Human-Environment Relationships in Alba: A Typological Analysis of Player Engagement in Steam Reviews

Chien Lu[1], Giacomo Lauritano[2], Timo Nummenmaa[1], and Jaakko Peltonen[1]

[1]Tampere University, Kalevantie 4, 33100 Tampere, Finland,
first.lastname@tuni.fi
[2]University of Milano-Bicocca, Italy, Piazza dell'Ateneo Nuovo, 1, 20126 Milano
MI, Italy, g.lauritano@campus.unimib.it

ABSTRACT

This paper focuses on the player experiences of the game *Alba: A Wild Life Adventure*. We analyze players' reviews of the game and their profiles in an integrated way to investigate opportunities of using digital games to engage players in the issue of human-environment relationship. The analytical results indicate the players reflect on environmental issues in their reviews. Our findings yield implications on several issues including 1) the importance of immersive design and narrative in terms of engaging players; 2) instead of classifying a game as "serious" or "entertainment" based on the intentions behind the game development, more emphasis should be puton the player's experiences; and 3) the role of video games in parenting.

Keywords

Human-environment Relationship, Player Engagement, Topic Modeling

INTRODUCTION

Climate change is a widely recognized global challenge with significant impacts on the environment, society, and human well-being (IPCC 2014). The scientific evidence has clearly shown that human activities such as consuming fossil fuels and deforestation are the primary drivers of climate change, as reported in Masson-Delmotte et al. (2021). Therefore, addressing climate change requires a thorough understanding of the human-environment relationship. Mitigating measures are necessary to prevent increasingly severe and irreversible impacts, such as more frequent natural disasters, and to ensure a sustainable future for both humanity and the planet.

Games have been advocated as one form of the responses and potential solutions to the challenges posed by climate change (Abraham and Jayemanne 2017). The quality of their storytelling and interaction makes games a suitable tool to communicate issues related to climate change and human-environment relationship to the public. By offering players playful experiences and engaging them with recreational experiences, games can help to raise awareness about the issues, and encourage and inspire players to take action to address climate change (Lee et al. 2013; Meya and Eisenack 2018). By conducting studies on the role of games and gaming in promoting environmental awareness and behavior change, game

studies can help identify the effective ways in which games can be used to address climate change.

In this study, we investigate a recently launched single-player, open world adventure game called *Alba: A Wild Life Adventure* (*Alba*, Ustwo Games 2020), through a collective analysis of player reviews and corresponding profiles on the Steam platform. In the game, the player takes on the role of Alba Singh, a young girl who visits her grandfather in Valencia, Spain during her vacation. As Alba, the player explores the natural beauty of a fictional island (an example screenshot is shown in Figure 1) by taking pictures and cataloging wildlife animals. The game also includes missions in which the player must rescue animals in need. Ultimately, the player must collect enough signatures to stop a luxury hotel construction project that threatens the island's ecosystem.

While solely analyzing player reviews has been proven effective for different research purposes (Phillips et al. 2021; Yu et al. 2021), in this paper we take a novel data analysis strategy which collectively analyzes not only the player reviews but also player profiles of the players who wrote the reviews. As each player profile contains the personal history of the player on the platform, the collection of profiles can be used to investigate the distributions over various player types among players. Incorporating such information can facilitate going beyond an overall understanding of players' general perceptions to reach a more personalized understanding of playful experiences (Busch, Mattheiss, Hochleitner, et al. 2016). For example, we can investigate how player types can potentially affect the game-play experiences such as what kind of settings and contents can interest certain types of players.

This paper is organized as follows. The section **Background** describes the related works, and the importance of player typologies. The section **Method** describes the data collection and analysis. The section **Results** displays the analytical results, and the section **Discussion** analyzes their implications. Finally, the section **Conclusions, Limitations, and Opportunities** summarizes the paper.

BACKGROUND
Games embedding Human-environment Relationship
Games and play has become a primary cultural form in human society (Buckingham and Burn 2007). The global games market is estimated to consist of 3.2 billion players in the year 2022 (Wijman 2022). Games are not only popular, but are also thematically diverse. Environmental aspects including climate change are also themes that appear in games currently, and there is effort to increasingly support the inclusion of climate change and environmental issues into games (Patterson and Barratt 2019) .

Engagement (Milne and Otieno 2007) with climate change is a key to make engaged individuals "to care about it, be motivated and able to take action" (Lorenzoni et al. 2007). However, it has been suggested that most existing video games do not directly engage players to climate change, but embed messages related to a broader notion of human-environment relationships where environment can be backdrop, resource, antagonist, or text (Abraham and Jayemanne 2017).

Various digital and tabletop games related to climate change have been created (D'Angelo et al. 2015; Illingworth et al. 2019). However, it has been pointed out that a large proportion

Figure 1: Game-play Screenshot of *Alba: A Wildlife Adventure* showing the main character, one of the wildlife animals (a sheep), the environment, and part of the game interface.

of developed games in academia have not been able to effectively reach the public (Galeote et al. 2021) for they disappeared after being reviewed.

Scholarly efforts have been made in analyzing existing video games. In one study 150 games that represent climate change were analysed (Fernández Galeote and Hamari 2021) using a 15-attribute climate change engagement framework (Ouariachi et al. 2019). While the study focused on both serious games and entertainment games and revealed that most games complied with the majority of the recommendations in the framework, credibility, achievability, meaningfulness and social aspects were uncommon. Serious games tend to engage the player with climate change differently to entertainment games, but both styles of games do engage the player with the topic. In another study (Gerber et al. 2021) 115 climate games were identified. The games were classified to gain an overview of their characteristics. Most games were specifically designed for learning purposes, but not all. The characteristics of the games cover a wide range, indicating that climate change as a topic is included in games of different types.

Alba: A Wild Life Adventure

This paper focuses on the game *Alba: A Wild Life Adventure* (*Alba*), a single-player, open world adventure game. During the game play, the player plays the role as a little girl Alba, who visited her grandparents in the fictional island Pinar del Mar. The game contains various quests such as saving a dolphin stranded on the beach, or identifying the pesticide that causes disease of animals on the island. The final task is to collect enough signatures from islanders to stop a luxury hotel construction project. The players are also encouraged to use the cellphone to take pictures of the wild animals, there is an installed application to detect if it is a newly discovered species. The game-play of *Alba* comprises two components:

exploring the nature on this island, and preserving the wildlife.

Alba is available on different platforms including Nintendo Switch, Xbox, PlayStation, and PC. In particular, players can purchase and play the game via the Steam platform. The availability on Steam enables us to analyze the player experiences through analyzing the game reviews.

The clear position as a environment-themed game has attracted academic attention when it comes to engaging players with climate change issues (Seelow 2022; Luhova 2022; Heemsbergen et al. 2022). However, in those previous works *Alba* has only been mentioned as an example of climate change game and the overall player experiences have not been analyzed thoroughly. To our knowledge, this is the first research effort analyzing the player experiences through a large collection of player reviews. Apart from the game reviews, the authors have also played or watched the play-through video[1] in order to gain an overall understanding of the game.

Steam Reviews

Steam is a popular digital game distribution platform that offers not only purchasing and downloading services, but also serves as a space for online gaming communities where players can leave reviews and ratings for games. It has been widely used for research purposes (Kang et al. 2017; Lin et al. 2019) due to its abundance of data. The reviews left by players on Steam are a valuable source of information for researchers to understand players perceptions, preferences, and experiences (Lu et al. 2020).

Analyzing Steam reviews can provide valuable insights especially when it comes to the reception of a game. Analyzing the game reviews is a way to gain a better understanding of, for example, the quality of the game, player preferences, and game-play experiences of the players. By examining the content of game reviews, it is possible to learn of how players feel about the game. This can provide valuable information when trying to understand if some game features or characteristics are well-received, as well as areas where it may need improvement.

On the other hand, the reviews often contain not only game-play related content but also implications outside of game-play. This can help in understanding a broader scope of social and cultural aspects of gaming, including values and preferences of players, the trends and themes that are popular among players, and the ways in which games are being used and consumed. In the context of climate change communication, the reviews can help identify how the key notions that the game tries to deliver have been perceived by the players.

Player Typology and Gameful Experiences

Player types and player experience are two intertwined concepts in the study of video games and gaming behavior. Player types refer to the different ways that people approach and engage with video games, and can be used to classify players based on their motivations, preferences, and behaviors. Player experience, on the other hand, refers to the overall feelings that players have while playing a game, and can include perceptions like enjoyment, frustration, challenge, and immersion. It is notable that not all playful experiences are pleasurable, as is identified in the PLEX framework that categorizes playful experiences into

22 categories (Lucero et al. 2013). It has also been proven that player types can affect the perceptions of gameful elements (Hassan et al. 2020).

Besides, player experience is often a more individualized and subjective concept (Busch, Mattheiss, Hochleitner, et al. 2016). Different players may have different experiences while playing the same game, depending on their motivations, preferences, and behaviors. For example, a completionist may have a very different experience playing a game than a socializer or an explorer.

Player type can be important when analyzing game reviews because it can provide insight into the perspectives and expectations of the reviewers. Different player types are likely to have different experiences with a game, and their reviews may reflect this. For example, a casual player may focus on the game's accessibility and fun factor, while a hardcore player may be more interested in its depth and challenge. By considering the player type of the reviewers, researchers can gain a more nuanced understanding of the game's strengths and weaknesses, and how it is perceived by different segments of the player population. This can help researchers and game developers better understand the preferences and expectations of players, and design games that appeal to a wider audience.

Overall, player types and player experience are important concepts in the study of digital games and game experiences (Vahlo et al. 2017). Understanding these concepts can help us understand how games can engage and satisfy players, and can provide valuable insights into the ways that people approach and engage with video games.

Factorized Player Typologies

There have been many different frameworks of player typologies that have been proposed to study video games. Perhaps the earliest contribution in the literature is Bartle's typology which suggests a segmentation of players into socializers, achievers, explorers, and killers (Bartle 1996). However, such frameworks have received criticism for been excessively dichotomous and simplifying (Kallio et al. 2011; Hamari and Tuunanen 2014) as several player types can be correlated to each other. One the other hand, a player can belong to different player types and the motivation can be often mixed.

Apart from typical player typologies under the the notion of looking for segmentation or categorization of players (Tseng 2011; Stewart 2011). Various approaches have been proposed through using a factor analysis model to uncover underlying representations of players. (Yee 2006; Yee et al. 2012; Vahlo and Hamari 2019). For example (Yee 2006) extracted three principle components Achievement, Social, and Immersion out a survey consists of 40 questions for MMORPG players. In another framework, Immersion, Autonomy, Competence, Fun, and Relatedness are extracted from a 25-item inventory (Vahlo and Hamari 2019).

In principle, a factor analysis model works by decomposing a large matrix of player data into smaller, more manageable matrices, which can then be used to analyze individual player behaviors and characteristics. For example, a factor analysis model could be used to identify common patterns among players who are highly skilled (higher achievements, percentage of perfect games) at a particular game, or to understand why certain players are more likely to showcase artworks or screenshots in their profiles.

Compared to conventional player type systems, which use a limited set of categorical labels to classify players, factor analysis models offer a more flexible and nuanced representation of the underlying patterns of player behavior. Besides using surveys or questionnaires, Li et al. (2019) proposed a framework that performs a factor analysis on a collection of Steam player profile features, which demonstrates the promise of harnessing available player data online.

METHOD
Data Collection
In this study, we use the Steam Web API, the official interface provided by the Steam platform developer, to collect user review data for *Alba: A Wild Life Adventure*. After collecting the reviews and the user IDs of the players who wrote the reviews, we use a web crawler and a web parser based on the R package `rvest` (Wickham 2022) to gather data from the Steam player profiles associated with each collected user ID. This allows us to collect a rich dataset of player profile information, which we can then use to analyze player behavior and characteristics.

The data collection was conducted on the 7th of December, 2022. After removing too short reviews, and keeping only reviews where the player has a public player profile, there are 1356 reviews with corresponding public player profiles taken into the model training. For each player profile, after web parsing, 12 profile variables and 41 showcase variables across 15 showcase areas are collected.

Text Analytics
To analyze the large amount of collected data, this paper employs a computational approach called topic modeling (Blei et al. 2003). It has been a widely used method of analyzing text data to identify the underlying themes or topics that are present in a document or collection of documents. This method can be applied to game reviews in order to identify the most common topics or themes that are discussed in these reviews.

Since we have available not only review texts but associated numeric player profiles, we aim to analyze them jointly. In this study, we use a text analysis technique called Cross-Structural Topic Model (CFTM, Lu et al. 2021) to collectively analyze the player profile data and review texts. The key advantage of such a model is that it can not only identify underlying themes of the textural reviews but can also distill factorized player types that act as common characteristics across the player profiles. Moreover, the interactions between textual content and player types can be collectively modeled.

CFTM is a model that combines a topic model and a factor model. The topic model extracts the underlying themes of text, while the factor model is used to identify factorized player types. Each review text is then modeled as a mixture of topics, and each player profile as a mixture of factors. CFTM also models the interactions between topics and factors, by modeling how factors can influence the topic proportions in each document and how factors can affect the wordings in a specific topic. This allows for a more detailed and nuanced understanding of the relationship between player behavior and the themes in the text.

In CFTM, each document is represented as a mixture of underlying topics and each topic has a distribution over words that symbolize an underlying theme of discussion. The probability

of a word w occurring in a document d is modeled as a sum over K topics, so that

$$p(w|d) = \sum_{k=1}^{K} p(k|d)p(w|k) \ . \tag{1}$$

where $p(k|d)$ are probabilities of each topic k in the document and $p(w|k)$ are probabilities of the words w in each topic.

Further, CFTM models the topic prevalences $p(k|d)$ of all K topics in a document d with a vector $\theta_d = [p(1|d), \ldots, p(K|d)]^\top$ which is drawn from a distribution that depends on the covariates, so that $\boldsymbol{\theta}_d = \text{softmax}(\boldsymbol{\eta}_d)$ and

$$\boldsymbol{\eta}_{d,1:(K-1)} \sim \boldsymbol{N}(\boldsymbol{\Gamma}^\top \boldsymbol{\Lambda}_d, \boldsymbol{\Sigma}_\eta) \ , \tag{2}$$

where $\boldsymbol{\Lambda}_d$ is a vector of L document-level factor loadings, $\boldsymbol{\Sigma}_\eta$ is a covariance matrix, and Γ is a $L \times K$ coefficient matrix that governs the interaction between topic prevalence and document-level factor loading.

The same document-level factor loading $\boldsymbol{\Lambda}_d$ also governs the generation of the document-level covariates, with a factorization structure

$$x_d \sim N(\boldsymbol{\Phi}^\top \boldsymbol{\Lambda}_d, \boldsymbol{\Sigma}) \tag{3}$$

where x_d denotes a P-dimensional covariate vector of the document d, the coefficient matrix Φ is a $L \times P$ matrix where each column $\boldsymbol{\Phi}_p$ is a vector of feature/ covariate weights on the L factors, and $\boldsymbol{\Sigma}$ is a covariance matrix. Here, we take two play time measurements (playtime when writing the review, and total playtime of the player) and 53 player profile variables as the covariates.

We preprocess the text data by removing stop words (such as "is", "this", "etc.") and rare words (words that only appear once in the corpus). We then apply lemmatization to the remaining words, (so that, e.g., "play" and "played" are lemmatized to their common lemma "play"). This preprocessing step helps to improve the performance of the model by reducing the dimensionality of the data and ensuring that the words are in a consistent form.

The final model was decided based on a criterion called held-out likelihood, which measures ability of the model to predict previously unobserved (held-out) text. To compute the value, a proportion (50%) each document is considered unobserved ("held out") and is not used to build the topic distributions. The models are evaluated by the probability they give to the content of the held-out portion, representing ability of the models to model unseen text content. We searched among topic numbers $K = 5$ to 20 and factor numbers $L = 5$ to 20. For each setting, we trained 10 random initialized models. We found that the model with $K = 12$, and $L = 7$ yielded the maximum averaged value of the held-out likelihood criterion.

After deciding the number of topics, the semantic coherence value (Aletras and Stevenson 2013) was taken as the criterion to choose the best model. Again, we performed multiple runs with different initializations using the full data set. The semantic coherence value measures how strongly the top words in each topic co-occur over documents, thus, it can be employed to evaluate the performance of topic models and to choose the best-performing

model among several models. The model with the best average semantic coherence value over topics was selected as the final model.

When analyzing the output from the final model, to outline the characteristics of each topic, we examine words of the topic. To address the problem of common, uninformative words appearing in multiple topics, we examine both the top words lists with highest probabilities and Frex values which emphasize exclusivity of words to a topic. The Frex value for each word v in topic k is computed as

$$FREX_{k,v} = \left(\frac{\omega}{ECDF(\beta_{k,v}/\sum_{j=1}^{K} \beta_{j,v})} + \frac{1-\omega}{ECDF(\beta_{k,v})} \right)^{-1} \tag{4}$$

where $ECDF(\cdot)$ denotes the empirical cumulative distribution function (proportion of items smaller than the value inside the parentheses). The weight factor, ω, is used to balance the word frequency and exclusivity, where we set $\omega = 0.5$ in this case.

RESULTS

Extracted Topics

Table 1 shows the extracted 12 topics with the top 10 words with highest probabilities and Frex values. Topic labels are given by the authors based on analysis of the top words and example texts (reviews with prominent proportion of the topic). This process is similar to "coding" in Thematic analysis (Cooper et al. 2012) but without requiring analysts to read through all the collected review text.

The topic **Casual & Relaxing** has the highest overall proportion in the analyzed reviews (19.04 % of all words are predicted to arise from the topic). Its top words such as "casual", "cute", and "relax" indicate the main design style of *Alba*. Quotes from documents where the topic is prevalent show players appreciate the relaxing nature of the game setting:

"... *Incredibly beautiful, thoughtful and relaxing... just sit and take in your surroundings really do put you in another world...I would highly recommend if you like cute, casual games...*"

"... *This is the perfect "casual" game, because while it has a relaxing atmosphere, it's not boring at all ... It didn't take me long, but I loved every step of the way. Get this!*"

A noteworthy topic related to player experiences is **Parenting & Fun** with top words such as "lynx", "fun", "year", and "old". The lynx can be considered the final trophy after completing all necessary tasks in game. Words "year" and "old" relate to playful experiences for kids or playing with kids, as in these examples:

"*This game seems to be made specifically for my 5 year old daughter. We had such a great time exploring and taking pictures of the animals... We beat the game together, but she still wants to play and explore the island!... My daughter wants to play through it again! Alba 2 pls?*"

"*...the best kids game I ever played together with my son...The controls are easy to learn and use for a six year old...the lynx is sitting on a rock where you cannot reach him. The whole*

Table 1: Topics: words with highest probabilities [P] and Frex values [F].

Topic (Prob %)	Top 10 Words
Casual & Relaxing (19.04%)	[P]: casual hike cute line sit joy love sweet relax truly [F]: hike sit line joy absolutely casual super excellent vibes recommend
Appreciation (13.75%)	[P]: anyone highly art wholesome chill yet gorgeous educational calm satisfy [F]: anyone highly art yet gorgeous calm chill satisfy style incredible
Parenting & Fun (12%)	[P]: lynx fish year video daughter snap finally old together pokemon [F]: year snap fun probably nice play clean read time control
Photographing Wildlife (9.10%)	[P]: chance wildlife local draw feelgood identify picture effort depend restore [F]: wildlife picture around island help take one photo able several
Environmental Awareness, Warmth & Music(8.68%)	[P]: protection environmental warm effect attention music suitable wonderful matter relationship [F]: environmental music warm wonderful make spend beautiful sound thank experience
Negative Feedback(6.60%)	[P]: dark computer significant deaf soul spare paint average decent grandma [F]: price easy grind average bad decent bug long money paint
Game Design (6.25%)	[P]: list light plot upon listen couple particular appear craft beat [F]: list light plot listen couple beat craft friendly particular challenge
Exploring & Information (6.03%)	[P]: hunt actually actual wish info pay plan animation kinda community [F]: actually wish animation nature conservation know say dev learn pay
Abilities & Control(5.38%)	[P]: break ability mean change button lack open invert point night [F]: break mean change open ability button point incredibly map stuff
Game Setting (5.18%)	[P]: area summer memory live connect sure mar pinar del thats [F]: summer area live sure negative different come care think something
Achievement & Low-poly Art (4.05%)	[P]: achievement item since low although poly content use detail biome [F]: achievement since low although item use content detail quest poly
Narrative (3.94%)	[P]: follow storyline pretty ustwo young fairly realistic future plant complete [F]: follow storyline pretty ustwo young fairly future plant complete scan

game the biggest wish for the kid is to meet the lynx and when you finally meet...Please add a path up to the top of the rock and let us pat the lynx - you'll get one more star from my son"

Another prominent topic is **Environmental Awareness, Warmth & Music** with top words such as "protection", "environmental", "warm", and "effect". The topic indicates how players reflected on human-environmental relationship and enhanced awareness of sustainability when describing various aspects of immersive experience:

"*...The environmental sound effects in the game are very rich. As a game with the theme of animal environmental protection...which makes people immersive when walking through the island...we need to pay more attention to the environment, wild animals, and the daily lives of the people around us... As a resident of the earth, environmental protection is everyone's inescapable responsibility*"

"*...At first I was astounded at how lovingly it captured the warmth and comfort...remind us how much of an impact everyone as individuals can have on each other and our environment by taking the time to be considerate. A wonderful thing to remember packaged in a wonderful experience, and a wonderful way to inspire others to do what they can to help protect the environment...*".

Additionally, topics related to player ratings and recommendations such as **Appreciation**, **Exploring & Information** and **Negative Feedback** are discovered. Especially the topic **Appreciation** has a focus on the "wholesome", "chill", and "calm" atmosphere:

"*This game is wonderful! Such a beautiful and wholesome experience... The game just makes you smile, whether it be the character interactions or the cute animals it is a joy to play... I highly recommend this game it is a genuinely fun and heartwarming experience and a beautiful game, definitely one my favourite games.*"

"*A really cute and short game about animal conservation! I very much enjoyed the chill vibe and cute, yet clear, art style.*"

The topic **Negative Feedback**, although having low overall probability, reveals a certain degree of dissatisfaction from players:

"*...I noticed a few minor mistakes and bad direction decisions involving the character animation...There are far too many glitches and strange visual bugs for a game that costs 18 dollars...There's not enough content or story for the price...*"

"*...Its a little overpriced for what its worth but its still a pleasant experience ... if the camera falls beneath the ground which darkens the screen a bit and looks as if its changing the time of day...*"

We noticed some reviews having top words of the topic used a checklist and stated also unselected options, hence proportion of the topic may not reveal their rating of this game.

Another group of topics where players mention playability and various design elements in-

Table 2: Feature weights of factors (1); [PT]: Play-time

	Inactive User	Achiever & Owner	Instr-uctor	Elite	Creat-or	Trader	Artist
[PT] At Review	0.88	-10.67	6.40	1.05	-2.62	6.69	-1.77
[PT] Total	0.55	-11.23	6.77	0.53	-2.54	7.51	-1.33
Level	-13.91	-4.37	-5.29	22.50	-0.33	0.45	6.87
Profile Awards	-16.06	-8.92	5.48	10.06	0.10	7.31	10.47
Badges	-10.70	-12.45	-10.35	27.04	-1.31	0.38	10.81
Games	-11.76	27.84	-1.05	14.63	-3.35	-8.98	-11.40
Screenshots	3.00	-36.41	-5.38	26.27	1.17	-10.13	13.47
Reviews	-9.81	-5.44	19.58	13.06	-0.52	-17.10	0.08
Groups	-6.93	-30.36	-8.53	22.29	1.98	10.65	13.25
Friends	-17.18	-18.55	-3.04	15.28	1.20	7.69	22.68
Guides	-6.45	-26.28	21.84	6.81	-2.17	3.85	3.54
Artwork	7.59	-46.31	-8.86	25.40	-0.54	-6.46	18.82
Workshop Items	-5.39	-20.46	-12.72	15.72	34.03	-17.07	2.53
Videos	-3.74	-10.89	9.45	3.47	-0.83	0.32	2.91

cludes **Abilities and Control**, **Achievements & Low Poly Art**, **Narratives**, **Photograph-ing Wildlife**, **Game Design**, and **Game Settings**. The topic **Achievements & Low Poly Art** highlights the main gameplay mechanics and the art style of the game. The topic **Nar-ratives** is about the main storyline where "Pinar del Mar" is the name of the fictional island:

"... an adorable "feel-good" game by ustwo games that takes place on the beautiful Mediter-ranean island of Pinar del Mar... The game follows Alba, a young girl...and follow a fairly strict story-line..."

Extracted Player Factors

Tables 2 to 4 contain the extracted factors and their weights on each profile variable. We describe each factor and their average prevalence (percentage %) among players' profiles below. Each player's profile is a combination of many factors, the average prevalence of a factor is its average weight in the combinations across players.

Inactive Users (20.76% among the players): This factor has small to negative weights on most features, and represents tendency in Steam users not to actively maintain their profile, although keeping it open.

Achiever and Owner (12.55% among the players): This factor has high weights on covari-ates related to achievements, completions, and perfection of games. It represents players aiming for achievements, whose screenshots are generally appreciated by other users.

Instructor (14.01% among the players): This factor has higher weights on Reviews, Guides, and Videos. It represents players actively providing instructions to other players.

Elite (14.33% among the players): This factor has higher weights on variables such as level, profile awards, and badges. It represents players spending relatively more effort on maintaining their profile.

Table 3: Feature weights of factors (2): [GC]: Game Collector; [F]: Favorite Game; [A]: Award; [AC]: Achievement; [C]: Completionist; [B]: Badge; [S]: Screenshot

	Inactive User	Achiever & Owner	Instr-uctor	Elite	Creat-or	Trader	Artist
[GC] Games Owned	-10.47	32.61	-4.67	15.51	-2.55	-12.02	-13.33
[GC] DLC Owned	-9.17	27.27	-5.53	13.51	-1.42	-9.32	-10.73
[GC] Reviews	-8.74	2.62	15.27	14.16	0.15	-20.61	-3.55
[GC] Wishlisted	-10.83	21.21	-7.50	10.10	-3.37	-0.99	-2.65
[F] Hours played	-1.01	7.14	-5.98	6.50	0.01	-2.92	-3.37
[F] Achievements	-6.53	29.10	-12.51	11.82	-1.93	-4.90	-10.45
[A] Awards Received	-12.61	-9.17	-8.20	5.87	37.34	-8.17	-1.44
[A] Awards Given	-10.56	-9.79	4.25	4.95	5.29	11.99	0.72
[AC] Achievements	-15.83	30.82	5.78	9.32	-2.62	-10.09	-9.27
[AC] Perfect Games	-16.68	27.56	6.20	11.68	-2.40	-8.10	-8.98
[AC] Avg. Game Completion Rate	-12.24	3.03	9.35	8.76	-2.10	-2.22	0.89
[C] Perfect Games	-13.01	32.16	2.25	11.50	-2.72	-10.51	-12.98
[C] Achievements in Perfect Games	-14.13	32.64	5.64	6.84	-2.69	-10.33	-10.51
[B] Total Badges	-6.36	-10.64	-16.98	26.12	-0.80	2.36	8.28
[B] Game Cards	-6.77	32.86	-16.13	12.58	-2.95	2.11	-15.05
[B] Foil Badges	-8.92	3.72	-8.44	5.72	-2.39	6.96	9.60
[S] Up Votes	-40.13	38.29	17.08	-28.14	7.62	15.26	17.90
[S] Comments	-44.89	38.33	18.21	-27.71	7.92	15.20	23.18
[S] Number	3.48	-40.20	-9.76	26.83	1.43	-7.06	17.38
[S] Favorites	-45.59	43.25	18.34	-30.32	7.62	16.66	21.50

Table 4: Feature weights of factors (3): [AR]: Artwork; [FA]: Featured Art-
work; [W] Workshop; [V]: Video; [FI]: Favorite Items; [I]: Items; [IT]: Items
for Trade; [G]: Guide; [FG]: Favorite Guide

|	Inactive User	Achiever & Owner	Instr- uctor	Elite	Creat- or	Trader	Artist
[AR] Up Votes	-14.26	1.88	-2.62	-2.86	-3.98	-4.78	32.97
[AR] Number	8.04	-46.15	-9.59	25.18	-0.44	-6.90	19.21
[AR] Comments	-22.02	16.56	-1.75	-10.37	-3.17	-0.20	33.83
[AR] Favorites	-22.45	19.42	-0.99	-11.83	-3.02	-0.86	32.98
[FA] Up Votes	-1.28	-18.11	-3.81	8.01	-4.530	-8.54	25.05
[FA] Number	-3.30	-18.62	-3.13	10.07	-3.75	-3.56	21.07
[FA] Favorites	-10.54	-12.27	-5.53	6.96	-3.25	-8.01	34.78
[FA] Comments	-5.60	-29.32	-9.91	15.14	-2.36	-7.95	37.85
[W] Submissions	-5.08	-24.70	-15.47	14.35	36.64	-13.97	5.13
[W] Followers	-8.10	-8.01	-11.75	4.17	39.80	-12.04	-3.35
[V] Number	-9.31	-13.43	29.05	2.75	-3.25	-0.24	-2.68
[V] Up Votes	-5.62	-1.45	24.15	2.28	-1.17	-16.12	-3.39
[V] Comments	-3.84	-4.97	22.48	1.70	-0.98	-14.40	-2.11
[FI] Items Owned	-15.14	24.72	-20.35	11.75	4.95	18.66	-10.66
[IT] Items Owned	-12.39	-2.21	-14.63	5.22	-1.81	44.785	-2.93
[IT] Trades Made	-8.80	-14.37	-4.17	4.68	-1.16	31.614	2.25
[IT] Market Transactions	-14.89	-5.81	-13.31	4.64	-1.52	50.68	-1.50
[G] Guides	-9.52	-25.28	30.12	4.19	-3.15	7.56	-0.34
[G] Followers	-8.19	-17.94	20.68	3.60	-0.39	6.07	-0.42
[FG] Stars	-16.61	7.51	2.57	-2.93	-0.75	11.82	10.11
[FG] Ratings	-5.45	2.58	-0.58	0.010	-0.86	8.44	0.72
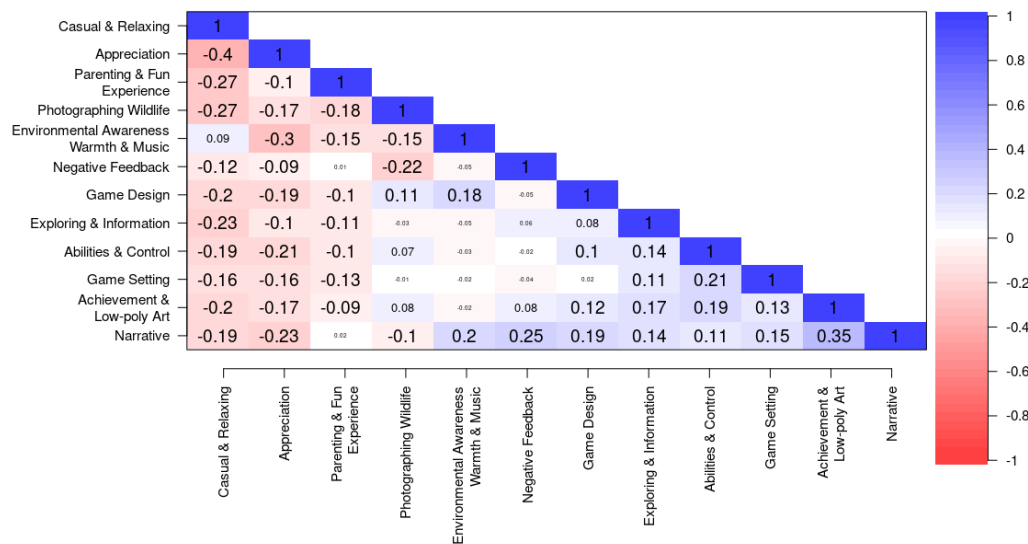
Figure 2: Topic Correlations

Creator (13.79% among the players): This factor emphasizes workshop items, and appreciation by other viewers through awards. It represents a creativity degree of player profiles.

Trader (10.73% among the players): This factor again shows positive correlation to playtime of **Alba**, and represents players who trade item frequently on Steam.

Artist (13.84% among the players): This factor has prominent weights on variables related to showcasing artworks. It represents players using Steam as a platform to share and exhibit game-related artwork.

In terms of the two playtime variables in Table 2, factors **Instructor** and **Trader** are both positively associated to playtime on *Alba* whereas the factor **Achiever and Owner**, in general, spends comparatively less time on playing the game.

Topic Correlations

The model yields a weight for each topic in each review. We further investigate connections between different topics by measuring the statistical correlation of their weight over the reviews. Figure 2 shows the pair-wise correlations among topics. A positive correlation coefficient of two topics implies the topics are likely to be mentioned in the same review. A negative correlation coefficient means the opposite relation.

Topics related to playability and design elements including **Abilities & Control**, **Exploring & Information**, **Narrative**, **Achievement & Low-poly Art**, **Photographing Wildlife**, **Game Setting**, and **Game Design** are generally positively correlated. The exception is that **Wildlife in the Island** is negatively associated to **Game Setting** and **Narrative**.

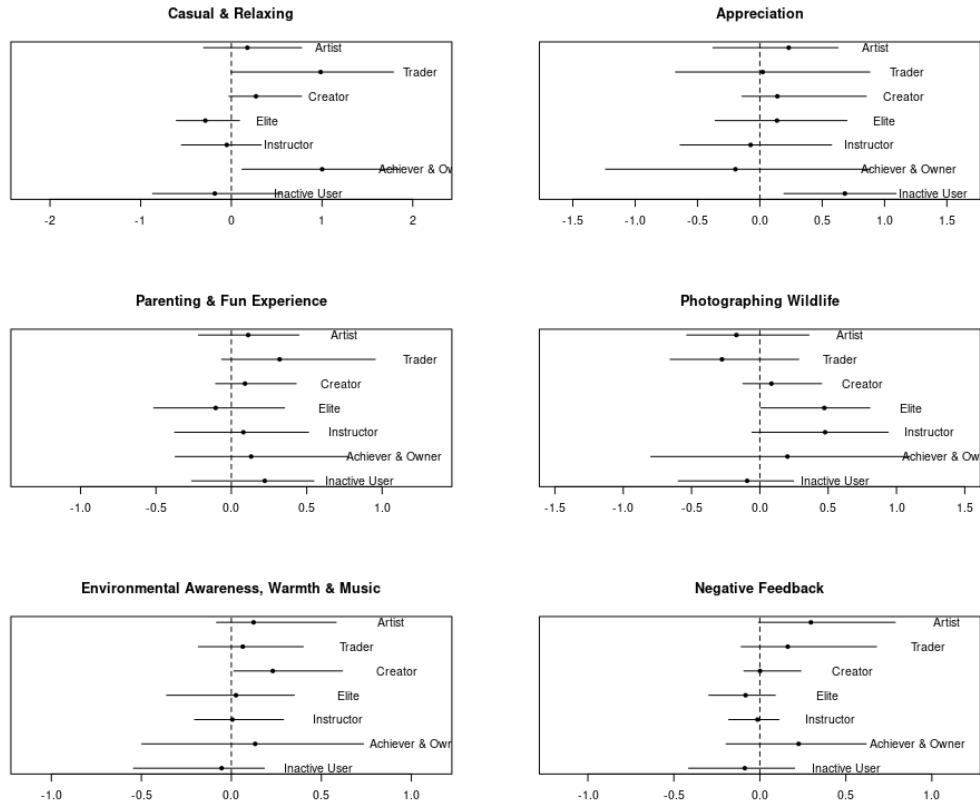The topic **Environmental Awareness, Warmth, & Music** is positively associated to **Nar-**

Figure 3: Factor Impact on Topic Prevalence (1)

rative, **Game Design**, and **Casual & Relaxing**. Topics **Appreciation** and **Parenting & Fun** are mostly negatively associated to other topics.

Player Factors vs. Topics

The CFTM model lets researchers analyze the association between the extracted factors and topics. We investigate how factors affect the topic prevalences in each document. In detail, CFTM yields a posterior distribution of factors Λ_d for each document d, and Λ_d generates topic prevalences θ_d. We estimate influence of factors on topic prevalences following a standard procedure (Roberts et al. 2016; Roberts et al. 2019): 1) for each document we sample Λ_d from the posterior and a corresponding θ_d, 2) for each topic we fit linear regression from the Λ_d to the weight of the topic in θ_d, yielding regression weights telling how each factor affects the topic weight, and 3) we repeat 1-2 several times to get credible intervals of the regression weights. Figures 3- 4 show the influences of factors on the prevalence of each topic (means and confidence intervals of regression weights; interval outside zero indicates notable positive/negative influence). Most factors do not show significant influence on topic prevalence as their credible interval crosses the zero line.

In particular the factor **Achiever & Owner** is positively associated to the topic prevalence of **Casual & Relaxing**, the factor **Inactive User** is positively associated to topics **Appreciation** and **Game Design**. The factor **Elite** affects the topic **Photographing Wildlife**,
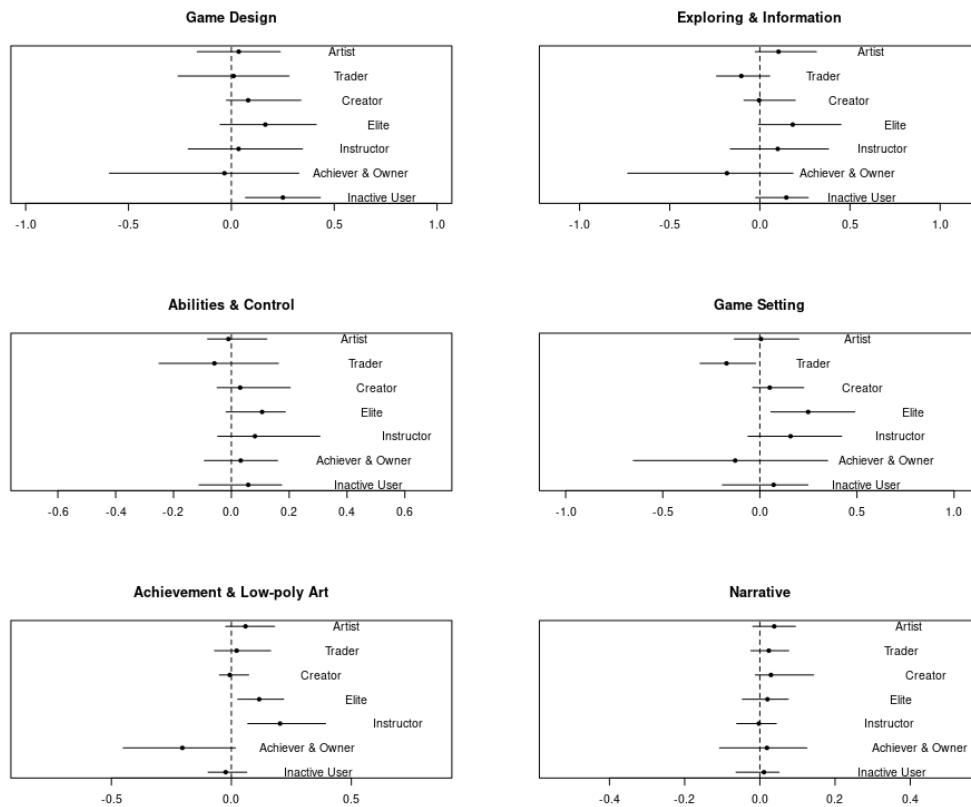
Figure 4: Factor Impact on Topic Prevalence (2)

Achievement & Low-ploy Art, and **Game Setting** significantly and the factor **Creator** is positively associated to the topic **Environmental Awareness, Warmth, & Music**. The factor **Instructor** is associated to the topic **Achievement & Low-poly Art**.

DISCUSSION
Environmental Awareness and Player Engagement

The topic **Environmental Awareness, Warmth, & Music** indicates that the players have reflected on environment relationship and sustainability awareness in their game reviews. This topic is not solely about environmental issues but also the warm atmosphere and music. Players also mention a wide range of design elements that are related to immersive experiences including music, sound effects, and the warm atmosphere during game-play. The combination of themes in the same extracted topic highlights the importance of immersive design in terms of engaging players and in enhancing the awareness of human-environment relationship. The association to the topic **Casual & Relaxing** further corroborates the importance of immersive experiences for engaging players. Note that a calm or relaxing style of game design is also employed in other environment themed games such as *Beyond Blue* (E-Line Media 2020) and *Flower* (Thatgamecompany, Bluepoint Games 2009).

On the other hand, topics related to the overall flow of *Alba* including **Narrative** and **Game Setting** are also extracted from the model. Game narrative and flow plays an important role in the terms of immersion and meaningfulness (Taylor 2002; Mäyrä and Ermi 2011). In *Alba*, the association between topics **Narrative** and **Environmental Awareness, Warmth, & Music** further corroborates the importance in terms of player engagement (Dede 2009).

Another intriguing discovery about the topic **Environmental Awareness, Warmth, & Music** is its association with the **Creator** factor. Players who show higher creativity level and invest more efforts in creating various workshop items (as seen in their profiles) tend to mention this topic more frequently. This connection implies the role of imagination when it comes to engaging players to issues such as climate change (Yusoff and Gabrys 2011), as these players, who are represented by the **Creator** factor, tend to be more expressive and appreciate the design aspects of the game. They also tend to reflect on issues and make meaning beyond gameplay.

The factors **Instructor** and **Trader** have the highest weight on the playtime of the game whereas the factor **Achiever and Owner in Other Games** has the lowest weight. This can be pertinent to the mechanics in the game. The quests and tasks in the game are where the environmental awareness-related education elements are implemented. They include helping out other villagers, fixing historical heritage, cleaning the island, and rescuing animals. This fits the profile of **Instructor** and **Trader**. It also reflects that some design elements of *Alba*, e.g., suited for children, low-poly art, are not as attractive to hardcore players or players of mainstream games.

Achievements, Challenges and Quests

The topic **Achievements & Low-poly Art** captures two primary design elements. The Low-poly art is the overall artistic style of the game, and the game-play of *Alba* comprises a series of achievements, challenges and quests ranging from saving wild animals to an environmental activism campaign. Those achievements and quests, in general, employ direct

action: clean the beach and save animals from the trash in first person. While this could be seen as a case of "volunteering activity" where movements are forced to fill in the gaps of the institutions and end up legitimizing them (Cuttitta 2018), this is unlikely to be the case. In *Alba*, a community that lives far from any central institution (only one policewoman is present on the island and she participates in the action) takes directly into their hands the wellbeing of their natural environment. The design of everything is very cartoonish, presented in low-poly art, and the worst excesses of pollution, like poisoned squirrels, are very sanitized to keep the game playable for a very young audience. Still, the urgency of the environmentalist mission of the protagonists is very much felt.

Interestingly, the topic **Achievements & Low-poly Art** is negatively associated to the factor **Achiever and Owner** but positively associated with factors **Instructor** and **Elite**. The negative association to the factor **Achiever and Owner** implies that the player types are not necessarily a suitable predictor for player experiences (Busch, Mattheiss, Orji, et al. 2016). The achievements and tasks in the game are mostly altruism-driven, which is different from the notion of achievements in other games. On the other hand, the characteristics of those tasks can fit the factor **Instructor** better which can be perceived as players who are willing to help others.

Serious or Entertaining?

The notion of "serious game" has been adopted in a series of previous studies that investigate the intersection of human-environment relationships and games. As serious games are games featuring *"use of games and gaming technology for purposes other than mere entertainment or 'fun'"* (Susi et al. 2007), previous research has focused on either the potentials of solely serious games (Flood et al. 2018; Djaouti, Alvarez, Jessel, and Rampnoux 2011) or comparison to "entertainment games" (Fernández Galeote and Hamari 2021).

The major issue is that the distinction between "serious games" and "entertainment games" can be vague, especially when categorization is based on evaluating the original intended purpose of a game from publicly available material. Based on the real player experiences distilled from player reviews of *Alba*, it is not easy to categorize if the game is purely a serious or an entertaining game. On the other hand, even if one can rely on some "explicit statements" to probe the intention and categorize the game as "serious" or "entertainment", the situation of "purpose-shifting" (Djaouti, Alvarez, and Jessel 2011), where the players' perceptions deviate from the original intention of the developer, is usually inevitable. Moreover, player experiences are usually very personal and individual: for some players *Alba* is educational whereas for other players the game is only relaxing and fun, as shown in the fact that the topic **Environmental Awareness, Warmth, & Music** is negatively correlated to the topic **Parenting & Fun**.

Another issue with this distinction is that the "serious purpose" and "fun" can co-exist. Here the serious purpose-oriented characteristic, the topic **Environmental Awareness, Warmth, & Music**, is correlated to an entertaining-related topic **Casual & Relaxing**. In terms of individual engagement attributes (Ouariachi et al. 2019), the extracted topics (particularly the task-related topics **Exploring & Information**, **Photographing Wildlife**, and **Achievement & Low-poly Art**) reveal that *Alba* exhibits the attributes **Achievable**, and **Challenging** that are empirically associated to "serious climate-change games". At the same time, the player

reviews also reveal a connection to the attribute **Narrative-driven** (through topics **Game setting**, and **Narrative**) which is empirically associated to "entertaining climate-change games" (Fernández Galeote and Hamari 2021).

The gameful content of the *Alba* also shows such dual characteristics. While the language of the game is simplistic and emphasizes the casualness of play, it does not shy away from using serious vocabulary such as "animalist", and "change" that closely relate to youth environment movements such as *Fridays for Future* (Kühne 2019). The game also shows very accurately the usual targets of environmentalist campaigns (agricultural pesticides, real estate expansion) and why society engages in these activities. The game shows why environmentalist discourse may struggle: new business means more jobs, more tourism, etc.

Based on our analysis, we suggest that the player experiences and perceptions can be emphasized more when it comes to investigating the environment-theme, or climate-change games. As engaging players and raising environmental awareness is the primary focus, instead of analyzing games depending on prior "top-down" classification or discrimination, more attention should be put directly on the player-centered, "bottom-up" perspectives.

Roles of video games in parenting

The topic **Parenting & Fun** is prominently connected to parenting. This evidence in player reviews aligns with how the target players of *Alba* are visible in its design: to resonate with the world of today's kids, the photos are taken with a smartphone, the wildlife guide also happens to be an app on the smartphone, and kids' stream live unusual and meaningful experiences, like saving a stranded dolphin. However the game is also parents-friendly: Alba does not own her smartphone but borrowed one under the supervision of adults (her grandparents), who use the phone to check on Alba every now and then.

This topic has low to negative correlation coefficients with other topics (-0.27 to 0.02), which shows this theme of discussion is separate from others. It is positively connected to the factor **Inactive users**, which is also the most prominent player factor. One possible explanation is that those profiles are owned by parents who, in general, do not actively play games on Steam and maintain their personal profiles but use the account to purchase *Alba* for their kids and write reviews. Such findings underscore the significance of game culture education (Soriani et al. 2021). The increasing use of video games as both an educational tool and a parenting tool illustrates the need for education to adapt to this phenomenon. Video games can offer engaging storytelling and interaction, making them an effective medium for presenting various subjects to children (Soriani 2021). It may be beneficial for the education system to "*teach about computer games as a medium in their own right, just as they teach about film or television or literature*" (Buckingham and Burn 2007).

Notably, climate-change education for children has attracted increasing attention (Seddighi et al. 2020) as they are "*often positioned as the next generation of leaders in whom the public imagines or expects to overcome the legacies of climate and environmental inaction*" (Cutter-Mackenzie and Rousell 2019). However, the approach in this paper cannot directly investigate perceptions of the game by child players as the game reviews are presumably written by the adults. The highlighted design elements can still benefit development of games having similar intentions and purposes.

CONCLUSIONS, LIMITATIONS, AND OPPORTUNITIES

In this work we have analyzed the review texts and corresponding player profiles of the game *Alba* on Steam to examine how digital games can engage players in climate change issues. *Alba* is a game that focuses on protecting and preserving the environment, making it a relevant example for studying the use of digital games in addressing climate change.

Our analysis shows that the players have reflected on and engage with the issue of human-environment relationship in their reviews. Moreover, different types of players are showing different perceptions (e.g., players prominent along the **Creator** factor reflect more on **Environmental Awareness, Warmth, & Music** in their reviews) and may take different perspectives when engaging with such issues. Our findings demonstrate the importance of immersion and narrative for engaging the players. Nevertheless, whether the discovered associations can be further generalized requires further investigation.

The results also reveal other implications such as validity of the conventional categorization of games into "serious" or "entertaining", and role of digital games in parenting. We argue that since the ultimate goal is to engage players, emphasis should be put on player experiences instead of intention-based categorizations. We also highlight the significance of education of game culture.

One potential limitation of this study is that we only consider player discussions on the Steam platform. However, Alba: A Wild Life Adventure is also available on other platforms, such as Nintendo Switch and Xbox among others, that may offer a different game-play experience. As a result, our analysis may be incomplete, as it only considers the experiences of players who play the game on PC. The interactive experiences of players who use consoles are not included in this paper. One the other hand, the game reviews can possess various biases (Stepien et al. 2021). For example, it has been suggested that *Alba* is not capable of representing the complexity of the issue of climate change in real-life (Hubert 2021). However, similar concerns or level of discussions are not found in our text analytical results. Such limitations may affect the generalizability of our findings.

Another potential pitfall of this study is that the player profile data were collected at a single point in time. Player profiles can change over time, as players may alter their interests, preferences, or behaviors. Thus the player type factors extracted from the data may not accurately reflect the current state of the players' profiles. This limitation should be considered when interpreting the results, as the extracted player type factors can only be considered as proxies that may not fully capture the complexity of underlying player characteristics.

In summary, in this research, we we investigated the player experiences of *Alba* from two perspectives: player typologies and game reviews. The results reveal players' reflection on environmental awareness and potential association to e.g., player factors and other topics. We also highlight pertinent implications such as prospective focal points and game culture education. We expect these insights can be a foundation for future academic efforts in the intersection of games and human-environmental relation.

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ENDNOTES

Notes

1. https://www.youtube.com/watch?v=Y4XFXzH1WUo

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