

# Understanding Cultural Values in Designing Persuasive Games for Pro-Environmental Behavior

PATTIYA MAHAPASUTHANON, School of Computing - George Mason University, USA

VIVIAN GENARO MOTTI, School of Computing - George Mason University, USA

Air pollution has caused tremendous environmental health problems around the world. These problems have been prolonged because of the existing carbon emissions from both human-made and nature-made activities, such as transportation and industrialization. To reduce carbon emission, persuasive games can be used, motivating people towards more sustainable ways of living. In this paper, we present two video game prototypes (CleanAirT and CleanAirU) that were designed as persuasive games to increase carbon emission awareness among collectivist and individualist populations. We applied cross-cultural theories and used results from the focus groups to develop design strategies for persuasive applications. With appropriate persuasive techniques, we expect that the targeted populations will reduce activities that generate carbon emissions. Thus, they would become less exposed to environmental health threats.

CCS Concepts: • **Human-centered computing** → **User interface design**; *Interface design prototyping*.

Additional Key Words and Phrases: Cross-Culture, Persuasive Games, Game Design, Sustainability

## ACM Reference Format:

Pattiya Mahapasuthanon and Vivian Genaro Motti. 2024. Understanding Cultural Values in Designing Persuasive Games for Pro-Environmental Behavior. In . ACM, New York, NY, USA, 14 pages. <https://doi.org/XXXXXXXX.XXXXXXX>

## 1 INTRODUCTION

The rising problem of air pollution has created several major health risks to the world population. These health impacts vary from irritations to chronic and respiratory diseases [23]. However, long-term exposure to air pollutants ultimately increases the mortality rate among populations [3]. With around eight million deaths annually linked to the exposure to air pollution worldwide [53], there is a need to increase air pollution awareness. By increasing air pollution awareness, world populations would understand the severity of the issue and how to mitigate related problems. This will result in people performing activities that generate less carbon emission and change their daily behaviors towards pro-environmental choices.

Persuasive technologies have been used to motivate people to achieve certain goals and to change their behaviors. Some of these applications include but are not limited to fitness and health [17, 38], mental health and well-being [7, 55], transportation [32], and energy efficiency [19, 47]. To convince people to change their behaviors, social influences play an important role, enhancing the persuasiveness of technology [33]. Persuasive technologies should be designed with social cues in order to influence behavioral change and benefit society. In other words, such technologies should persuade people to change their courses of action to save the environment and reduce air pollution.

Design strategies for persuasive applications have been studied extensively [6, 9, 10, 27]. Based on psychological theories and models (e.g. Fogg behavior model [16]), persuasive designs have been mostly studied in Western countries

---

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from [permissions@acm.org](mailto:permissions@acm.org).

© 2024 Copyright held by the owner/author(s). Publication rights licensed to ACM.

Manuscript submitted to ACM

[24]. However, persuasive techniques differ across cultures because of several factors, including cognitive and communication styles [26]. For instance, Lu et al. studied the cultural norms that affect persuasive design in food journaling applications and found that Chinese apps emphasized body shape [31]. Consequently, persuasive techniques must be adapted to fit the cultural norms and values.

Cultural dimensions as defined by Hofstede [20] consist of five dimensions which represent the spectrum of cultural norms for national cultures. Culture can be defined with geographical location as languages and places are the factors that transfer the cultural values and norms through generations [49]. In this research, we focus on individualism, a dimension referring to the degree individuals are integrated into societal groups. In individualist cultures, people focus on their individual well-being and interests. Their motivations to change behavior are based on independent benefits [24]. Conversely, people in collectivist cultures focus on the interests of a societal group. They often perform activities that are in line with their cultural norms [20]. With these cultural identities, we focus on conceptualizing design guidelines for individualists and collectivists.

This paper presents two game designs for promoting sustainable behaviors in individualist-collectivist populations inspired by Hofstede's cultural model [22]. Also, we carried out focus group sessions with 16 participants (9 US nationals and 7 Thai nationals). CleanAirT and CleanAirU were designed to help individualist and collectivist populations understand environmental health threats and persuade them to perform sustainable behaviors. The contributions of this paper include (1) an understanding of how cultural values play a role in persuasive games, and (2) cross-cultural design guidelines for persuasive games to reduce carbon emissions.

## 2 RELATED WORK

To engage people with reducing carbon emissions and improve pro-environmental behaviors, persuasive games can be employed. In this section, we provide an overview of the related work on video games for pro-environmental behavior considering cultural contexts in persuasive games.

### 2.1 Game-based Approach for Pro-Environmental Behavior

Gamification has been studied to promote pro-environmental attitudes and behaviors [5, 37, 51]. Centieiro et al. [5] developed a location-based multiplayer game to persuade participants to recycle their wastes. The game was able to change the participants' attitudes and affect their behavior towards environmental consciousness. According to [51], gamified applications were found to promote pro-environmental behaviors. Nonetheless, the gamification strategies need to be adapted to match the levels of motivation and personality of end users.

Overall, environmental attitudes influence environmental behaviors [45]. More specifically, biospheric (pro-environmental) attitude is a strong predictive factor of individuals' willingness to take environmental-friendly actions [46]. Conversely, people with egoistic attitudes tend to voice their environmental health concerns on their own health benefits [43]. These attitudes align with cultural values and social norms as well [42]. With environmental themes, Eco [48] was a game used to test environmental behavioral intention [34]. This work shows that visual communication in game is effective among participants who did not have high environmental awareness.

### 2.2 Culture and Persuasive Games

Video games have been increasingly popular around the world with 2.69 billion games by the end of 2020 [18]. The Southeast Asian region alone had the largest mobile game expansion after COVID-19 [18]. With the rapid growth of games, it is important for game designers to understand cultural norms and persuasive techniques to successfully

increase gamers' engagement [24]. The games that have been developed by Western companies would need to be tailored to fit with the targeted users in the other parts of the world.

Culture in the game context has been studied in commercial aspects, media production, and gamer cultures [25]. The video game culture as stated in [44] is often conceptualized as the descriptions of gamers. However, Pyae [39] indicates that culturalization is needed in game design. In other words, cultural aspects (including characters and traditions) should be considered when designing and developing digital games. The localization of game contents is the adaptation of visual elements and game plots to a given culture [40].

In this paper, we focus on understanding how cultural values affect users' requirements from different cultures. As US and Thai nationals were proved to be on the opposite spectrum of Hofstede's cultural dimensions, we aim to investigate how individualist-collectivist culture affect involving design decisions in persuasive game design.

### 3 METHOD

We conducted four focus group sessions with 16 participants (2 US focus groups and 2 Thai focus groups) to collect requirements regarding persuasive games for pro-environmental behavior. Participants were recruited through word of mouth, flyers, and the author's network after obtaining IRB approval of GMU. The focus groups were conducted in person at George Mason University.

Each focus group consisted of three major activities, including workshop discussion, card activities, and prototype sessions. We first explained the study protocol and obtained the informed consent from study participants. For the workshop discussion, the moderator asked participants opening questions and started the discussion. The focus group questions were grouped into three categories: (1) opening questions about participants' environmental health concerns, (2) questions about air pollution and their usage of technologies, and (3) questions about technological needs. Firstly, participants were asked about their environmental health concerns and how these environmental problems impacted their health. Secondly, participants were asked about their experience with air pollution along with their air pollution tracking behavior. This set of questions were created to understand the technologies used for air pollution awareness. Lastly, participants were asked about the features and requirements for potential persuasive technologies. They were invited to imagine the technology they would like to use to change their behavior towards sustainability.

For the card activities, participants were instructed to write down different aspects of a persona for the persuasive game. They interacted with a 'Post-it' sticky wall pad by placing the sticky notes on it (Figure 1). The moderator and the facilitator periodically asked participants during the activity to elaborate on their answers. For the prototype session, participants were given two sheets of paper with instructions to draw the storyboard on one paper and to sketch the persuasive game on the other paper. They explained their design solutions while sketching. All of these activities lasted around 60 minutes and were video recorded for transcriptions and analysis.

The US participants in the focus group study consisted of 7 females and 2 males. The average age of the US participants was 21 years old (SD = 1.9). All US participants were undergraduate students at George Mason University. On the other hand, Thai participants consisted of 5 females and 2 males (Mean = 36 years old, SD = 6.5). All Thai participants were Thai natives who lived in USA at the time of study. The focus groups for Thai participants were conducted in Thai language.

### 4 RESULTS

Overall, the preliminary results indicate that Thai participants were more familiar with using mobile applications to track the air quality. All Thai participants used mobile applications to monitor their air pollution exposure as they

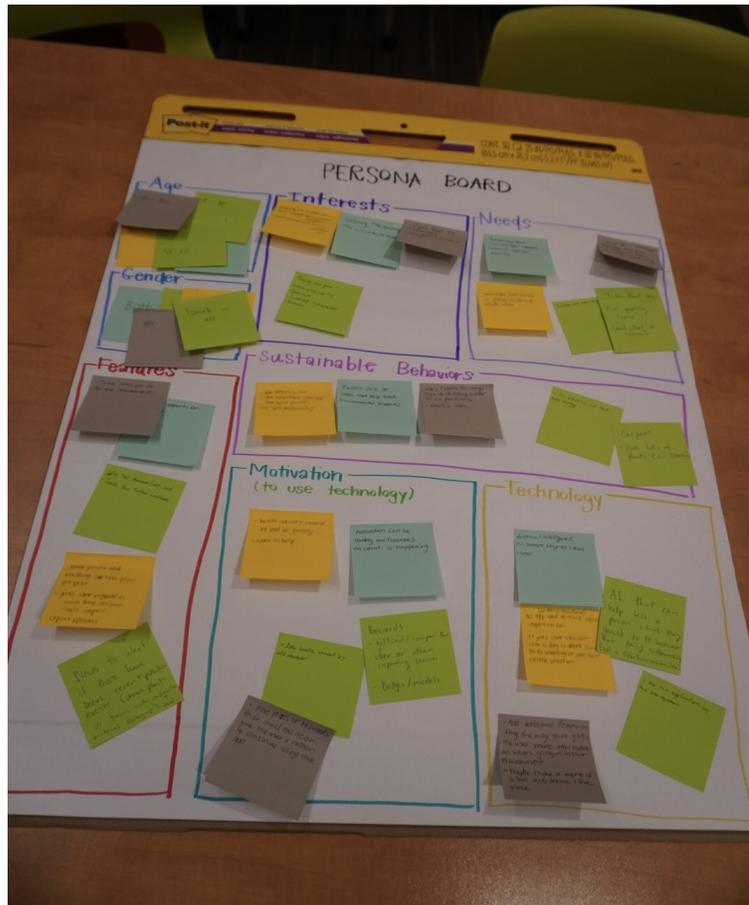


Fig. 1. Persona activity on Post-it sticky pad.

had experiences living in cities with bad air quality before. When discussing about sustainability, the majority of the US participants stated that public transportation was the first thing that came to their mind. Meanwhile, 90% of Thai participants thought of air pollution. Reducing energy consumption and recycling are the main sustainable behaviors for participants from both countries. They expressed their interests in a more sustainable way of living, yet they need persuasive technologies which can monitor their progress and tell them how to live in an eco-friendly way. Increasing environmental responsibility and awareness is the main purpose for these users' personas. Technological solutions need to be implemented to provide educational resources, recommendations and feedback on ecological footprints to users.

The gamified elements were extracted from both persona analysis and the discussion during the focus group sessions. Thai participants focused on team progress and social comparison, while US participants expressed their preferences on individual progress and feedback on their carbon footprint. An example is displayed in Figure 2, P1 from the US participant sample sketched her storyboard for the game where her individual progress was reflected in the forms of plant and pet life scores. These scores change according to the sustainable activities participants do. For example, their

virtual pet is growing healthy based on the footprint scores of the participants. The first page of the games should display higher overview of their performance and personalized goals. As shown in Figure 3, a drawing created by a participant, the carbon reduction should be displayed upon opening the application while the application still needs to provide motivation features to participants.

All focus group participants regardless of culture indicated that incentives need to be added to the game. As for motivations, all participants from both cultures clearly mentioned having incentives and rewards to perform sustainable behaviors. In other words, the interests to use technology are tied to incentives, discounts, and rewards. To encourage sustainable behavior and improve environmental health awareness, US participants preferred physical gift cards, money, or virtual points, while Thai participants preferred discounts or waiving electricity costs. We incorporated these preliminary results to tailor messages, eco-feedback, and features of CleanAir games which will be discussed in the next section.

## 5 DESIGN IMPLICATIONS

In this section, we will explain the theoretical perspectives we used to implicate the design strategies to support the preliminary results from the focus groups. The design strategies from collectivist and individualist cultures will be explained in the subsection 5.1 and subsection 5.2 respectively.

### 5.1 Design Strategies for Collectivist Culture

A collectivist culture refers to a society which values social relationships and harmony within the groups [35]. This means that people in collectivist cultures prefer to communicate with people from their own group. Collectivist cultures are found in many countries in Asia and African continents (e.g. Japan, Korea, Thailand). The characteristics of the collectivist people are strong loyalty for in-groups and concerns for their extend families [20]. With these characteristics, we proposed six design strategies for a persuasive game to motivate sustainable behaviors among people in collectivist culture.

*5.1.1 Team Performance.* Harmony is crucial in the collectivist cultures in order to maintain the dynamics in the group [21]. Collectivists must act according to the interests of the group. Team performance is the design strategy that allows a player to achieve in-group's goals over personal goals. This strategy is for players to form the family circle in the game. The multi-player game feature allows the family to perform the activities with the in-group's goals.

To be able to listen to other in-group members' opinions is crucial among collectivists. Collectivists should be able to form a group opinion on what actions they should perform. The game should provide the feature for a team to report activities they select to do and how many  $CO_2$  emission they save.

Thai focus group participants preferred to have the ability to play an interactive game or to share their achievements with their friends. Collectivist goals may have lied in cultural values as suggested by [26]. Individuals from cultures with social norms of encouraging societal impacts tended to use collaborative technology designed with community goals.

*5.1.2 Third-person Perspectives.* Third-person perspectives or third-person imagery refers to a field and observer imagery [36]. This field and observer imagery means people imagine themselves acting the scene, but at the same time, they also imagine themselves watching the scenes. Collectivist cultural norms are biased towards third-person perspectives [54]. Collectivists focus on others' opinions and tend to have "we" consciousness [21]. To design for the



Fig. 2. A storyboard depicts the drawing from US participant on persuasive game.

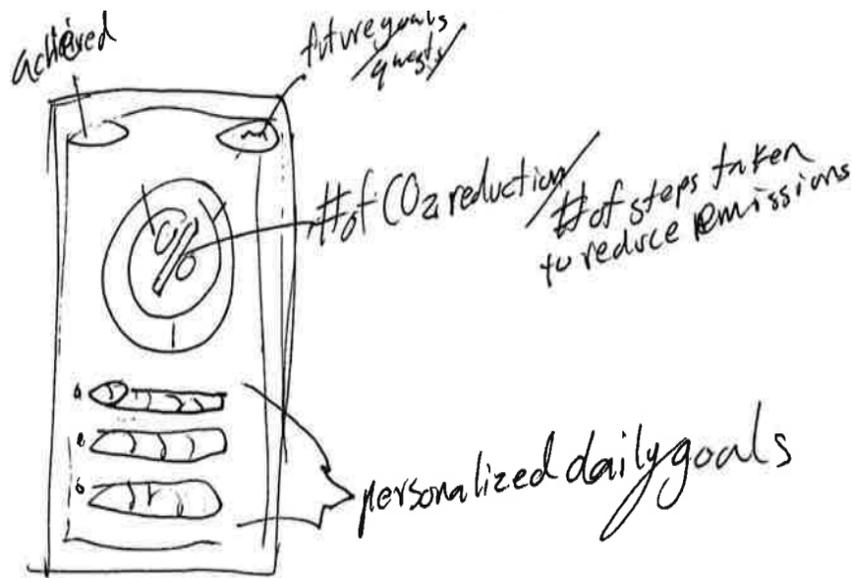


Fig. 3. A sketch displays the home page with dashboard from a US participant.

third person perspectives, it is important to create games that integrate the third person point of view by allowing collectivists to anonymously observe the game actions without playing game by themselves [11].

**5.1.3 Indirect Narratives.** In addition to the third-person perspectives, collectivist cultures are also associated with indirect narratives. In other words, game narratives should contain motivational narratives that are related to environmental concerns [41]. For collectivists, the narratives should present collectivist motivational concerns which present the effects from their behaviors. These concerns can range from reducing carbon footprint to world sustainability. By including such narratives in the game, collectivists can better understand the motivations for their behavior change.

**5.1.4 Socially-dependent Feedback.** Socially-dependent feedback was proved to be effective in communications among collectivists [2]. Fogg suggested the use of positive reinforcement (e.g. praise) to persuade collectivists for behavior change [15]. The negative reinforcement is often used in the collectivist cultures [20]. Collectivists felt shame when they act out of their social norms [20]. Using this as a negative reinforcement has been commonly used as motivation in the collectivist cultures [50]. Because collectivists thrive to be accepted in their social roles, the game can employ socially-dependent feedback, such as having ideal scale for  $CO_2$  emission in the persuasive game. Additionally, visual feedback for collectivists should consist of both positive and negative reinforcement [26].

**5.1.5 Social Comparison.** The social comparison in the collectivist cultures refers to the ability to compare collectivist's own progress. The social comparison with others is one of the characteristics of the collectivists [52]. Individuals from the collectivist cultures tended to seek more social acceptance from others. As a result, relationship is more important than task for collectivists [20]. The game designer combined these perspectives by allowing users to visualize their progress as well as compare their points with the others in their in-group's circle.

*5.1.6 General Characters.* Game characters for collectivists should be similar to their in-group visual appearances and characteristics [29]. However, such characters should be general and anonymous (i.e. using common names). The similarity to the in-group's characters increases trusts among collectivists. The game provides general character which players can choose from. These characters depict the appearance and occupations of the general populations.

## 5.2 Design Strategies for Individualist Culture

An individualist culture refers to social orientation that focuses on the independence of an individual [13]. This means that individuals' concerns are toward their own preferences, interests, and needs. Individualist cultures are commonly found in North America and Europe. The characteristics of the individualist people are independence, no strong ties between individuals, and self consciousness. We proposed six design strategies for a persuasive game to motivate sustainable behaviors among people in the individualist culture.

*5.2.1 Personal Performance.* Opposite of team performance, individualists emphasize on personal interests, goals, and benefits. Preserving individual game dynamics are their main goal [20]. Individualists prefer completing learning tasks over maintaining relationships while playing games. Personal performance design strategy involves game objects which display only their progress. The game provides health point goals which individualist players can collect when they complete each learning task and report the sustainable activities. This provides the milestones individualists could complete as self-evaluation [1].

US focus group participants described how they did not want to share any tasks or goals they accomplished for rewards with their families or friends. They wanted to keep their personalized goals to themselves.

“There could be like a reward and I know some apps will have rewards that are like you can have this. But then you can up things and eventually go for different medals and badges. ” (US, P9)

*5.2.2 First-person Perspectives.* First-person perspectives or first-person imagery refers to acting out any games through specific character [36]. This means that individualists perceive the games through the eyes of the characters. Individualists focus on their personal opinions and tend to have "I" consciousness [20]. To design for the first person perspectives, games should integrate the first person point of view by allowing role-playing and character personalization [11]. The first-person perspectives are associated with egoistic attitudes [30]. It implies that persuasive games should displays individualists' health benefits from reducing CO<sub>2</sub> emission and air pollution.

*5.2.3 Direct Narratives.* With the first-person perspectives, individualist cultures are associated with direct narratives. Game narratives should contain motivational narratives that are related to self concerns [41]. For instance, the concerns can range from improving their own quality of life to their healthcare quality. The game incorporates the online card page which uses direct narratives to explain the health impacts individualists could face if they do not contribute to the reduction of the air pollution.

*5.2.4 Socially-independent Feedback.* Socially-independent feedback should be integrated in the persuasive games for individualists. Critical feedback is widely accepted with people from collectivist cultures [14]. Individualists prefer individual-referenced feedback that allows them to improve self-efficacy. Individualists also felt guilt when they act out of their social norms [20]. Because individualists compare their received feedback with their previous feedback (instead of comparing with other people), the game provides the progress bar which allows them to see how much they have changed in their behaviors over time.

*5.2.5 Degree of Freedom.* Freedom is a key cultural value in individualist cultures [4]. With personal freedom integrated in individualist communities, the game should incorporate alternative player mode allowing players to play games individually instead of in a multi-player mode. Individualists should be able to choose their own self-direction and certain degree of freedom [28].

*5.2.6 Personal Identifiers.* Designing personal characters is important for individualists [29]. In individualist cultures, self-representation is integrated into society. The personal identifiers include unique ID has become prominent in the individualist society [8]. When individualists achieve a certain level in the game, personal identifiers should be presented with ranking. In opposition of the preferences to stay anonymous in collectivist cultures, individualists prefer having unique game identifiers. Customized avatars or characters can also be used in persuasive games to increase individualists' engagements.

## 6 CLEANAIR GAMES

To validate the effects of the design strategies, we designed and developed two versions of the persuasive games (CleanAirT and CleanAirU) to encourage people to perform sustainable behaviors in order to reduce carbon emission. Existing work, such as [12], provides persuasive location-based games to engage children with environmental sensor data. However, such persuasive game was not designed to adapt to different cultural contexts.

CleanAir game prototypes were developed using GDevelop software. GDevelop has the visual scripting feature which allows game designers to create a game logic based on the game objects. With the interactive versions of CleanAir, the game prototypes are deployed online in a website for further validation. All game characters were designed in Inkscape. These three characters include: a physician, a teacher, and an adult woman. These characters were created for the purpose of role-play.

The learning objectives of CleanAir games are to educate users about health impacts from air pollution and to motivate users to perform sustainable behaviors to reduce  $CO_2$  emissions. The main page of the game displays three characters which users can click on one character to continue the stories. Each character represents different game features. The physician character presents major health impacts from air pollution. Players will interact with the online educational card which teaches them about each health risk. The teacher character tells the science stories about the causes of air pollution in the video format. Lastly, the adult woman character navigates through persuasive game plot which aims to persuade players to reduce  $CO_2$  emission by performing sustainable activities. Figure 5 displays the list of sub-activities that users can do while performing that selected activities. These sub-activities represent sustainable behaviors.

## 7 DISCUSSION

This research is preliminary and it needs to be further explored. Although Hofstede's cultural values [22] can be used to explain participants' societal norm, they need to be tested when applying to real-world design settings. With the limited number of participants, our study is preliminary and ongoing. We plan to conduct further studies with a large sample size including diverse demographic backgrounds to investigate how CleanAir games work to persuade users with interaction data.

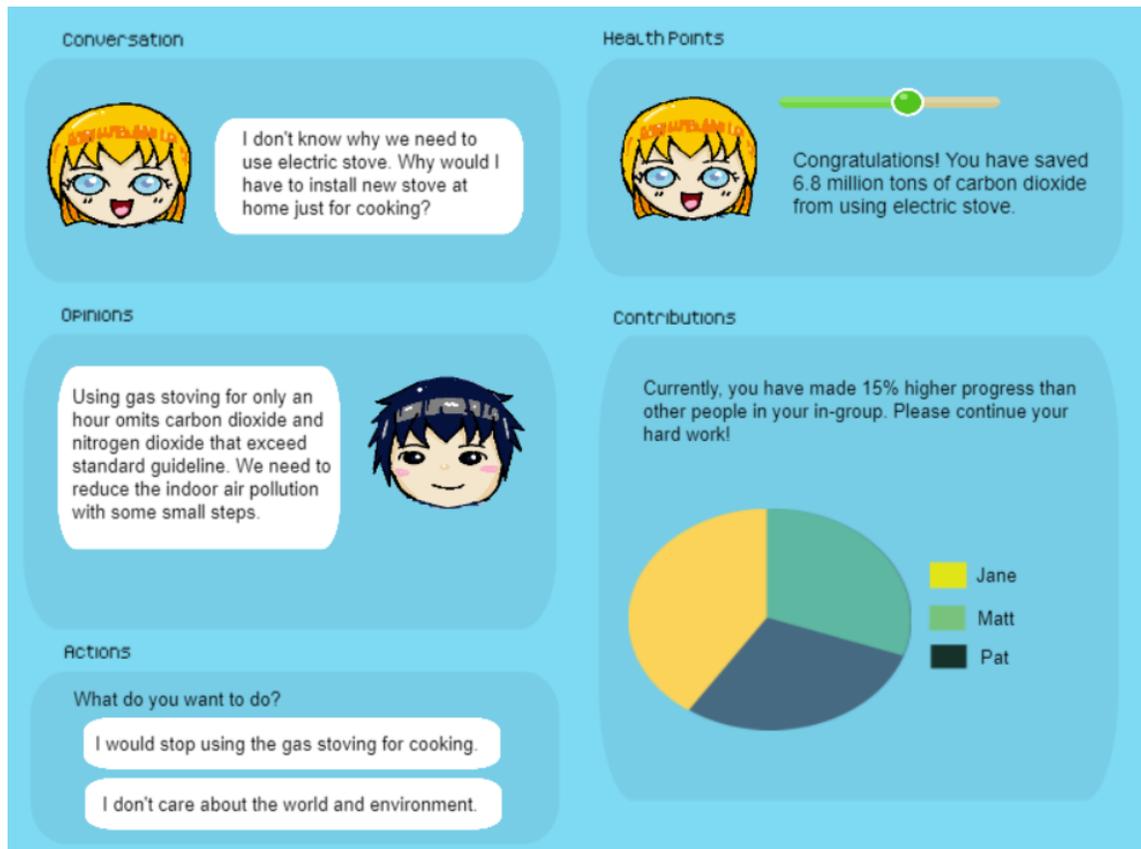


Fig. 4. A game screen for CleanAirT prototype which incorporates the proposed design strategies for collectivists.

## 8 FUTURE WORK

CleanAir games are following an iterative development and testing phases. The prototypes are preliminary with the user evaluation planned. The next steps for CleanAir games are game implementation and user evaluation. We plan to deploy the games to participants from both collectivist and individualist culture. The real world interaction data would allow us to understand which gamified features affect their pro-environmental behavior. This evaluation will ultimately validate our design strategies. Additionally, the feedback we receive would help us to understand the limitations of CleanAir and assess the gameplay experience.

Future iterations for the game development would extend the difficulty levels and include more game activities. These features include fully customizable game characters, health data integration, and visual narratives of the air pollution stories. The games will also be deployed online on the web platform to accommodate further comparative studies between cultures.

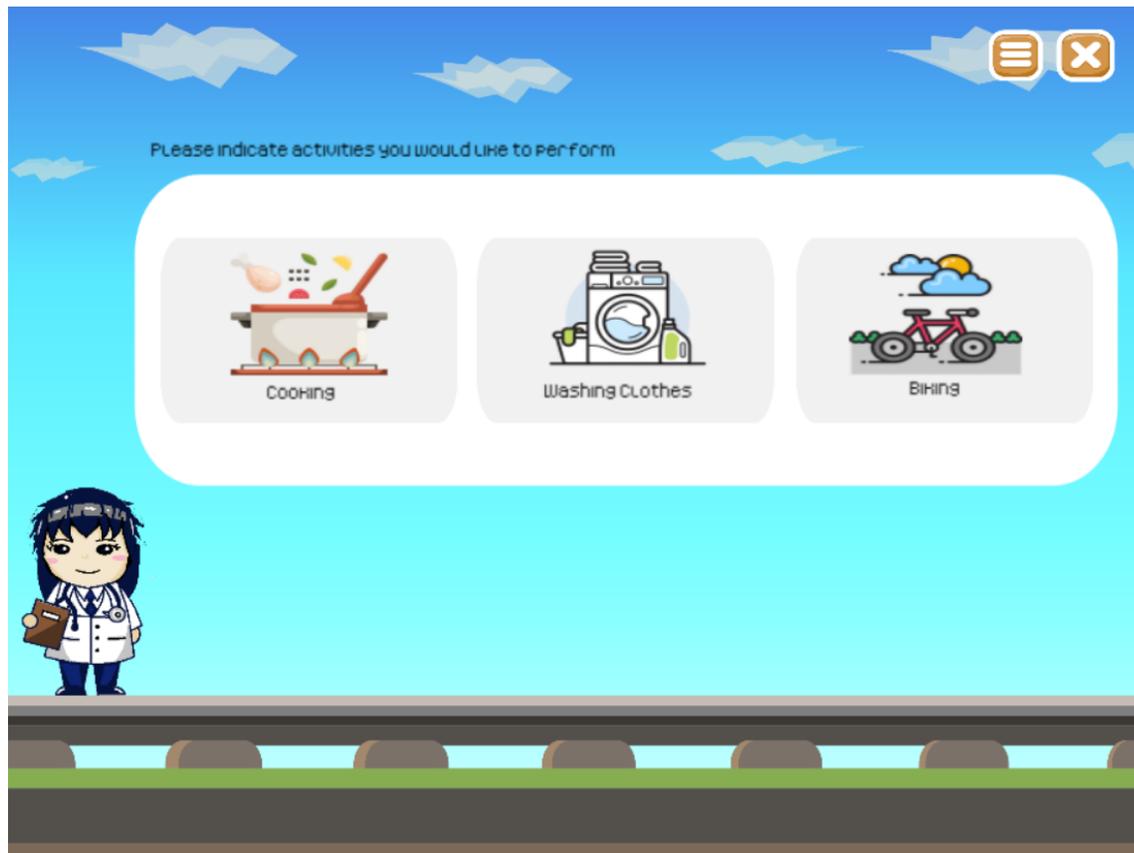


Fig. 5. A Game page asks users about activities they want to perform.

## 9 CONCLUSION

As climate change has become one of the major issues around the world, persuasive games have showed potential to motivate users towards sustainable behaviors. To develop persuasive games that fit with cultural values and norms, in this paper, we presented two versions of CleanAir games which are persuasive games to increase air pollution awareness and change users'  $CO_2$  emissions. We proposed six design strategies for persuasive games in individualist and collectivist cultures. These design strategies are derived from cross-cultural psychology literature and preliminary results from focus groups.

## REFERENCES

- [1] Jennifer L Aaker and Durairaj Maheswaran. 1997. The effect of cultural orientation on persuasion. *Journal of consumer research* 24, 3 (1997), 315–328.
- [2] Malik Almaliki and Raian Ali. 2016. Persuasive and culture-aware feedback acquisition. In *International Conference on Persuasive Technology*. Springer, 27–38.
- [3] Bert Brunekreef and Stephen T Holgate. 2002. Air pollution and health. *The lancet* 360, 9341 (2002), 1233–1242.
- [4] Catherine L Caldwell-Harris and Ayse Aycicegi. 2006. When personality and culture clash: The psychological distress of allocentrics in an individualist culture and idiocentrics in a collectivist culture. *Transcultural psychiatry* 43, 3 (2006), 331–361.

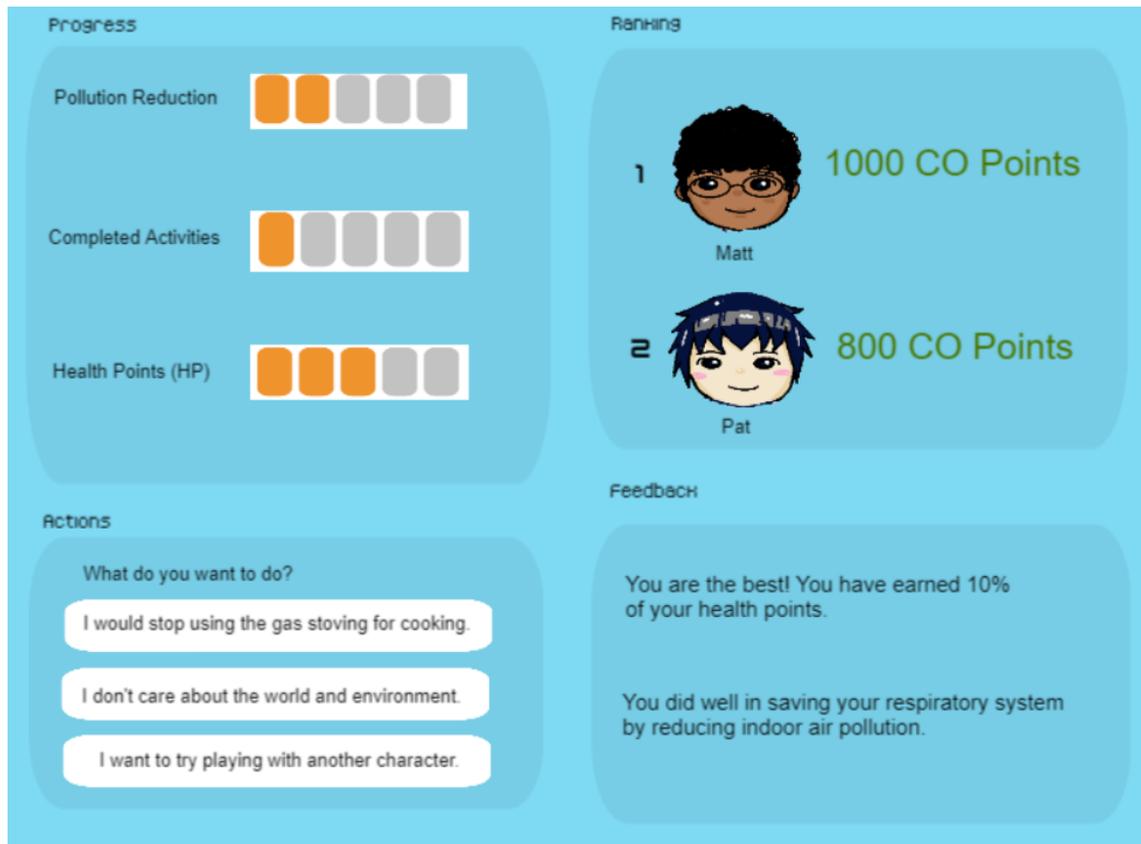


Fig. 6. A game screen for CleanAirU prototype which incorporates the proposed design strategies for individualists.

- [5] Pedro Centieiro, Teresa Romão, and A Eduardo Dias. 2011. A location-based multiplayer mobile game to encourage pro-environmental behaviours. In *Proceedings of the 8th International Conference on Advances in Computer Entertainment Technology*. 1–8.
- [6] Ming-Chuan Chiu, Tsai-Chi Kuo, and Hsin-Ting Liao. 2020. Design for sustainable behavior strategies: Impact of persuasive technology on energy usage. *Journal of Cleaner Production* 248 (2020), 119214.
- [7] Ana Ciocarlan, Judith Mashhoff, and Nir Oren. 2017. Qualitative study into adapting persuasive games for mental wellbeing to personality, stressors and attitudes. In *Adjunct Publication of the 25th Conference on User Modeling, Adaptation and Personalization*. 402–407.
- [8] Rhonda Marisa Clossum. 2010. Information Privacy: A Quantitative Study of Citizen Awareness, Concern and Information Seeking Behavior Related to the Use of the Social Security Number as a Personal Identifier. (2010).
- [9] Sunny Consolvo, Kendra Markle, Kevin Patrick, and Kara Chanasyk. 2009. Designing for persuasion: mobile services for health behavior change. In *Proceedings of the 4th international conference on persuasive technology*. 1–1.
- [10] Johannes Zachrisson Daae and Casper Boks. 2011. Reinforcing preliminary design strategy selection guidelines with insight from Fogg’s behaviour grid. In *Proceedings of the 6th International Conference on Persuasive Technology: Persuasive Technology and Design: Enhancing Sustainability and Health*. 1–7.
- [11] Alena Denisova and Paul Cairns. 2015. First person vs. third person perspective in digital games: do player preferences affect immersion?. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. 145–148.
- [12] Andrew Dickinson, Mark Lochrie, and Paul Egglestone. 2015. UKKO: enriching persuasive location based games with environmental sensor data. In *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play*. 493–498.
- [13] Mohan J Dutta-Bergman and William D Wells. 2002. The values and lifestyles of idiocentrics and allocentrics in an individualist culture: A descriptive approach. *Journal of Consumer Psychology* 12, 3 (2002), 231–242.

- [14] P Christopher Earley, Cristina B Gibson, and Chao C Chen. 1999. “How did I do?” versus “How did we do?” Cultural contrasts of performance feedback use and self-efficacy. *Journal of cross-cultural psychology* 30, 5 (1999), 594–619.
- [15] Brian J Fogg. 2002. Persuasive technology: using computers to change what we think and do. *Ubiquity* 2002, December (2002), 2.
- [16] Brian J Fogg. 2009. A behavior model for persuasive design. In *Proceedings of the 4th international Conference on Persuasive Technology*. 1–7.
- [17] Thomas Fritz, Elaine M Huang, Gail C Murphy, and Thomas Zimmermann. 2014. Persuasive technology in the real world: a study of long-term use of activity sensing devices for fitness. In *Proceedings of the SIGCHI conference on human factors in computing systems*. 487–496.
- [18] N Gilbert. 2020. Number of gamers worldwide 2021/2022: Demographics, statistics, and predictions.
- [19] Jaap Ham, Cees Midden, and Femke Beute. 2009. Can ambient persuasive technology persuade unconsciously? Using subliminal feedback to influence energy consumption ratings of household appliances. In *Proceedings of the 4th International Conference on Persuasive Technology*. 1–6.
- [20] Geert Hofstede. 1997. Organization culture. *The IBM handbook of organizational behavior* (1997), 193–210.
- [21] Geert Hofstede. 2011. Dimensionalizing cultures: The Hofstede model in context. *Online readings in psychology and culture* 2, 1 (2011), 2307–0919.
- [22] Geert H Hofstede, Gert Jan Hofstede, and Michael Minkov. 2005. *Cultures and organizations: Software of the mind*. Vol. 2. McGraw-hill New York.
- [23] Marilena Kampa and Elias Castanas. 2008. Human health effects of air pollution. *Environmental pollution* 151, 2 (2008), 362–367.
- [24] Rilla Khaled, Pippin Barr, Robert Biddle, Ronald Fischer, and James Noble. 2009. Game design strategies for collectivist persuasion. In *Proceedings of the 2009 ACM SIGGRAPH Symposium on video games*. 31–38.
- [25] Rilla Khaled, Pippin Barr, Ronald Fischer, James Noble, and Robert Biddle. 2006. Factoring culture into the design of a persuasive game. In *Proceedings of the 18th Australia conference on Computer-Human Interaction: Design: Activities, Artefacts and Environments*. 213–220.
- [26] Hiroaki Kimura and Tatsuo Nakajima. 2010. EcoIsland: a persuasive application to motivate sustainable behavior in collectivist cultures. In *Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries*. 703–706.
- [27] Hiroaki Kimura and Tatsuo Nakajima. 2011. Designing Persuasive Applications to Motivate Sustainable Behavior in Collectivist Cultures. *PsychNology Journal* 9, 1 (2011).
- [28] Catherine Konsky, Mariko Eguchi, Janet Blue, and Suraj Kapoor. 2000. Individualist-collectivist values: American, Indian and Japanese cross-cultural study. *Intercultural Communication Studies* 9, 1 (2000), 69–84.
- [29] Michel Laroche and Seong-Yeon Park. 2013. Recent advances in globalization, culture and marketing strategy: Introduction to the special issue. , 955–957 pages.
- [30] Béatrice Longuenesse. 2019. *The First Person in Cognition and Morality*. Oxford University Press.
- [31] Xi Lu, Yunan Chen, and Daniel A. Epstein. 2021. How Cultural Norms Influence Persuasive Design: A Study on Chinese Food Journaling Apps. In *Designing Interactive Systems Conference 2021*. 619–637.
- [32] Pattiya Mahapasathanon, Niloofar Kalantari, and Vivian Genaro Motti. 2021. Evaluating an mhealth application: Findings on visualizing transportation and air quality. In *Diversity, Divergence, Dialogue: 16th International Conference, iConference 2021, Beijing, China, March 17–31, 2021, Proceedings, Part I* 16. Springer, 301–312.
- [33] Cees Midden and Jaap Ham. 2018. Persuasive Technology to Promote Pro-Environmental Behaviour. *Environmental psychology: an introduction* (2018), 283–294.
- [34] Melissa M Moore and Janet Z Yang. 2020. Using eco-guilt to motivate environmental behavior change. *Environmental Communication* 14, 4 (2020), 522–536.
- [35] Charlotte Nickerson. 2021. Understanding collectivist cultures. *Simply Psychology* (2021).
- [36] Zachary Adolph Niese, Richard P Eibach, and Lisa K Libby. 2022. Picturing yourself: a social-cognitive process model to integrate third-person imagery effects. *Journal of Cognitive Psychology* 34, 1 (2022), 24–44.
- [37] Dilay Seda Özgen, Yasemin Afacan, and E Surer. 2020. Save the Planets: A Multipurpose Serious Game to Raise Environmental Awareness and to Initiate Change. In *Proceedings of the 6th EAI International Conference on Smart Objects and Technologies for Social Good*. 132–137.
- [38] Stephen Purpura, Victoria Schwanda, Kaiton Williams, William Stubler, and Phoebe Sengers. 2011. Fit4life: the design of a persuasive technology promoting healthy behavior and ideal weight. In *Proceedings of the SIGCHI conference on human factors in computing systems*. 423–432.
- [39] Aung Pyae. 2018. Understanding the role of culture and cultural attributes in digital game localization. *Entertainment computing* 26 (2018), 105–116.
- [40] Aung Pyae and Leigh Ellen Potter. 2017. Does culture matter? Understanding the impact of cultural contents in digital games on older people. In *Proceedings of the 29th Australian Conference on Computer-Human Interaction*. 607–611.
- [41] Zachary Schrank and Katrina Running. 2018. Individualist and collectivist consumer motivations in local organic food markets. *Journal of Consumer Culture* 18, 1 (2018), 184–201.
- [42] P Wesley Schultz. 2001. The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of environmental psychology* 21, 4 (2001), 327–339.
- [43] P Wesley Schultz. 2002. Environmental attitudes and behaviors across cultures. *Online readings in psychology and culture* 8, 1 (2002), 2307–0919.
- [44] Adrienne Shaw. 2010. What is video game culture? Cultural studies and game studies. *Games and culture* 5, 4 (2010), 403–424.
- [45] Paul C Stern and Thomas Dietz. 1994. The value basis of environmental concern. *Journal of social issues* 50, 3 (1994), 65–84.
- [46] Paul C Stern, Thomas Dietz, and Gregory A Guagnano. 1995. The new ecological paradigm in social-psychological context. *Environment and behavior* 27, 6 (1995), 723–743.
- [47] Valerie Sugarman and Edward Lank. 2015. Designing persuasive technology to manage peak electricity demand in ontario homes. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. 1975–1984.

- [48] Peter Irtmann Teacher and Jeff Grubb Venture Beat. [n. d.]. ECO. <https://play.eco/>
- [49] Harry C Triandis. 2001. Individualism-collectivism and personality. *Journal of personality* 69, 6 (2001), 907–924.
- [50] Harry C Triandis. 2018. *Individualism and collectivism*. Routledge.
- [51] Leen Van Houdt, Martijn Millecamp, Katrien Verbert, and Vero Vanden Abeele. 2020. Disambiguating preferences for gamification strategies to motivate pro-environmental behaviour. In *Proceedings of the annual symposium on computer-human interaction in play*. 241–253.
- [52] Katherine White and Darrin R Lehman. 2005. Culture and social comparison seeking: The role of self-motives. *Personality and Social Psychology Bulletin* 31, 2 (2005), 232–242.
- [53] WHO. 2024. Air Pollution. [https://www.who.int/health-topics/air-pollution#tab=tab\\_1](https://www.who.int/health-topics/air-pollution#tab=tab_1)
- [54] Sukki Yoon and Patrick T Vargas. 2006. A Cultural Third-Person Effect: Actual and Expected Effects of Source Expertise Among Individualists and Collectivists. *Creating Images and the Psychology of Marketing Communication* (2006), 171.
- [55] Renwen Zhang, Kathryn E. Ringland, Melina Paan, David C. Mohr, and Madhu Reddy. 2021. Designing for Emotional Well-being: Integrating Persuasion and Customization into Mental Health Technologies. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 1–13.

Received 1 September 2024; revised 6 November 2024; accepted 6 November 2024