DATA PAPER

# A Multinational Data Set of Game Players' Behaviors in a Virtual World and Environmental Perceptions

Quan-Hoang Vuong[1], Manh-Toan Ho[1†], Viet-Phuong La[1,2], Tam-Tri Le[1,2], Thanh Huyen T. Nguyen[1,2] & Minh-Hoang Nguyen[1†]

[1]Centre for Interdisciplinary Social Research, Phenikaa University, Yen Nghia Ward, Ha Dong District, Hanoi 100803, Vietnam

[2]A.I. for Social Data Lab, Vuong & Associates, Dong Da District, Hanoi 100000, Vietnam



**Keywords:** Environmental psychology; Virtual environment; Game-playing behaviors; Multinational; UN compliance design

Citation: Vuong, Q.H. et al.: A multinational data set of game players' behaviors in a virtual world and environmental perceptions. Data Intelligence 3(4), 606-630 (2021). doi: 10.1162/dint_a_00111

Received: June 22, 2021; Revised: August 27, 2021; Accepted: October 8, 2021

## ABSTRACT

Video gaming has been rising rapidly to become one of the primary entertainment media, especially during the COVID-19 pandemic. Playing video games has been reported to associate with many psychological and behavioral traits. However, little is known about the connections between game players' behaviors in the virtual environment and environmental perceptions. Thus, the current data set offers valuable resources regarding environmental worldviews and behaviors in the virtual world of 640 Animal Crossing: New Horizons (ACNH) game players from 29 countries around the globe. The data set consists of six major categories: 1) socio-demographic profile, 2) COVID-19 concern, 3) environmental perception, 4) game-playing habit, 5) in-game behavior, and 6) game-playing feeling. By making this data set open, we aim to provide policymakers, game producers, and researchers with valuable resources for understanding the interactions between behaviors in the virtual world and environmental perceptions, which could help produce video games in compliance with the United Nations (UN) Sustainable Development Goals.

† Corresponding author: Minh-Hoang Nguyen (Email: hoang.nguyenminh@phenikaa-uni.edu.vn; ORCID: 0000-0002-7520-3844) and Manh-Toan Ho (Email: toan.homanh@phenikaa-uni.edu.vn; ORCID: 0000-0002-8292-0120).

## 1. INTRODUCTION

Nowadays, video gaming is the favorite entertainment of both young and older people around the world. During the Covid-19 pandemic, while many industries are shaken, the video game industry is rising rapidly in terms of game players and revenue. As people worldwide were forced to stay at home for public health safety, video games exploded in popularity, with an estimate of 2.7 billion game players worldwide in 2020 [1]. In the first nine months of 2020, the number of video games sold in the United States surged 23% from the same period of last year to 29.4 billion [2]. The global video games market was expected to reach US$ 179.7 billion in 2020, increasing 20% compared to 2019 [3].

The relationship between playing video games with gamers' behavior and perception has been a pivotal topic of many researchers worldwide. Playing video games have been reported to improve the problem-solving skill of children [4] or enhance the visual short-term memory of action video game players [5]. This development of behavior and perception is dependent on the genre of the video game being played. For example, real-time strategy players perform better in task switching and multiple object tracking than shooter players [6]; or the action video game focuses on developing the domains of top-down attention and spatial cognition [7], improving the attentional control [8], and supports to enhance complex mathematical skills [9]. In addition, the genre of video games affects the increase or decrease of grey matter within the hippocampus of players [10]. Therefore, adolescents who spend more time playing games than learning activities with the proper navigation strategy can still achieve high academic grades [11].

Many educational video games have been designed, and gamification has played an important role in students' academic performance thanks to the impacts of video games on perception development and academic performance [12, 13]. For example, an educational video game called "Knowledge Battle" was found to drastically improve math scores for students with low math skills [14]. Another study about the impact of The Cherry Orchard video game on players' reading comprehension also reported the more positive reading comprehension test result of students who directly played the game than those who simply read the printed version of the game [15]. Furthermore, the students who set specific goals when playing educational video games have more fun and receive knowledge easily [16].

However, the games designed for educational purposes are less popular than commercial games designed solely for entertainment [17]. With the huge communities of game players, commercial video games can be the potential tools for environmental education. Especially because 2021 is expected to be the turning point for tackling climate change issues [18], enhancing people's environmental perception through commercial games can help in the fight against climate change. Nevertheless, there are limited studies and data sets about the association between game players' in-game environmental interaction and environmental perception. The data set of Johannes, Vuorre, and Przybylski [19] is one of the few data sets about game players' behavior and perception; however, its scope is solely restricted to the well-being and motivation aspects.

The authors, thus, present a data set to examine the relationship between game-playing, in-game behaviors, and environmental perceptions to fill in the gap of lacking resources for studying the effects of commercial video games. The data set includes six categories demonstrating different aspects of game players: 1) socio-demographic profiles, 2) COVID-19 concerns, 3) game-playing experience, 4) in-game environmental interaction, 5) game-playing emotions, and 6) environmental perceptions.

Several studies have been conducted using the current data set [20, 21]. For example, Vuong et al. [20] found associations between in-game behaviors and environmental perceptions. They suggested policymakers develop a guideline for commercial games to incorporate pro-environmental elements compliant with the United Nations (UN) sustainable development goals. Making the current data set open can help worldwide researchers replicate and validate the publications' results, strengthening the results' integrity and reliability and improving scientific transparency [22]. Furthermore, it can facilitate the open review and open dialogue within the discipline [23]. Making scientific research less costly is another benefit of this data set [24].

In addition, the current data set is also prospected to help researchers better understand how behaviors in the virtual world associate with real-life perceptions and discover insights helpful for both commercial game developers and policymakers in developing video games with "UN-compliance" designs.

The data article is structured into five primary sections. The first section, or Introduction, implies the background and brief literature review of the topic related to the current data set. The second section, or Methodology, indicates procedures of collecting, curating and validating the data set. An exemplary analysis using Bayesian analysis in corporation with the Monte Carlo Markov Chain (MCMC) technique is performed in the third section, or Exemplary Data Analysis, to validate the data set. Next, the FAIR compliant repository that stores the data set and its description for dissemination and reusing the data is described. Finally, the current data set's values, applications, and limitations are delineated in the last section, or Usage Notes and Conclusion.

## 2. METHODOLOGY

We chose Nintendo's Animal Crossing: New Horizons (ACNH) game players as the survey targets. ACNH is a typical life-simulation game that hit the market in March 2020 when almost everyone around the globe was forced to stay at home. The game was swiftly sold to more than 13.4 million copies in the first six weeks [25, 26]. When playing ACNH, the players immerse into an idyllic and deserted island with the responsibilities of building their island by developing the ecosystem and community. Their daily activities are related to the environment, such as growing flowers, planting fruit, catching fish, snaring bugs, or submitting the fish and bugs to the museum. The interaction is so lifelike that People for the Ethical Treatment of Animals (PETA) has protested against the in-game fishing behaviors [27].

### *2.1 Survey Design*

The survey collection included five phases: (1) questionnaire design, (2) survey collection, (3) data validation, (4) data set generation, and (5) data analysis. First of all, the questionnaire was designed by referring to the in-game activities of ACNH and the established scales of prior studies. There are six major sections on which the questionnaire focuses.

1) *Socio-demographic profile*: This section includes basic information of the game players, such as origin, biological sex, age, highest education level, ethnicity, marital status, and employment status. Besides these factors, we also added a question that whether game players had a pet/a garden in real life.
2) *COVID-19 concern*: When we designed the questionnaire, people around the globe might be mentally suffering from the effects of isolation and social distance due to the COVID-19 pandemic, which might adjust their game-playing behaviors. Therefore, we attempted to examine whether game players were affected by isolation or social distancing and their anxiety due to COVID-19.
3) *Environmental perceptions*: For examining the environmental perception of game players, the well-known revised New Environmental Paradigm Scale of Dunlap, Van Liere, Mertig, and Jones [28] was used.
4) *Game playing practice*: Four questions were designed to explore the habits of game players in terms of game playing experience, the genre of video games, game playing frequency, and daily game playing frequency.
5) *In-game behavior*: Based on the direct experience of playing ACNH, two authors (M.T.H. and M.H.N.) designed questions covering the most prominent activities associated with environmental values. Then, the questions were adjusted according to the feedbacks of ACNH game players during the pilot collection.
6) *Game playing feeling*: We employed the core questions of The Game Experience Questionnaire [29]. Specifically, IJsselsteijn et al. [29] divided the questionnaire into three primary modules: the core module, the social presence model, and the post-game module. Since our purpose was to examine the experience while playing ACNH, we only utilized the core module's questions.

The survey was conducted from 15 to 30 May 2020 using Google Form in the communities of ACNH players on Discord, Reddit, and Facebook platforms. Google Form was chosen as the survey tool because of its user-friendly interfaces, confidentiality, and easy distribution method (using shared URL). Before making the questionnaire public, the authors had contacted each community's admin or moderator team to ask for permission to distribute the questionnaire. We carefully explained all the purpose and contents of the survey and ensured that they meet the rules and standards of the community. The post with a clear indication of research purposes, contents, and URL to the online questionnaire was only posted in the community after the admin or moderator team validated and granted permission. The respondents were asked to read a consent form and agree with the terms before participating in the survey. Also, we provided US$5 Amazon gift cards to the first hundred respondents and US2$ Amazon gift cards to the next two hundred respondents as thank-you presents. Finally, 640 respondents from 29 countries responded to the questionnaire.

Before data collection was conducted on a large scale, the authors performed a pilot survey with 15 students in Japan, Singapore, the USA, and Vietnam to test the questionnaire. Based on the participants' feedback and responses, the questions were modified for better clarity and accuracy. To limit the missing data, we made all questions mandatory, which means that the respondents could not proceed further or submit the survey without filling in all the questions. For supporting survey participants, the authors provided contact information to inquire while filling in the questionnaire immediately. We received several inquiries from respondents and answered them satisfactorily.

We officially announced that the survey collection had ended in all the distributed communities when the survey was completed. The data were downloaded from Google Form under two formats: Microsoft Excel spreadsheet (.xls) and comma-separated values (.csv). Next, we cleaned and disambiguated responses that were not clear. All the variables were also coded during this process for later use. Finally, the data were validated through visualization and statistical analyses.

### *2.2 Data Sample*

In 640 surveyed respondents, female game players occupied 64.38% (412/640). The respondents mainly came from the US/Canada (55%), Asia (28.13%), and the European Union (EU) (14.38%), while the remaining 2.5% (16/460) were from other regions. These figures were consistent with the data about ethnicity while the White and the Asian accounted for 54.22% and 31.25% respondents, respectively. More than half of the sample were undergraduate students (52.5%). Regarding their marital status, 61.09% of respondents were single and never married. In terms of age, most respondents were relatively young, ranging between 18 and 30 years old (72.8%, 466/640); the youngest player was only 11 years old, and the oldest player was 55 (Figure 1A). 63% of game players had a stable job (403/640) (Figure 1B), and only 13.44% did not have a pet or a garden.

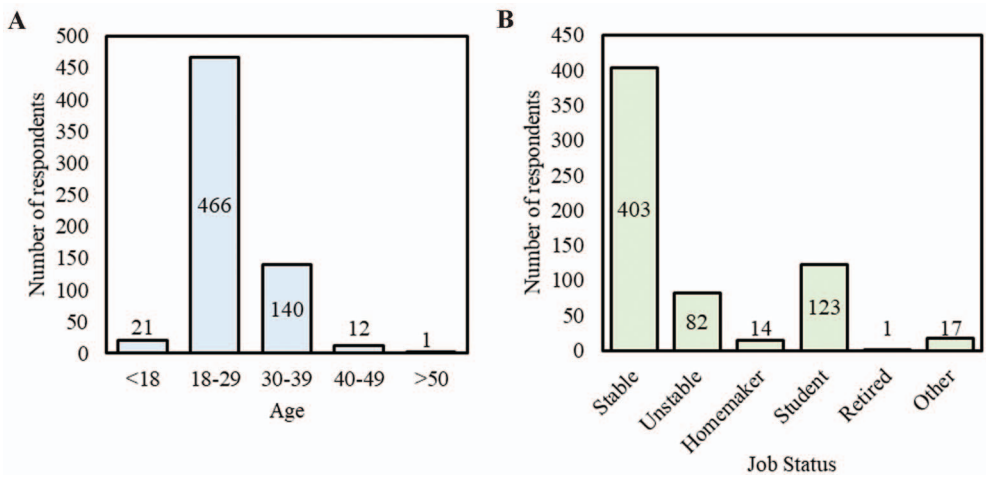


**Figure 1.** Visual illustrations of respondents' information.

### *2.3 Response Coding*

The survey consisted of six main categories: *socio-demographic profile*, *COVID-19 concern*, *environmental perception*, *game-playing habit*, *in-game behavior*, and *game-playing feeling*. In this sub-section, we present how the variables of each category were coded along with their explanation. All the tables below show five columns that represent the coding and characteristics of the variables. For categorical variables, five columns include "variable", "explanation", "level", "frequency", and "proportion". In contrast, five columns of numerical variables include "variable", "explanation", "range", "mean", and "standard deviation". The "variable" column indicates how the variables were coded in the .csv file, while the "explanation" column exhibits the brief description of the corresponding variable.

#### 1) Socio-demographic Profile

The *socio-demographic profile* category includes nine variables: eight categorical variables and one numerical variable (Table 1). The categorical variables from *A1_1* to *A8* (except for variable *A5*) represent the nationality, region, biological sex, the highest level of education, owning a pet or garden, ethnicity, marital status, and employment status, respectively. Notably, we used *A1_2* to demonstrate the region in which the respondent was living because it was generated from the *A1_1* variable. Variable *A5* is a numerical variable that indicates the age of the respondent.

**Table 1.** Description of variables related to *socio-demographic profile*.

| Categorical variables | | | | |
|---|---|---|---|---|
| Variable | Explanation | Level | Frequency | Proportion |
| *A1_1* | Nationality | NA | NA | NA |
| *A1_2* | Region, which is generated from variable A1_1 | Asia | 180 | 28.13% |
| | | EU | 92 | 14.38% |
| | | Other | 16 | 2.50% |
| | | US/Canada | 352 | 55.00% |
| *A2* | Biological sex | Female | 412 | 64.38% |
| | | Male | 228 | 35.63% |
| *A3* | The highest level of education | Primary school | 1 | 0.16% |
| | | Secondary school | 13 | 1.88% |
| | | High school | 128 | 20.03% |
| | | Undergraduate school | 336 | 52.58% |
| | | Graduate school and higher | 162 | 25.35% |
| A4 | Whether the game player has a pet or a garden or both | A pet | 215 | 33.59% |
| | | A garden | 67 | 10.47% |
| | | Both | 272 | 42.50% |
| | | None | 86 | 13.44% |
| *A6* | Ethnicity | Asian | 200 | 31.25% |
| | | Black or African American | 29 | 4.53% |
| | | Hispanic or Latino | 40 | 6.25% |
| | | Native American or American Indian | 7 | 1.09% |
| | | Pacific Islander | 8 | 1.25% |
| | | White | 347 | 54.22% |
| | | Other | 9 | 1.41% |

| Categorical variables | | | | |
|---|---|---|---|---|
| Variable | Explanation | Level | Frequency | Proportion |
| *A7* | Marital status | Single, never married | 391 | 61.09% |
| | | Married or domestic partnership | 237 | 37.03% |
| | | Widowed | 3 | 0.47% |
| | | Divorced | 6 | 0.94% |
| | | Separated | 3 | 0.47% |
| *A8* | Employment status | Stable | 403 | 62.97% |
| | | Unstable | 82 | 12.81% |
| | | Homemaker | 14 | 2.19% |
| | | Student | 123 | 19.22% |
| | | Retired | 1 | 0.16% |
| | | Other | 17 | 2.66% |

| Numerical variable | | | | |
|---|---|---|---|---|
| Variable | Explanation | Range | Mean | Standard Deviation |
| *A5* | Age | 11–55 | 26.1 | 5.56 |

**2) COVID-19 concern**

The second category contains three variables that are related to the respondent's concerns about the COVID-19 pandemic (Table 2). All the variables are categorical. The *B1* variable was created from the question "Are you currently self-isolated/social distancing?". In contrast, the *B2* variable was created by asking participants the question, "How long have you been self-isolated/social distancing?". The last variable–*B3*–represents the respondent's anxiety about the COVID-19 outbreak, which was measured by four levels: "not at all", "a little", "worried", and "very worried".

**Table 2.** Description of variables related to *COVID-19 concern*.

| Categorical variables | | | | |
|---|---|---|---|---|
| Variable | Explanation | Level | Frequency | Proportion |
| *B1* | Whether the respondent is self-isolated/ social distancing or not | Yes | 499 | 77.97% |
| | | No | 141 | 22.03% |
| *B2* | The respondent's length of being self-isolated/ social distancing | No self-isolation/social distancing | 111 | 17.34% |
| | | Less than a week | 19 | 2.97% |
| | | More than a week | 20 | 3.13% |
| | | More than two weeks | 42 | 6.56% |
| | | More than three weeks | 45 | 7.03% |
| | | More than a month | 403 | 62.97% |
| *B3* | The anxiety of the respondent about COVID-19 | Not at all | 19 | 2.97% |
| | | A little | 148 | 23.13% |
| | | Worried | 319 | 49.84% |
| | | Very worried | 154 | 24.06% |

### 3) Environmental perception

The third category is about the environmental perception of the participant. For assessing the environmental perceptions, we employed the revised New Environmental Paradigm (NEP) scale. The scale has been widely applied across disciplines and populations to gauge the pro-environmental orientation [30]. Despite several criticisms on using the revised NEP scale [31, 32], Hawcroft and Milfont [30] suggested that the NEP scale can still be used as a standardized measure of environmental attitude. Nevertheless, the use of the NEP scale should be kept consistent with the 15-item version of [28], so we did not make any modifications to the scale. The revised NEP scale consists of 15 items that evaluate five different worldviews about the environmental paradigm: the reality of limits to growth, anti-anthropocentrism, the fragility of nature's balance, rejection of exemptionalism, and the possibility of an eco-crisis.

The respondents were asked to report their level of agreement towards 15 statements based on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) (Table 3). The variables *C1* to *C15* were coded according to the order of 15 items provided by Dunlap et al. [28]. As they noted, "agreement with the eight odd-numbered items and disagreement with the seven even-numbered items indicate pro-NEP responses", so we also reversed the Likert scale's direction of variables *C2*, *C4*, *C6*, *C8*, *C10*, *C12*, and *C14*. The 5-point Likert scale of these variables ranges from 1 (strongly agree) to 5 (strongly disagree).

**Table 3.** Description of variables related to *environmental perception*.

| Numerical variable | | | | |
|---|---|---|---|---|
| Variable | Explanation | Range | Mean | Standard Deviation |
| *C1* | Statement: "We are approaching the limit of the number of people the earth can support" | 1. Strongly disagree<br>2. Disagree | 3.78 | 0.94 |
| *C3* | Statement: "When humans interfere with nature, it often produces disastrous consequences" | 3. Unsure<br>4. Agree | 4.10 | 0.87 |
| *C5* | Statement: "Humans are seriously abusing the environment" | 5. Strongly agree | 4.33 | 0.86 |
| *C7* | Statement: "Plants and animals have as much right as humans to exist" | | 4.31 | 0.88 |
| *C9* | Statement: "Despite our special abilities, humans are still subject to the laws of nature" | | 4.28 | 0.84 |
| *C11* | Statement: "The Earth is like a spaceship with very limited room and resources" | | 3.69 | 1.07 |
| *C13* | Statement: "The balance of nature is very delicate and easily upset" | | 3.87 | 0.98 |
| *C15* | Statement: "If things continue on their present course, we will soon experience a major ecological catastrophe" | | 4.34 | 0.84 |
| *C2* | Statement: "Humans have the right to modify the natural environment to suit their needs" | 1. Strongly agree<br>2. Agree | 2.99 | 1.08 |
| *C4* | Statement: "Human ingenuity will ensure that we do not make the Earth unlivable" | 3. Unsure<br>4. Disagree | 2.70 | 1.05 |
| *C6* | Statement: "The Earth has plenty of natural resources if we just learn how to develop them" | 5. Strongly disagree | 2.15 | 1.06 |

| Numerical variable | | | | |
|---|---|---|---|---|
| Variable | Explanation | Range | Mean | Standard Deviation |
| *C8* | Statement: "The balance of nature is strong enough to cope with the impacts of modern industrial nations" | | 3.25 | 1.30 |
| *C10* | Statement: "The so-called 'ecological crisis' facing humankind has been greatly exaggerated" | | 3.72 | 1.28 |
| *C12* | Statement: "Humans were meant to rule over the rest of nature" | | 3.57 | 1.31 |
| *C14* | Statement: "Humans will eventually learn enough about how nature works to be able to control it" | | 3.00 | 1.23 |

**4) Game-playing habit**

The *game-playing habit* category comprises seven variables related to the game-playing routines of respondents (Table 4). Six variables, *D1* to *D6,* were structured based on multiple-choice questions; only variable *D7* was generated based on an open-ended question. Among seven variables, the first four variables exhibit the general game playing habits: 1) the length that the respondent has been playing video games (*D1*), the genre of video games that the respondent usually plays (*D2*), the game playing frequency of the respondent (*D3*), and the average hours that the respondent spent playing the game a day in the last two weeks by the survey (*D4*). The last three questions focus on the ACNH game-playing habits of the respondent (*D5–D7*). It should be noted that Terraforming in variable *D7* is an activity that the game players can change the shape and formation of the island.

**Table 4.** Description of variables related to *game playing habit*.

| Categorical variable | | | | |
|---|---|---|---|---|
| Variable | Explanation | Unit | Frequency | Proportion |
| *D1* | The length that the respondent has been playing video games | 0–1 year | 26 | 4.10% |
| | | 1–2 years | 46 | 7.26% |
| | | 2–3 years | 55 | 8.68% |
| | | More than 3 years | 507 | 79.97% |
| *D2* | The genre of video games that the respondent usually plays | Action | 297 | 46.41% |
| | | Adventure | 454 | 70.94% |
| | | RPG | 475 | 74.22% |
| | | Simulation | 436 | 68.13% |
| | | Strategy | 334 | 52.19% |
| | | Sports | 111 | 17.34% |
| *D3* | The game playing frequency of the respondent | Everyday | 258 | 40.38% |
| | | Almost everyday | 249 | 38.97% |
| | | Every week | 84 | 13.15% |
| | | Almost every week | 25 | 3.91% |
| | | Every month | 9 | 1.41% |
| | | Less than every month | 14 | 2.19% |

| Categorical variable | | | | |
|---|---|---|---|---|
| Variable | Explanation | Unit | Frequency | Proportion |
| *D4* | The average hours that the respondent spent playing the game a day in the last two weeks by the survey | None | 1 | 0.16% |
| | | 1–2 hours | 105 | 16.41% |
| | | 2–3 hours | 179 | 27.97% |
| | | 3–4 hours | 229 | 35.78% |
| | | 4–10 hours | 85 | 13.28% |
| | | More than 10 hours | 41 | 6.41% |
| D5 | The ACNH playing frequency of the respondent | Everyday | 362 | 56.56% |
| | | Almost everyday | 170 | 26.56% |
| | | Every week | 70 | 10.94% |
| | | Almost every week | 19 | 2.97% |
| | | Every month | 5 | 0.78% |
| | | Less than every month | 14 | 2.19% |
| D6 | The favorite activity of the respondent in ACNH | Catching bugs | 74 | 11.56% |
| | | Fishing | 150 | 23.44% |
| | | Planting trees/ flowers | 128 | 20% |
| | | Terraforming | 132 | 20.63% |
| | | Other | 116 | 18.13% |
| D7 | The style/theme that the respondent prefers when Terraforming | NA | NA | NA |

**5) In-game behavior**

The fifth category of the data set comprises 28 variables that measure the in-game behaviors of the respondents, so we call it the *in-game behavior* category (Table 5). These variables were generated from questions designed by the authors (M.T.H.) and (M.H.N.), who played the ACNH. Here, we only concentrate on the behaviors that have direct interactions with the environment, such as catching bugs, fishing, planting trees/flowers, terraforming trees/flowers and participating in Mystery Island Tours. Dependent on the types of questions, the measuring scales within this category are different accordingly

The first five variables are involved in the frequency of doing five major in-game activities: catching bugs (*E1*), fishing (*E2*), planting trees/flowers (*E3*), Terraforming *(E4)*, and participating in mystery island tours (*E5*). The frequency was measured on a 4-point Likert scale ranging from 1 (never) to 4 (often). The next four variables (*E6* to *E9)* are related to the willingness to collect or plant all the following species in the ACNH: fish (*D6*), bug (*D7*), tree (*D8*), and flower (*D9*). A 5-point Likert scale measures the willingness from 1 (very unlikely) to 5 (very likely).

The remaining variables are employed to measure the frequency of doing a specific activity with fish, bugs, trees, or flowers, and visiting a mystery island. There are five activities associated with a fish or bug: donate to the museum (*E10*), show it off at home (*E11*), sell it for profit (*E12*), send it to a friend as a gift (*E13*), and release it back to nature (*E14*). We combined fish and bug because they have similar utilities in ACNH.

There are five activities associated with trees: plant new trees (*E15*), take wood (*E16*), cut down the tree (*E17*), sell for profit (*E18*), and reserve for the bug (*E19*). In ACNH, a tree has to be chopped three times to be completely cut down, so the wood can be taken without cutting down the tree. For that reason, we separate it into two variables. Moreover, since many types of bugs respawn on trees or tree stumps, players tend to reserve tree or tree stumps for catching bugs. This is why we added the activity of reserving trees for the bug (*E19*).

Similar to fish or bug, we also found five activities associated with flowers, namely: plant flowers (*E20*), crossbreed flowers (*E21*), show it off (*E22*), send it to a friend as a gift (*E23*), and sell for profit (*E24*). Finally, when visiting a mystery island, players have four different activities to do: find resources (*E25*), find villagers (*E26*), enjoy the scenery (*E27*), and discover new species (*E28*).

All the variables from *E10* to *E28* were measured by a 4-point Likert scale ranging from 1 (never) to 4 (often).

**Table 5.** Description of variables related to *in-game behavior*.

| Numerical variables | | | | |
|---|---|---|---|---|
| Variables | Explanation | Range | Mean | Standard deviation |
| *E1* | How often do you do the following activities? [Catch bugs] | 1. Never | 3.20 | 0.75 |
| *E2* | How often do you do the following activities? [Fishing] | 2. Seldom | 3.24 | 0.79 |
| *E3* | How often do you do the following activities? [Plant trees/flowers] | 3. Sometimes | 3.19 | 0.77 |
| *E4* | How often do you do the following activities? [Terraforming] | 4. Often | 2.96 | 0.92 |
| *E5* | How often do you do the following activities? [Participate in Mystery Island Tours] | | 2.81 | 0.82 |
| *E6* | Do you want to collect or plant all the following species in the game? [Fish] | 1. Very unlikely 2. Unlikely | 4.35 | 0.92 |
| *E7* | Do you want to collect or plant all the following species in the game? [Bug] | 3. Maybe 4. Likely | 4.26 | 1.02 |
| *E8* | Do you want to collect or plant all the following species in the game? [Tree] | 5. Very likely | 4.21 | 1.00 |
| *E9* | Do you want to collect or plant all the following species in the game? [Flower] | | 4.18 | 1.01 |
| *E10* | How often do you do the following activities with fish or bugs? [Donate to the museum] | 1. Never 2. Seldom | 3.62 | 0.68 |
| *E11* | How often do you do the following activities with fish or bugs? [Show off at home] | 3. Sometimes 4. Often | 2.24 | 0.97 |
| *E12* | How often do you do the following activities with fish or bugs? [Sell for profit] | | 3.47 | 0.83 |
| *E13* | How often do you do the following activities with fish or bugs? [Send it to a friend as a gift] | | 1.99 | 1.07 |
| *E14* | How often do you do the following activities with fish or bugs? [Release it back to nature] | | 2.43 | 0.94 |

| Numerical variables | | | | |
|---|---|---|---|---|
| Variables | Explanation | Range | Mean | Standard deviation |
| *E15* | How often do you do the following activities with trees? [Plant new trees] | | 2.92 | 0.79 |
| *E16* | How often do you do the following activities with trees? [Take woods] | | 3.24 | 0.76 |
| *E17* | How often do you do the following activities with trees? [Cut down the tree] | | 2.69 | 0.85 |
| *E18* | How often do you do the following activities with trees? [Sell for profit] | | 2.45 | 1.10 |
| *E19* | How often do you do the following activities with trees? [Reserve for the bug] | | 2.75 | 0.87 |
| *E20* | How often do you do the following activities with flowers? [Plant flowers] | | 3.24 | 0.74 |
| *E21* | How often do you do the following activities with flowers? [Crossbreed flowers] | | 3.28 | 0.88 |
| *E22* | How often do you do the following activities with flowers? [Show off] | | 2.60 | 1.04 |
| *E23* | How often do you do the following activities with flowers? [Send as a gift] | | 2.40 | 1.01 |
| *E24* | How often do you do the following activities with flowers? [Sell for profit] | | 2.36 | 1.03 |
| *E25* | How often do you do the following activities when visiting a Mystery Island? [Find resources] | | 3.40 | 0.76 |
| *E26* | How often do you do the following activities when visiting a Mystery Island? [Find villagers] | | 3.07 | 0.90 |
| *E27* | How often do you do the following activities when visiting a Mystery Island? [Enjoy the scenery] | | 2.63 | 1.02 |
| *E28* | How often do you do the following activities when visiting a Mystery Island? [Discover new species] | | 2.98 | 0.93 |

**6) Game-playing feeling**

The last category regards the respondent's feeling about the game, so we named it *game-playing feeling* (Table 6). This category consists of 32 numerical variables adapted from the core module of IJsselsteijn et al. [29]'s Game Experience Questionnaire. We asked the respondents, "overall, how do you feel about the game?" and then provided five answers: "not at all", "slightly", "moderately", "fairly", and "extremely". We modified these answers into numerical values following an ascending order in the data set, with 1 being "not at all" and 5 being "extremely".

**Table 6.** Description of variables related to *game playing feeling*.

| Numerical variable | | | | |
|---|---|---|---|---|
| Variable | Explanation | Range | Mean | Standard Deviation |
| *F1* | I felt content | 1. Not at all | 4.33 | 0.78 |
| *F2* | I felt skillful | 2. Slightly | 3.80 | 0.94 |
| *F3* | I was interested in the game's story | 3. Moderately | 3.74 | 1.07 |
| *F4* | I thought it was fun | 4. Fairly | 4.41 | 0.85 |
| *F5* | I was fully occupied with the game | 5. Extremely | 4.33 | 0.94 |
| *F6* | I felt happy | | 4.42 | 0.85 |
| *F7* | It gave me a bad mood | | 1.88 | 1.17 |
| *F8* | I thought about other things | | 2.68 | 1.14 |
| *F9* | I found it tiresome | | 2.22 | 1.16 |
| *F10* | I felt competent | | 3.70 | 1.09 |
| *F11* | I thought it was hard | | 2.10 | 1.17 |
| *F12* | It was aesthetically pleasing | | 4.35 | 0.91 |
| *F13* | I forgot everything around me | | 3.52 | 1.20 |
| *F14* | I felt good | | 4.30 | 0.87 |
| *F15* | I was good at it | | 3.96 | 0.94 |
| *F16* | I felt bored | | 2.17 | 1.11 |
| *F17* | I felt successful | | 3.83 | 0.98 |
| *F18* | I felt imaginative | | 4.08 | 0.97 |
| *F19* | I felt that I could explore things | | 4.19 | 0.93 |
| *F20* | I enjoyed it | | 4.39 | 0.86 |
| *F21* | I was fast at reaching the game's targets | | 3.78 | 1.08 |
| *F22* | I felt annoyed | | 2.02 | 1.10 |
| *F23* | I felt pressured | | 2.13 | 1.24 |
| *F24* | I felt irritable | | 1.83 | 1.14 |
| *F25* | I lost track of time | | 3.73 | 1.18 |
| *F26* | I felt challenged | | 3.30 | 1.16 |
| *F27* | I found it impressive | | 4.09 | 0.95 |
| *F28* | I was deeply concentrated on the game | | 3.99 | 0.99 |
| *F29* | I felt frustrated | | 2.04 | 1.12 |
| *F30* | It felt like a rich experience | | 3.91 | 1.06 |
| *F31* | I lost connection with the outside world | | 3.10 | 1.36 |
| *F32* | I felt time pressure | | 2.18 | 1.27 |

## 3. EXEMPLARY DATA ANALYSIS

In this section, we perform an exemplary analysis of the data set. The model was constructed from the anti-anthropocentrism perception and two in-game behaviors related to trees (taking wood and cutting a tree). As the current data set is valuable in studying the relationship between in-game behaviors and environmental attitudes of game players, we constructed a model examining this relationship for validation. We hypothesized that people holding an anti-anthropocentric perception would associate with the frequency of in-game behaviors that harm natural lifeforms. To test this hypothesis, we used three variables from the data set. The anti-anthropocentrism perception (*anti_anthro*) is represented by the *C12* variable, which measures the disagreement towards the statement "Humans were meant to rule over the rest of nature" (note that for this variable, a higher value means a higher level of disagreement).

Meanwhile, the frequency of taking wood (*TakeWood*) and cutting down a tree (*CutTree*) was measured by *E16* and *E17* variables. In this investigation, we expected that anti-anthropocentric people would utilize the natural resources (here: take wood) without harming the natural lifeforms (here: cutting tree–which in the game context means destroying the tree even after having received some wood from it). The model is presented below, and its logical network is displayed in Figure 2:

$$Anti\_Anthro \sim \alpha + TakeWood + CutTree$$

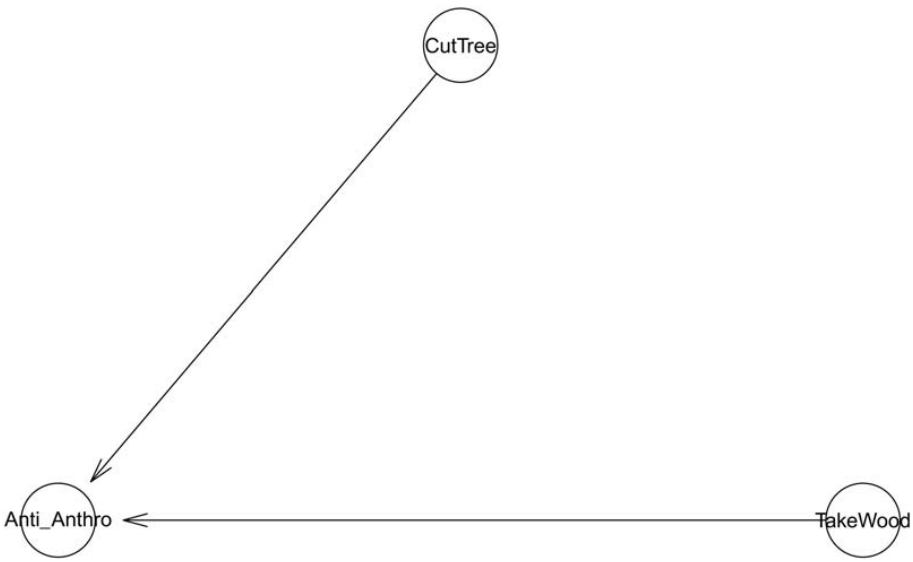


**Figure 2.** Logical network of the exemplary model.

As for methodology, we used Bayesian analysis incorporation with the MCMC technique as the method was shown to be effective and reliable in working with social science data, especially on psychological processes [33, 34, 35]. We used the bayesvl R package [36] and followed the protocol proposed by Vuong et al. [37]. Some of the advantages of the bayesvl package are that it automatically generates all the Stan code and can visualize all the posterior diagnostic and simulated results [36]. The simulation was run on R (version 4.0.5).

First, we loaded the data to R and changed the variables' names; Then, we started to construct and fit the model using four Markov chains and 5,000 iterations, of which 2,000 were warmup iterations. All priors were set as "uninformative". All the code snippets employed for performing this analysis are presented in Box A1 in the Appendix A.

All the simulated posterior coefficients are shown in Table 7. It can be seen that all the diagnostic statistics show a good sign of convergence. More specifically, the effective sample size (n_eff) is greater than 1,000, and the Gelman shrink factor (Rhat) equals 1.

**Table 7.** Estimated posterior coefficients.

| Parameter | Mean | Standard deviation | n_eff | Rhat |
|---|---|---|---|---|
| *Constant* | 3.11 | 0.24 | 6342 | 1 |
| *TakeWood* | 0.27 | 0.07 | 6865 | 1 |
| *CutTree* | -0.15 | 0.07 | 8286 | 1 |

The model's convergence can also be diagnosed visually using the trace plots and Gelman plots. Figure 3 illustrates the samples of four Markov chains from the 2000th iteration to the 5,000th iteration. The Markov chains' movement is relatively stationary, and the chains are well mixed, indicating a stable central tendency. Thus, we can conclude that the chains are convergent.

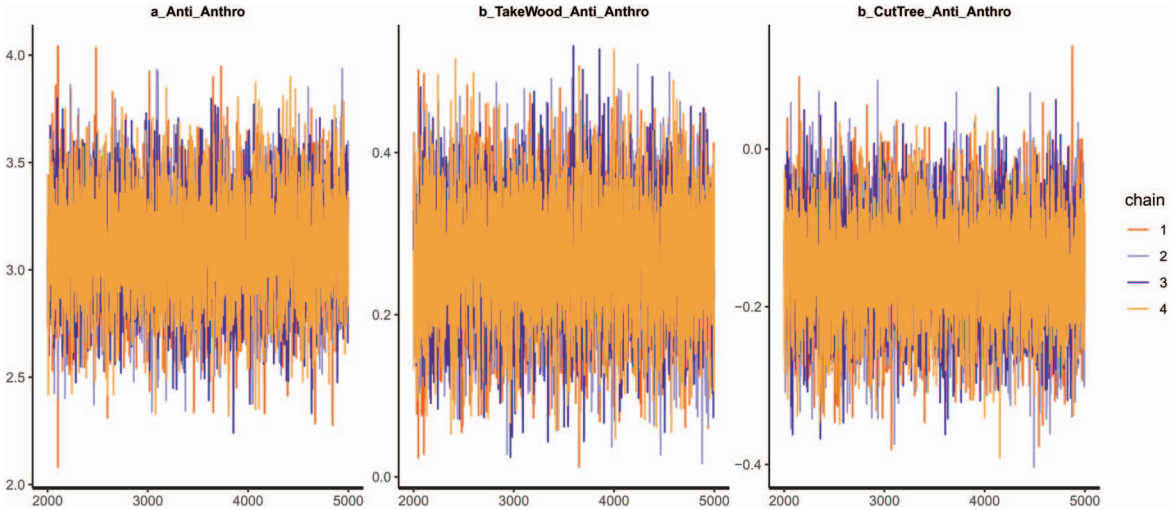


**Figure 3.** Trace plots of coefficients.

The Gelman plots of coefficients are displayed in Figure 4. The *x*-axis indicates the number of iterations, while the *y*-axis implies the shrink factor value. Gelman and Rubin [38] suggested that if the shrink factor value drops swiftly to 1 during the warmup period when the number of iterations increases, the model can be deemed convergent. All the coefficients' shrink factor values in Figure 4 meet that criterion, so the model's convergence is acquired.

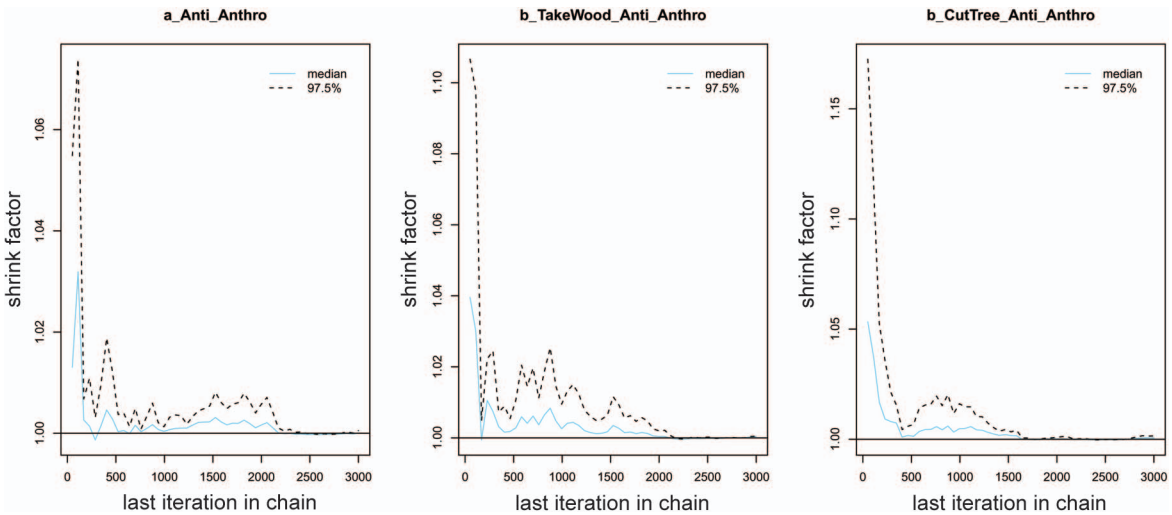


**Figure 4.** Gelman plots of coefficients.

The posterior results show that *TakeWood* is positively associated with *Anti_Anthro* ($\mu_{TakeWood}$ = 0.27 and $\sigma_{TakeWood}$ = 0.07), whereas *CutTree* has the opposite association with *Anti_Anthro* ($\mu_{CutTree}$ = -015 and $\sigma_{CutTree}$ = 0.07). These associations can be interpreted as follows. A game player that takes wood from the tree is more likely to disagree that "humans were meant to rule over nature". In contrast, if a player intentionally cuts down the tree even when he/she has taken wood from the tree (chopping the tree more than three times), he/she is more likely to agree with the anthropocentric worldview.

To validate these findings' reliability, we visualized the distributions of posterior coefficients in Figures 5-A and 5-B. In both figures, most of the simulated samples of *TakeWood* and *CutTree* are located entirely on the positive and negative sides of the x-axis, respectively. Especially, Figure 5-B shows that 97.5% of the simulated posterior samples (illustrated by the largest black boundary) of both coefficients entirely belong to a certain side (e.g., larger than 0 or lower than 0). Regardless of the variation, *TakeWood* has a reliable positive impact on *Anti_Anthro*, whereas *CutTree* has a reliable opposite effect.

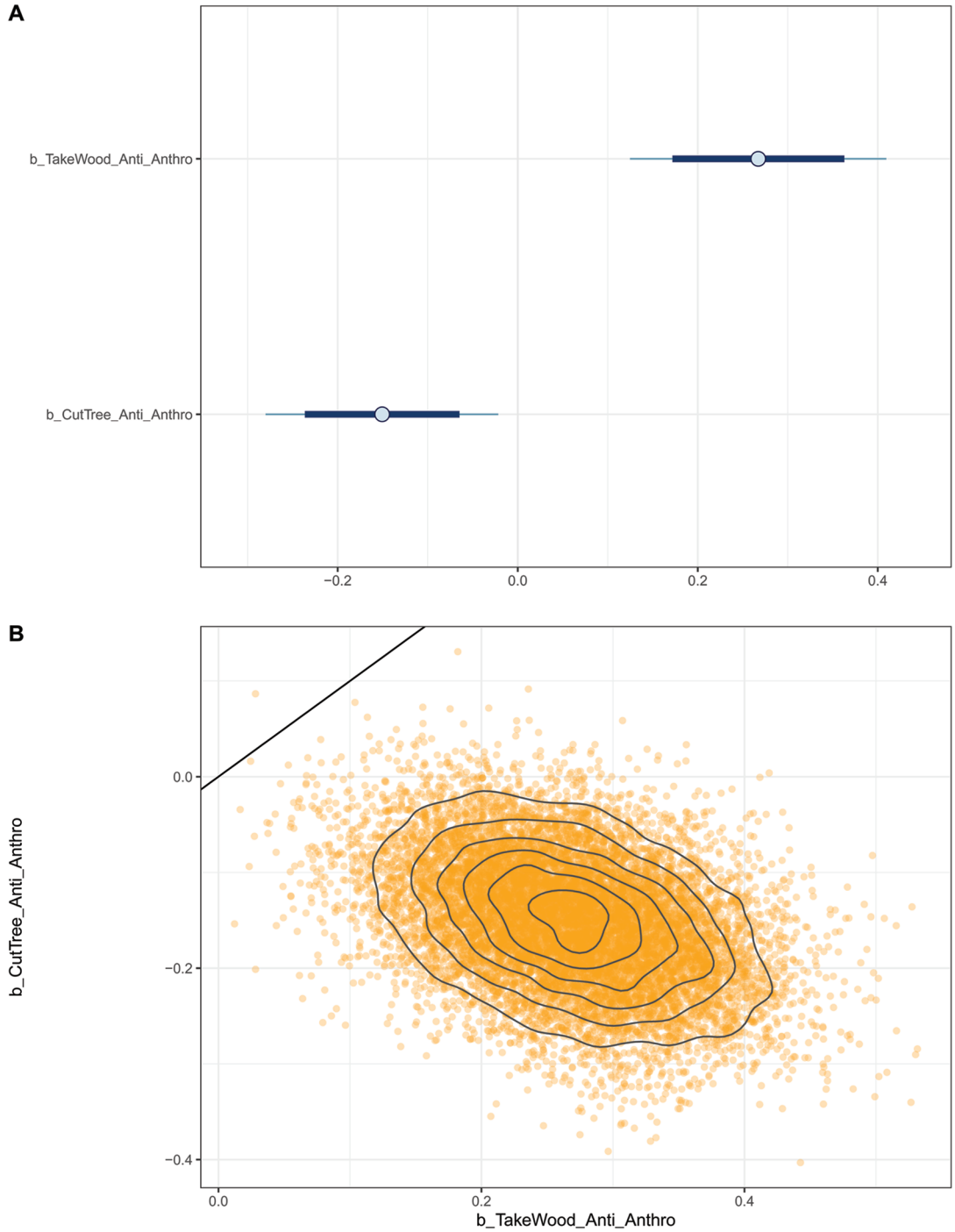


**Figure 5.** Distributions of coefficients. Note: A: Interval plot, and B: Two-dimensional density plot.

## 4. USAGE NOTES AND CONCLUSION

The current data article describes the multinational and multifaceted data set of 640 ACNH game players. The data set consists of six major categories: 1) socio-demographic profile, 2) COVID-19 concern, 3) environmental perception, 4) game-playing habit, 5) in-game behavior, and 6) game-playing feeling. Video games can be considered good platforms to integrate educational purposes [16, 17]. However, the current understanding of the relationship between game players' behaviors in commercial games and real-life perceptions, especially the environmental attitudes, is limited. Thus, the current data set is useful for conducting studies and enriching the literature about virtual behaviors and environmental worldviews.

As the data set was deliberately and systematically designed as six major categories, it is beneficial for researchers to investigate any explicit or subtle relationships among these aspects. For example, future studies can use this data set to explore the relationships among socio-demographic factors (A-series variables), environmental perception (C-series variables), and environmentally oriented in-game behavior (E-series variables). They will help investigate the psychological processes of certain groups' environmental attitudes and their corresponding behaviors in a virtual world. Alternatively, researchers can also explore the relationship between COVID-19 concerns (B-series variables) and game-playing feeling (F-series variables), mediated by the game-playing habit (D-series variables). This will help increase knowledge about the influence of leisure activities (video games) on the relationship between the social isolation and emotional states affected by playing a video game. Researchers can use methodologies and tools deemed beneficial and suitable for their studies' purposes and designs for analyzing the data.

Moreover, insights generated from studies using this data set might also be valuable for game developers in cooperation with policymakers in improving game players' pro-environmental attitudes through "UN-compliance" game design. Well-designed gameplay and environment might also help build up an environmental-healing culture–the 11th core value of progressive cultures–among game players [40, 41].

Before this data descriptor article, several studies have employed the current data sets [20, 21]. Making this data set open will allow worldwide researchers to continue using the data for further explorative and replicative studies. It improves transparency in science, which is crucial in the contemporary research landscape [42]. Additionally, as the cost of science is a big issue in the global scientific communities [24], our data set is a valuable resource for in-depth research of the connections between behaviors in virtual environments and real-life perceptions, particularly environmental perceptions.

Regarding the data set's limitations, its national representativeness is modest due to the limited sample size per country. More specifically, with 640 respondents from 29 countries, the number of respondents from some countries is relatively small and may lead to statistical inaccuracy if treated separately. However, it still provides valuable resources for global preliminary research into several topics that have not been studied until now, like the relationship between virtual environment-related behaviors and environmental perceptions. Moreover, despite the sample size constraint, the survey questions were deliberately and systematically designed to offer more in-depth investigation into many aspects of game players regarding environmental attitudes, virtual world behaviors, or game-playing emotions, etc. We also recommend using

the variable "Region" (*A1_2*) or "Ethnicity" (*A6*) instead of "Nationality" (*A1_1*) when studying issues that concern the socio-cultural backgrounds of the game players. Another limitation is that the survey was constructed in English, so it does not adequately represent non-English speakers.

In conclusion, this data set was rigorously and systematically designed, collected, curated, and validated to ensure a high standard of quality and usability. We hope that the data will help improve the scientific advance of videogame behavioral studies concerning environmental psychology.

## ACKNOWLEDGEMENTS

We would like to send our gratitude to Anh-Phuong Luong (research staff of Vuong & Associates) for her support during the data preparation.

## AUTHOR CONTRIBUTIONS

Quan-Hoang Vuong (hoang.vuongquan@phenikaa-uni.edu.vn) designed the questionnaire, administered the data collection, and validated the data set. Manh-Toan Ho (toan.homanh@phenikaa-uni.edu.vn) conceptualized the study, designed the questionnaire, and administered the data collection. Viet-Phuong La (phuong.laviet@phenikaa-uni.edu.vn) validated and supervised the data input process. Tam-Tri Le (tri.letam@phenikaa-uni.edu.vn) contributed to manuscript writing. Thanh Huyen T. Nguyen (huyen.nguyenthanhthanh@phenikaa-uni.edu.vn) contributed to manuscript writing. Minh-Hoang Nguyen (hoang.nguyenminh@phenikaa-uni.edu.vn) designed the questionnaire, administered the data collection, and contributed to manuscript writing and software implementation.

## DATA AVAILABILITY STATEMENT

The data publishing process is compliant with the FAIR Guiding Principles for scientific data management and stewardship [39]. The data set–comma-separated values file (data_640_validated.csv) was stored in the Science Data Bank repository, https://doi.org/10.11922/sciencedb.j00104.00098, under an Attribution 4.0 International (CC BY 4.0) along with a data description spreadsheet–Microsoft Office Excel file (Data description_validated.xlsx). We removed all the personal contacts of the respondents for the sake of confidentiality.

## REFERENCES

[1] Clement, J.: Number of gamers worldwide in 2020, by region. Available at: https://www.statista.com/statistics/297874/number-mobile-gamers-region/. Accessed 25 March 2021

[2] Epstein, A.: Game on: How COVID-19 became the perfect match for gamers. Available at: https://www.weforum.org/agenda/2020/09/covid19-coronavirus-pandemic-video-games-entertainment-media/. Accessed 25 March 2021

[3] Witkowski, W.: Videogames are a bigger industry than movies and North American sports combined, thanks to the pandemic, 2020. Available at: https://www.marketwatch.com/story/videogames-are-a-bigger-industry-than-sports-and-movies-combined-thanks-to-the-pandemic-11608654990. Accessed 25 March 2021
[4] Suziedelyte, A.: Media and human capital development: Can video game playing make you smarter? Economic Inquiry 53(2), 1140–1155(2015)
[5] McDermott, A.F., Bavelier, D., Green, C.S.: Memory abilities in action video game players. Computers in Human Behavior 34, 69–78 (2014)
[6] Dobrowolski, P., et al.: Cognitive enhancement in video game players: The role of video game genre. Computers in Human Behavior 44, 59–63 (2015)
[7] Bediou, B., et al.: Meta-analysis of action video game impact on perceptual, attentional, and cognitive skills. Psychological Bulletin 144(1), 77–110 (2018)
[8] Green, C., Bavelier, D.: Action video game training for cognitive enhancement. Current Opinion in Behavioral Sciences 4, 103–108 (2015)
[9] Libertus, M., et al.: The impact of action video game training on mathematical abilities in adults. AERA Open 3(4), 233285841774085 (2017)
[10] West, G., et al.: Impact of video games on plasticity of the hippocampus. Molecular Psychiatry 23(7), 1566–1574 (2017)
[11] Adžić, S., et al.: The impact of video games on Students' educational outcomes. Entertainment Computing 38, 100412 (2021)
[12] Chang, M., et al.: The effects of an educational video game on mathematical engagement. Education And Information Technologies 21(5), 1283–1297 (2015)
[13] Beserra, V., Nussbaum, M., Oteo, M.: On-task and off-task behavior in the classroom: A study on mathematics learning with educational video games. Journal of Educational Computing Research 56(8), 1361–1383 (2017)
[14] Hieftje, K., et al.: An evaluation of an educational video game on mathematics achievement in first grade students. Technologies 5(2), 30 (2017)
[15] Komala, A., Rifai, I.: The impacts of the Cherry Orchard video game on players' reading comprehension. Procedia Computer Science 179, 368–374 (2021)
[16] Nebel, S., et al.: Goal-setting in educational video games. Simulation & Gaming 48(1), 98–130 (2016)
[17] DeWeerdt, S.: Can science-based video games help kids with autism? Available at: https://www.science.org/news/2018/06/can-science-based-video-games-help-kids-autism. Accessed 6 April 2021
[18] Rowlatt, J.: 2021: Turning point for CC. Climate Northern Ireland. Available at: https://www.climatenorthernireland.org/news/2021-turning-point-for-cc. Accessed 6 April 2021
[19] Johannes, N., Vuorre, M., Przybylski, A.K.: Video game play is positively correlated with well-being. Royal Society Open Science 8(2), 202049 (2021)
[20] Vuong, Q.-H., et al.: On the environment-destructive probabilistic trends: A perceptual and behavioral study on video game players. Technology in Society 65, 101530 (2021)
[21] Vuong, Q.-H., et al.: (2021). Good ethics can't stop me from exploiting: The good and bad of anthropocentric attitudes in game environment. OSF preprints. doi: 10.31219/osf.io/8h5ma (2021)
[22] Munafò, M., et al.: A manifesto for reproducible science. Nature Human Behaviour 1, 0021 (2017)
[23] Vuong, Q.-H.: Open data, open review and open dialogue in making social sciences plausible. Available at: http://blogs.nature.com/scientificdata/2017/12/12/authors-corner-open-data-open-review-and-open-dialogue-in-making-social-sciences-plausible/. Accessed 15 April 2021
[24] Vuong, Q.-H.: The (ir) rational consideration of the cost of science in transition economies. Nature Human Behaviour 2, 5 (2018)

[25] Gilbert, B.: How big of a deal is 'Animal Crossing'? It had the biggest launch of any Nintendo Switch game, including 'Mario' and 'Zelda.'. Business Insider. Available at: https://www.businessinsider.com/animal-crossing-new-horizons-launch-sales-nintendo-switch-2020-5. Accessed 25 March 2021
[26] Handrahan, M.: Nintendo confirms 50% digital sales for Animal Crossing: New Horizons. GamesIndustry.biz. Available at: https://www.gamesindustry.biz/articles/2020-05-15-nintendo-confirms-50-percent-digital-sales-for-animal-crossing-new-horizons. Accessed 25 March 2021
[27] PETA: PETA's vegan guide to 'Animal Crossing: New Horizons'. Available at: https://www.peta.org/features/animal-crossing-new-horizons-vegan/. Accessed 25 March 2021
[28] Dunlap, R.E., et al.: New trends in measuring environmental attitudes: Measuring endorsement of the new ecological paradigm: A revised NEP scale. Journal of Social Issues 56(3), 425–442 (2000)
[29] IJsselsteijn, W., Kort, Y., Poels, K.: (2013). The game experience questionnaire. Available at: https://research.tue.nl/en/publications/the-game-experience-questionnaire. Accessed 14 April 2021
[30] Hawcroft, L.J., Milfont, T.L.: The use (and abuse) of the new environmental paradigm scale over the last 30 years: A meta-analysis. Journal of Environmental Psychology 30(2), 143–158 (2010)
[31] Dunlap, R.E.: The new environmental paradigm scale: From marginality to worldwide use. The Journal of Environmental Education 40(1), 3–18 (2008)
[32] Bernstein, J., Szuster, B.: The new environmental paradigm scale: Reassessing the operationalization of contemporary environmentalism. The Journal of Environmental Education 50(2), 73–83 (2018)
[33] Nguyen, M.-H., et al.: Alice in suicideland: Exploring the suicidal ideation mechanism through the sense of connectedness and help-seeking behaviors. International Journal of Environmental Research and Public Health 18(7), 3681 (2021)
[34] Vuong, Q.-H., Nguyen, M.-H., Le, T.-T. : Home scholarly culture, book selection reason, and academic performance: Pathways to book reading interest among secondary school students. European Journal of Investigation in Health, Psychology and Education 11(2), 468–495 (2021)
[35] Vuong, Q.-H., Nguyen, M.-H., Le, T.-T.: A mindsponge-based investigation into the psycho-religious mechanism behind suicide attacks. De Gruyter, Poland (2021)
[36] Vuong, Q.-H., et al.: Improving bayesian statistics understanding in the age of big data with the bayesvl R package. Software Impacts 4, 100016 (2020)
[37] Vuong, Q.-H., et al.: Bayesian analysis for social data: A step-by-step protocol and interpretation. MethodsX 7, 100924 (2020)
[38] Gelman, A., Rubin, D.B.: Inference from iterative simulation using multiple sequences. Statistical Science 7(4), 457–472 (1992)
[39] Wilkinson, M.D., et al.: The FAIR Guiding Principles for scientific data management and stewardship. Scientific Data 3, Article number 160018 (2016)
[40] Harrison, L.E.: Culture matters. The National Interest 60, 55–65 (2000)
[41] Vuong, Q.H.: The semiconducting principle of monetary and environmental values exchange. Economics and Business Letters 10(3), 149 (2021)
[42] Vuong, Q.-H.: Reform retractions to make them more transparent. Nature 582, 149 (2020)

## APPENDIX A

**Box A1.** Code snippets for the exemplary data analysis.

```
# Data preparation
dat <- read.csv("C:/…/data_640_validated.csv", header = T)
dat$Anti_Anthro<-dat$C12
dat$TakeWood<-dat$E16
dat$CutTree<-dat$E17
keeps<-c("Anti_Anthro","TakeWood","CutTree")
dat<-dat[keeps]
dat<-na.omit(dat)

library(bayesvl)
library(ggplot2)
library(cowplot)

# Model construction
model<-bayesvl()
model<-bvl_addNode(model,"Anti_Anthro","norm")
model<-bvl_addNode(model,"TakeWood","norm")
model<-bvl_addNode(model,"CutTree","norm")
model<-bvl_addArc(model,"TakeWood","Anti_Anthro","slope")
model<-bvl_addArc(model,"CutTree","Anti_Anthro","slope")

# Stan code generation
model_string <- bvl_model2Stan(model)
cat(model_string)

# Model fit
model<-bvl_modelFit(model, dat, warmup = 2000, iter = 5000, chains = 4)
summary(model)

# Figure 2
bvl_bnPlot(model)

# Figure 3
bvl_plotTrace(model)

# Figure 4
bvl_plotGelmans(model,params = NULL,1,3)

# Figures 5A and 5B
Figure5A<-bvl_plotIntervals(model,c("b_TakeWood_Anti_Anthro","b_CutTree_Anti_Anthro"))+theme_bw()
Figure5B<-bvl_plotDensity2d(model,"b_TakeWood_Anti_Anthro","b_CutTree_Anti_Anthro",color_scheme =
"orange")+theme_bw()
plot_grid(Figure5A,Figure5B,nrow = 2,labels = c('A','B'),align = TRUE)
```

## AUTHOR BIOGRAPHY

**Quan-Hoang Vuong** (PhD, Université Libre de Bruxelles) is Director of the Centre for Interdisciplinary Social Research (Centre ISR), Phenikaa University, Hanoi, Vietnam. He is chairman of the Vietnam Chapter of the European Association of Science Editors and serves in the NAFOSTED Scientific Council on Basic Research in the Social Sciences and Humanities (2019–2021). He has published nearly 200 academic papers and books with such publishers as Cell Press, De Gruyter, Elsevier, Emerald, Inderscience, MDPI, MIT Press, Nature Publishing Group, Oxford University Press, Palgrave Macmillan, Springer, Taylor & Francis, etc. Dr. Vuong was a recipient of Publons Global Peer Review Awards in 2018, 2019, writing over 200 peer review reports for about 90 academic journals. As an editor, he has also helped to handle 100 manuscripts with various research journals.
ORCID: 0000-0003-0790-1576

**Manh-Toan Ho** holds an M.A. at the National Economics University in Hanoi, Vietnam. He is working as a researcher in the Centre for Interdisciplinary Social Research, Phenikaa University, Hanoi, Vietnam, and a science communicator for EASE Vietnam SciComm/SSHPA (https://sc.sshpa.com/), in addition to other media outlets in Vietnam.
ORCID: 0000-0002-8292-0120

**Viet-Phuong La** is a researcher at the Centre for Interdisciplinary Social Research, Phenikaa University, Hanoi, Vietnam, and a software engineer for A.I. for Social Data Lab, Vuong & Associates, Hanoi, Vietnam.
ORCID: 0000-0002-4301-9292

**Tam-Tri Le** holds an MSc in Sustainability Science from Ritsumeikan Asia Pacific University, Beppu, Japan. Currently, he is working as a researcher in the Centre for Interdisciplinary Social Research, Phenikaa University, Hanoi, Vietnam. He has published several research articles on the topics of mental health. His research interests are metaphysics and general psychology. He believes that many psychological phenomena can be studied by examining the fundamental mechanism of belief.
ORCID: 0000-0003-3384-4827

**Thanh Huyen T. Nguyen** holds a B.A. in Economics from the Foreign Trade University. She is currently working as a researcher in the Centre for Interdisciplinary Social Research, Phenikaa University and A.I for Social Data Lab, Vuong & Associates in Hanoi, Vietnam. Her research interest is development economics, environmental studies and culture studies.
ORCID: 0000-0002-5969-5025

**Minh-Hoang Nguyen** holds an MSc in Sustainability Science from Ritsumeikan Asia Pacific University, Beppu, Japan, where he continues his PhD track. He works as a researcher in the Centre for Interdisciplinary Social Research, Phenikaa University, Hanoi, Vietnam. He has published two books and around 40 articles in journals and books by multiple publishers: Cell Press, De Gruyter, Elsevier, Emerald, MDPI, MIT Press, Nature Research, Oxford University Press, Springer, and Wiley. His research interest is about psychological issues. He believes understanding human mental constructs and mechanisms is a fundamental approach for achieving sustainability in multiple disciplines.
ORCID: 0000-0002-7520-3844