability < 0.05; ***probability < 0.01; ns = nonsignificant
Source: Authors own creation

Discussion and conclusion

Conclusion

This paper defines gamification in terms of different types of motivation (von Krogh *et al.*, 2012): extrinsic, intrinsic and internalized extrinsic motivation. Intrinsic motivation focuses on inherent stimuli such as principles, self-recognition and altruism (Ray *et al.*, 2014); extrinsic motivations are enhanced by tangible stimuli such as grades, leaderboards or emblems that can be exchanged for monetary compensation or simply for enjoyment (Huang and Zhang, 2013). Finally, internalized extrinsic motivation is distinctive. It initially

Fit index	X^2	X^2/df	NFI	TLI	CFI	RMSEA
Criterion	$p \geq 0.05$	≤3	≥0.9	≥0.9	≥0.9	≤0.08
New research model	2.295 ($p = 0.317$)	1.147	0.993	0.997	0.999	0.032

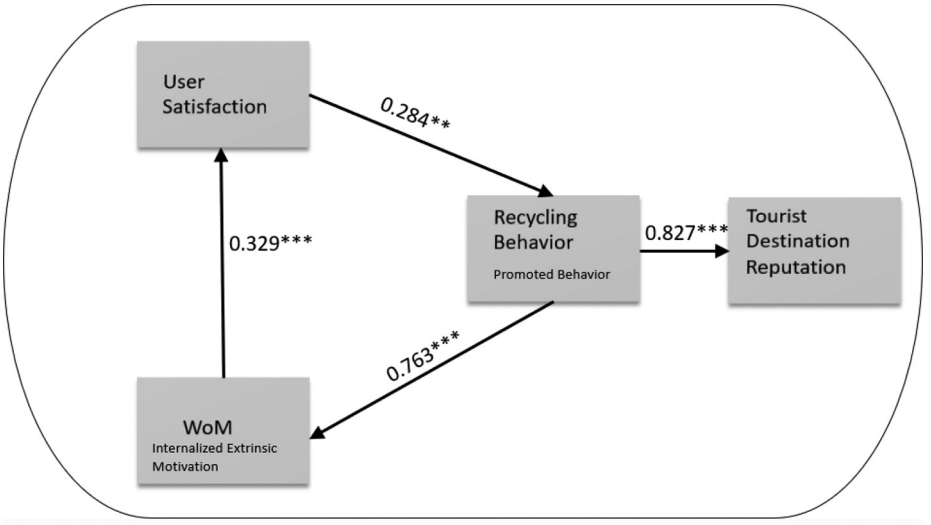
Source: Authors own creation

Table 7.
Aware sample model adjustment for the structural model test

Path		Estimate	S.E.	Sig.	*H*-test
H1'	User satisfaction → Recycling behavior	0.284	0.115	0.013	Supported
H2'	Recycling behavior → WoM	0.763	0.052	0.000	Supported
H3'	WoM → User satisfaction	0.329	0.111	0.003	Supported
H4'	Recycling behavior → Destination reputation	0.827	0.047	0.000	Supported

Source: Authors own creation

Table 8.
Aware sample model adjustment for the structural model test



Notes: *Probability < 0.10; **probability < 0.05; ***probability < 0.01; ns = nonsignificant
Source: Authors own creation

Figure 6.
New result model

arises from external impacts (good reviews from their contacts caused by conduct) to then gain ascendancy over the individual who takes it on as self-regulation regardless of external pressures (although there are recycling rules that the traveler complies with to give a good self-image) (Chen *et al.*, 2017; Ryan and Deci, 2017).

Exploring different approaches and considering the results of this study, a new meaning of gamification has been presented that focuses on the temporal component. Most studies view gamification statically, but this paper proposes it as a repetitive action. It is a succession of steps, a dynamic that evolves; it is not recreated once. It is an attempt to build player loyalty to prolong the behavior, and that behavior, when replicated, becomes a habit.

In conclusion, this process can be successful because tourist satisfaction arises from a mix of motivators. Therefore, travelers are satisfied with the gamified application as it contributes to their proenvironmental behavior. This recycling habit stems from a philanthropic desire to leave a more acceptable planet (intrinsic motivation) for ages to come. However, they also advise the application to the individuals around them to be considered good citizens, producing visible proenvironmental behaviors (internalized extrinsic motivation).

Theoretical implications

After studying the bases established by gamification experts and with the support of the research developed, it has been concluded that gamification applied to sustainability is based on the following principles:

- Motivation: creating habits through internalized extrinsic motivators;
- Feedback: generating positive feedback and predisposition to practice certain behaviors;
- Visibility: using social networks to disseminate behaviors can be crucial in gamification to encourage behaviors; and
- Transformation: affecting the notion and prestige of the gamified environment.

This idea is summarized in the following definition of gamification:

Gamification is a strategy based on extrinsic motivators, game elements, such as badges, leaderboards and scores, which aim to convert, over time, a behavior into a habit, transforming those extrinsic motivators into internalized extrinsic ones. Essentially, it would be a strategy that uses game elements to convert a behavior into a habit over time (Aguiar-Castillo, 2020; Aguiar-Castillo and Perez-Jimenez, 2022).

Practitioner implications

Several practical implications emerge from this study. The configuration of gamified applications should focus on helpful features, emphasizing social diffusion and making users visible to their touches. This social network diffusion of proenvironmental activities ensures the social distinction of the user (subjective rules). The rewards to be provided in a gamification initiative in the sustainability environment should follow the idea the application intends to disseminate (González-Rodríguez *et al.*, 2022). In other words, practitioners should consider valid rewards for proenvironmental behavior, including connecting to their social networks in the application's design. According to the research results, this kind of initiative seems sound. Organizations should encourage them to improve people's behavior and create a more valuable reputation for the institutions promoting the app.

Another relevant idea is the use marketers can make of the smartphone, which is an integral part of the travel experience to combat the unpleasant image of oversaturated destinations. The device supports the practitioners to help the traveler find waste recycling areas, thus increasing the prestige of the destination city.

Limitations and future study

Finally, this study has some limitations. It has been carried out only in European countries, which can be seen as a geographical limitation, and it would be desirable to extrapolate the study to other regions. In addition, gamification has been blamed for influencing behaviors, gamipulation, which is nothing more than implementing games that aim to direct specific habits where the developer of these applications wants them to go, regardless of the visitor's principles. The power of gamification in behavioral construction accentuates the risk of these instruments falling into the hands of unethical individuals whose purpose is not as gentle as encouraging environmentally friendly behavior. Using text mining technologies in customer reviews would be a fascinating study to clarify to what extent tourist ethics are relevant in generating proenvironmental habits (Cui *et al.*, 2023).

Future studies in this area could also analyze the elements that make a gamified application work or not in sustainability. It would also be attractive to discern the necessary ratio between "information" and "fun and games" for a gamified application to encourage proenvironmental behavior. The use of these tools to encourage proenvironmental behavior in the worldwide battle against global warming looks promising (Douglas and Brauer, 2021).

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