Climate Influence: implicit interactive storytelling for climate action purpose from comics to games

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Abstract. People often have emotionally ingrained perspectives when it comes to climate action, making it difficult to argue against climate change denial using only objective measures like data and policy. Stories and games, however, engage audiences on a subconscious level, working to promote causes that align with readers' innate motivations. Instead of argumentation and data, we created visual narratives and interactive games and exhibits that promote the values that align with pro-climate action without explicitly persuading for climate action. We designed stories and games based on purposes such as focusing on long-term consequences, individual responsibility, and caring for nonhuman entities, engaging antagonistic viewpoints like climate change denial indirectly. This strategy is applied to a comic that tells everyday stories without referencing climate change, as well as an interactive game that uses the guise of a Tamagotchi to nudge audiences to pro-climate actions without policy-based arguments. We found that audiences understood the exhibited game as communicating care-taking in environmental contexts as opposed to an intervention in resource depletion, interacting with the interactive instrument on a human purpose level as opposed to debating about resource and policy.

Keywords: Climate action, interactive media, games, implicit storytelling, tamagotchi.

1 Introduction

Despite a preponderance of scientific evidence on climate change [27], a gap remains between public awareness and the actions that people take in response to it. Climate change awareness significantly affects public perception and support of pro-climate policies [30]. Yet people can often see climate change as a distant and impersonal event [17,37], making it difficult to capture the attention and affect the actions of the public logically, especially those distrustful of science and skeptics of climate change. To address this, communication of climate change needs to take more motivating strategies to cultivate long-term actions, such as storytelling and interactive experiences designed for specific social goals [16] like pro-environmental behaviors and attitudes [3]. Long-term changes in behavior for climate action relies on intrinsic

motivation, which can be achieved by aligning personal goals with narrative themes of game experiences designed for social good [16]. We adopt a socially engaged form of speculative design [11] on storytelling and interactive games to communicate climate change without explicitly persuading readers through logical arguments.

On the physical level, climate change sees resource limitations, over-consumption, lack of natural resource management, failure of policy efforts to limit growth, etc. These are policy-related issues, and citing these arguments do not necessarily change perception or behavior. Studies have shown that direct evidence and scientific data do not effectively provoke public behavioral change [28]. The human level of climate change, on the other hand, is concerned with immediate gratification, myopic vision for future consequences, the idea that ignorance is comforting, the belief that individual action contributes little, lack of concern for fellow creatures and life forms, and desensitization over negativity. These human psychological issues are the real culprit of climate inaction [19], and are addressed through narrative and gamification strategies that promote pro-climate long-term behaviors. We hope to capture the attention of even climate skeptics despite them not knowing the influence imposed, to promote pro-climate behaviors implicitly while avoiding contentious debate.

We first designed a set of visual narratives that communicate pro-climate thinking without hinting on climate change data or arguments. Relying on the visual influence of storytelling comics, these stories activate beliefs about acting for long-term consequences, believing in individual influence on global events, taking responsibility for collective actions, caring for others, etc. To extend the intervention to operant interactive strategies that serve to *reinforce* pro-climate behaviors, we next created a game that uses the Tamagotchi device to carry forth the care-taking metaphor to a climate change issue that is not explicitly told to players. The Tamagotchi serves as an avatar for the Amazonian forest, and the game implicitly serves as a way to reduce deforestation by taking care of the digital avatar. The experience was shown at an art exhibition, where audience evaluation revealed that players actively participated in the care-taking process despite not knowing the topic of the intervention. Thus the reinforcement of the care-taking process contributes to influence pro-climate-like behavior despite never explicitly declaring a climate change issue.

Fig. 1. (**Left**) The comic magazine *Drizzle* serves as a narrative for pro-climate action influence. (**Middle**) The *Chikyuchi* is a care-taking game for pro-climate action through reinforcement of pro-environment behavior. (**Right**) Exhibition and evaluation of *Chikyuchi*.

2 Background

2.1 Interactive Storytelling as Climate Strategies

Character and plot design is an integral part of interactive digital storytelling [5]. In climate change communication, simply providing related information is not enough for the public to participate in climate action [21]. Stories have the potential to make climate change understandable and realistic, so that readers may have greater emotional connection [20]. Evidence suggests that narratives strengthen attitude-behavior relationships [31] for promoting pro-environmental behavior. Climate fiction leads to public understanding of negative consequences caused by climate change compared to reading about research [21], but one study showed that climate storytelling is not more persuasive than real life communication. Given the effectiveness of narratives for connecting personal and public goals, we hypothesize that interactive storytelling helps people engage and interact with climate change information so that they can become climate action-takers rather than passive consumers of information.

2.2 Visualising Storytelling in Climate Comics

Readers of different cultural backgrounds and age range can engage with comics [12]. Comics can strengthen the shared-knowledge relationship between audience and designer [13] and be used to convey nuanced ideas about science and its social context [34]. In scientific communication, illustrations play significant roles as a way of visually demonstrating [32] concepts being presented [12]. Such visual communication can convey the complexity of reality while still being accessible to non-specialists [9]. This ability for comics to engage public audiences using a character-driven approach [12] supports storytelling based on aspect transitions that convey mood and sense of place, allowing for implicit influence through an environmental design as opposed to explicit forms of narratives [18]. In particular, this contextual and graphical method of narrative communication avoids explicit arguments based on data alone that are filtered out by climate change deniers.

2.3 Narrating Climate Change in Interactive Games

Climate change games have gained traction due to their potential for advancing pro-climate actions [26]. These serious games attempt to further causes rather than only become sources of entertainment [15]. Games place players in scenarios and prompt them to analyze situations from different perspectives [36]. These scenarios enable the target audience to resonate with their physical situations and worldviews and create an emotional relationship with characters in the game [36]. In particular,

analyzing risks inherent in climate change [35] and adapting to future climate change scenarios [23] have utilized serious games, whereas explicit forms of entertainment involving saving worlds from environmental catastrophe have populated efforts to influence climate action in players [6,14,25]. However, these games with explicit climate change goals can alienate those who don't align with climate action goals such as climate change deniers, the very targets of pro-climate influence, since they are the ones whose attitudes and behaviors about climate change most need remediation. point out that providing knowledge and familiarity with climate change issues, While strengthening climate awareness and encouraging players to find solutions may drive interactive interventions for climate change [29], a more effective design would involve implicit forms of storytelling based on psychological goals rather than directly adding climate change themes into games [1]. In this study we propose that interactive games designed for the human level in climate change rather than directly addressing climate change on the physical level best addresses positive climate action goals in the long run.

3 Interventions

3.1 *Drizzle*: A comic for motivating climate action goals

Based on Booker's [2] story structure, five stories were designed to respond to different human behaviors that lead to climate issues: *Sonia McDougal*, *Redemption Park*, *VO*, *Every Flash of Light Is the Sun of Another World*, *New Revolia*. The stories were generated for particular human phenomena that may lead to climate change, including immediate gratification, the ignorance of an individual's effort, myopia, etc. Since we intend to strengthen pro-climate action among climate change skeptics, we described climate elements through plots instead of directly mentioning physical arguments in stories. For instance, the first story Sonia McDougal which is based on the theme of "Rebirth" [2] and uses metaphor to point out negative influences caused by immediate gains. In this story, Sonia should make decisions in a long-term plan to obtain success in her shoe business and life. To fit the future-directed theme in this story, the illustration applies a science fiction style and espouses long-term thinking instead of immediate considerations, even including panels that emphasize time passage (see Fig. 2-3).

To achieve the particular climate action purpose, these climate fictions mention climate change issues subtly and implicitly and visualize these stories into interesting comics. Since the comic intends to create implicit influence on climate action for climate change skeptics, a magazine-formatted tabloid was used to present it (see Fig. 3). Following the idea that sensational newsmagazines may engage with more climate change skeptics, we apply comic-drawing style into design.

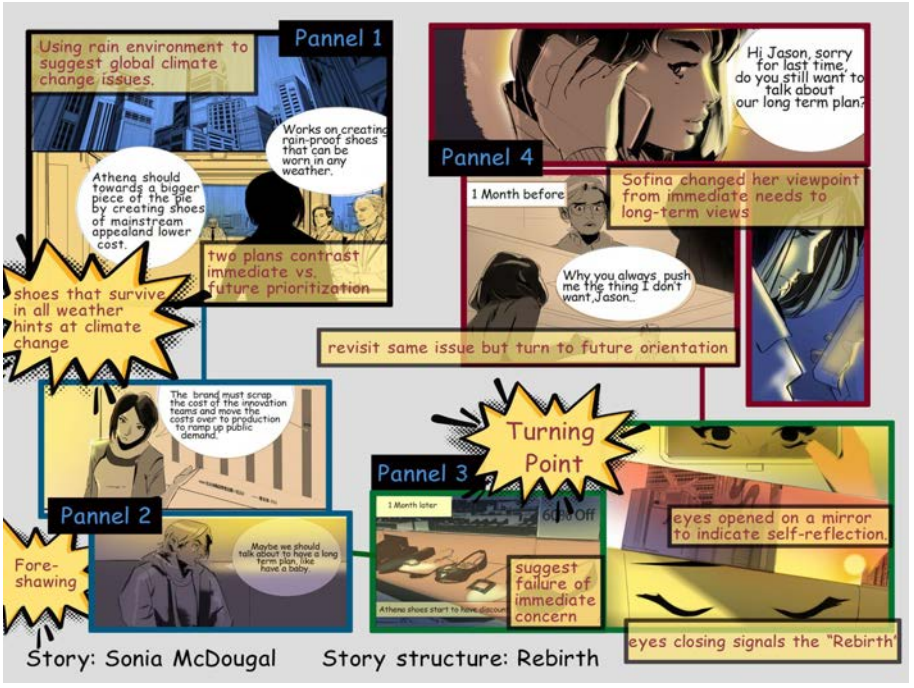

Fig. 2. Contextual storytelling for climate action by visual design in "*Sonia McDougal*".

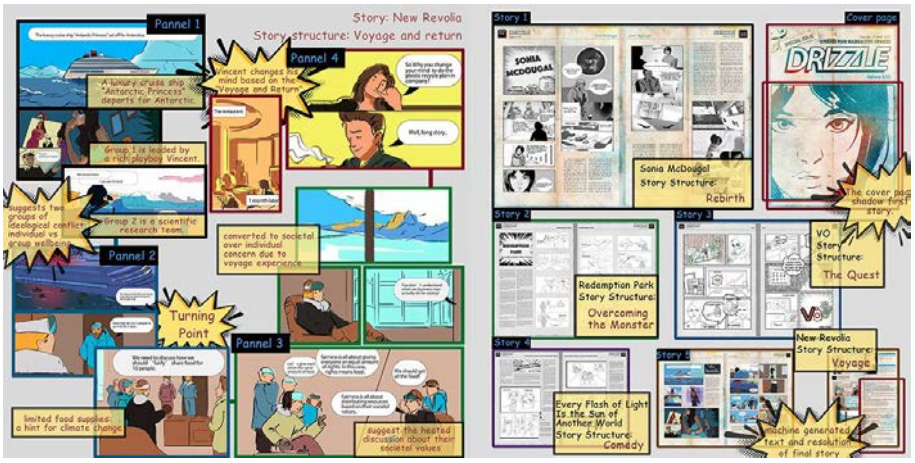

Fig. 3. (**Left**) Persuasion by visual character development in "*New Revolia*". (**Right**) Design purpose for each story and the layout of *Drizzle*.

3.2 ***Chikyuchi*: A Tamagotchi game for implicit climate action goals**

While visual narratives can frame stories that promote actions consistent with climate action, they cannot reinforce behaviors that actively lead to such pro-climate actions.

Visual narratives are Pavlovian [10] in the sense that equate certain types of goals like future-looking orientation and individual responsibility with a positive outcome but do not ask the reader to take actions interactively. In an interactive environment like games, players are reinforced or punished in an operant conditioning context [33], thus promoting certain actions directly in the game. To create a more immersive experience that reinforces audience behavior to align with climate change goals, we created and exhibited a game that reinforces the notion of "caring for environment" without explicitly revealing the concept. The game uses a metaphor to reinforce players who take care of an avatar that implicitly represents the Amazon forest.

3.2.1 **Game Design**

Chikyuchi is a virtual pet game, in which the player is tasked with taking care of the digital pet over time. The main avatar in the Chikyuchi game anthropomorphizes a natural resource (Amazon rainforest) that is declining at the rate of a hectare a minute in reality, leading to increased surface temperature and reduced rainfall [24].

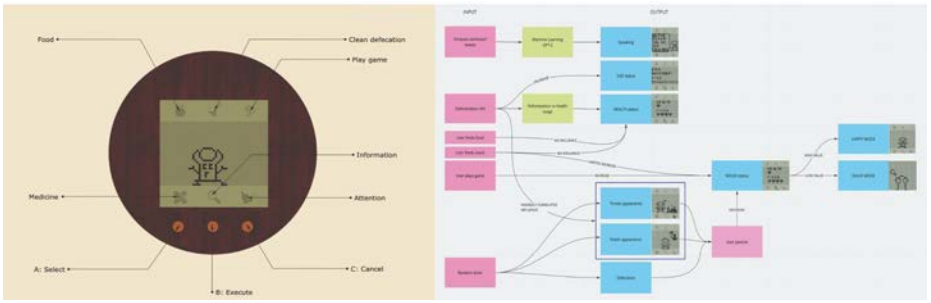

Fig. 4. (**Left**) Prototype for interaction in Chikyuchi. (**Right**) 6 caring strategies in Chikyuchi.

The Chikyuchi is connected to the deforestation API, reporting the actual size decreasing 2 km2 with every second in the last screen of the statistics menu. Chikyuchi is determined by its health and mood (each heart meter is from 1 to 4). The health is always bad due to the situation of deforestation. Although users are able to temporarily cheer up the Chikyuchis with thematically related food and games, increasing their mood status, it won't change their critical health status. The Chikyuchis also periodically chat about each crisis by interrupting the game. It does this by using text generated with the transformer language model GPT-2 pretrained on tweets containing the words "deforestation" and "global warming" over a 3 day period (temperature=0.8 during generation, 6500 epochs training). The text selected (Appendix) are implicit forms of persuasion rather than directly lobbying for climate action. Chikyuchi randomly selects one of the texts to say during each interruption.

There are three lower buttons (select, execute and cancel) that allow participants to make in-game decisions (Fig. 5-6). In the game, participants could interact with the

virtual pet through six functions: food, clean defecation, play game, medicine, information and attention. Each in-game decision and interaction may affect Chikyuchi's mood in the short term but does not improve its health. For example, feeding it water snacks, but not donuts, increases its mood. If random threats comes upon Chikyuchi, it would suffer unless it is healed. If further threats are not healed, the death graphic would appear. Playing a guessing game with the weather about whether it should bring an umbrella (it'll rain) or sunglasses (it'll be sunny) can raise its mood if the guess is correct. The stats menu gives the current health, mood, age, and size of Chikyuchi. In summary, Chikyuchi uses the interactive gaming paradigm to promote care-taking behavior from players in relation to climate change [4].

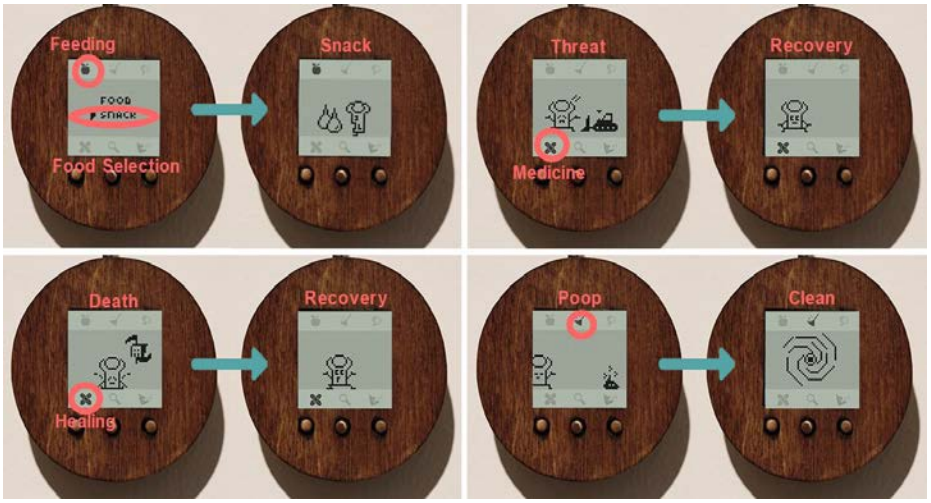

Fig. 5. (**Top Left**) Feeding function flow. (**Top Right**) Threat interaction flow. (**Bottom Left**) Death interaction flow. (**Bottom Right**) Poop and clean interaction flow.

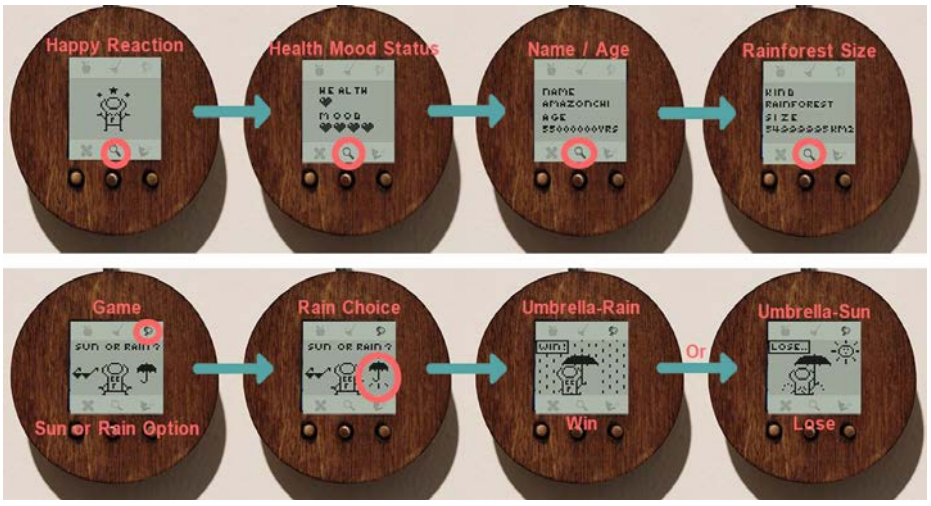

Fig. 6. (**Top**) The flow for checking Chikyuchi health and mood status and other information (name, age, the declining rainforest size). (**Bottom**) The flow for the umbrella/sunglasses game play in which the player must guess whether the next day will be sunny or raining (whether the Chikyuchi should wear sunglasses or bring an umbrella). Guessing correctly continues the game indefinitely and increases the mood of the character.

3.2.2 **Interactive Installation**

To create an immersive and comfortable environment for participants to engage with Chikyuchi, we set up the interactive installation at the exhibition hall. The installation consisted of several parts: a live video-feed for real-time interaction with participants in Tokyo (the project was exhibited simultaneously at Tokyo and Hong Kong), a comfortable experience area, game devices, the photos and books that hint at climate change and a rusted bronze sculpture of Chikyuchi that represent the monument of the destroyed natural resources as dead virtual pets. The cast tells the story of what would happen in the future to Tamagotchi devices, nudging audiences to consider future consequences. The interaction made visitors learn about different cultures and locales via the popular Japanese Tamagotchi game [7]. The live video feeds allowed people from different locations to have common practice of caring across parts of the world.

Fig. 7. (**Top Left**) Exhibition Strategies in Hong Kong (with labelling). Exhibit in Hong Kong. (**Top Right**) Real-time Interaction between Hong Kong and Tokyo through projection. (**Bottom Left**) Exhibition layout (with labelling). (**Bottom Right**) Evaluation of Gameplay.

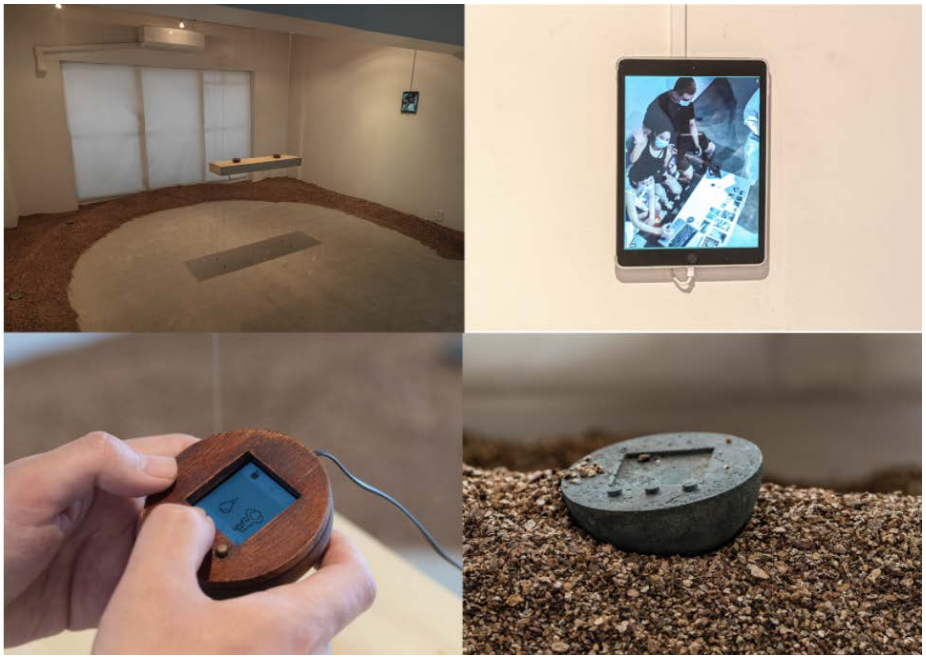

Fig. 8. (**Top Left**) Exhibition Strategies in Tokyo. Exhibit in Tokyo. (**Top Right**) Real-time Interaction between Tokyo and Hong Kong through an ipad on the wall. (**Bottom Left**) Close-up of Game Device interaction. (**Bottom Right**) Bronze 'Monument' Sculpture showing Chikyuchi's future decline.

4 Methods

To see how Chikyuchi affects visitors, post-game-playing participants surveys are used to estimate immediate impact, covering several aspects of game experience: immersion, emotional experience, game interaction, flow, challenge and positive influence. The sample is recruited among the audiences at the 'Constructing Contexts' exhibition from 10-20 July, 2021. To reduce external interference and provide the participants a quiet environment, these game events and surveys took place in an exhibition hall (Singing Waves Gallery). We conducted 2 surveys and semi-structured interviews, (n=23 and n=15). The first survey was focused on the effeteness of the whole interactive installation (n=23, 12 female), and the second survey put emphasis on the effectiveness of the game design (n=15, 7 female, 7 male, 1 non-binary).

To ensure the rigorousness of the research, all game events and surveys follow a consistent procedure. Firstly, the participants obtained a brief introduction about the interactive installation, gameplay and then engaged with the game (about 10 minutes). Subsequently, the researcher conducted the postgame survey separately. For data analysis, two researchers coded responses into categories. The emphasis of evaluation are participants' feelings and interaction during gameplay.

5 Findings and Discussions

5.1 Promoting climate actions in interactive games

We conducted a survey to explore the effectiveness and implicit influence of the interactive installation (n=23, Fig. 9). We found that the majority of players participated actively in the care-taking process, since 91% of the participants understood the "care-taking" theme. However, only 32% of players felt it was difficult to find connections between the topic of nature resources and the artwork, indicating that the physical factors regarding deforestation and climate change were not well communicated. This discrepancy between understanding of the behavior involved but lack of understanding of the actual issue of climate change suggests that the intervention was on the human psychology level (caring in this case) of climate action as opposed to the physical level of resource limitations and consumption.

It is interesting to note that the lowest score achieved in the survey involves how much participants learned about deforestation and climate change. This suggests that explicit knowledge in the form of statistics and policies were not picked up by the audience. This is despite the machine learning-generated text being perceived as strongly communicating the ideas of climate action.

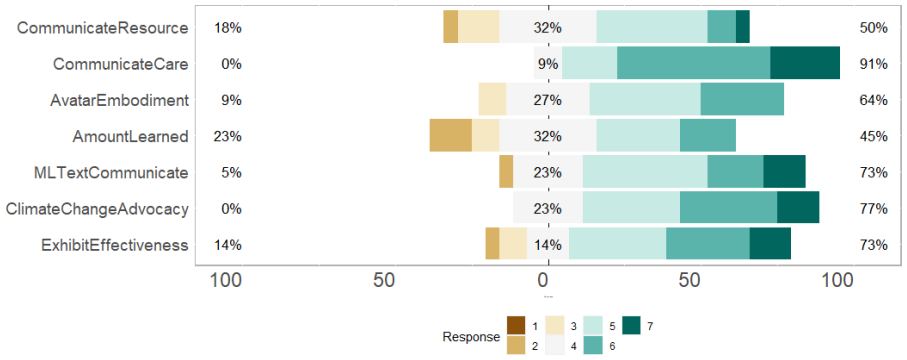

Fig.9. Interactive Installation Effectiveness by Participants by Likert scale rating (n=23). Survey 1: Q1. CommunicateResource: How strongly does the Chikyuchi tamagotchi game communicate a depletion of resources? Q2. CommunicateCare:How strongly does the Chikyuchi tamagotchi game communicate a process of care-taking? Q3. AvatarEmbodiment: How strongly does the main avatar in the Chikyuchi game embody a natural resource metaphorically? Q4. AmountLearned: Based on playing the game and experiencing the exhibit, how much have you learned about the state of natural resources in the world? Q5. MLTextCommunicate: How strongly do the text spoken by the character in the Chikyuchi game communicate the issue of deforestation? Q6. ClimateChangeAdvocacy: How strong are you an advocate for protection of the environment? Q7. ExhibitEffectiveness: How encouraged are you to take action in regards to the issues raised in the exhibit?

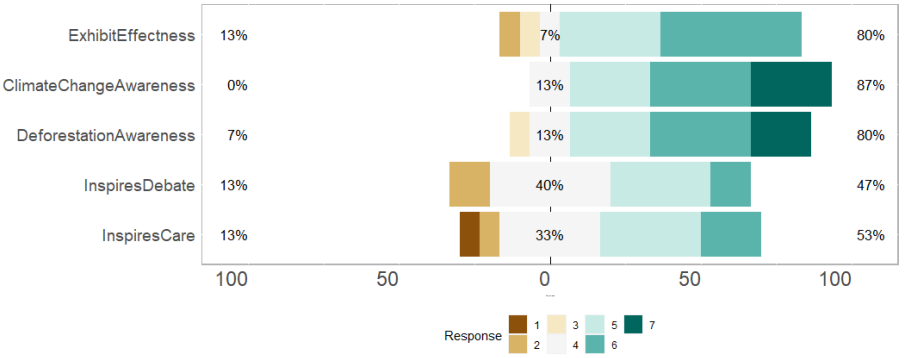

Fig. 10. Game Design Effectiveness by Participants by Likert scale rating (n=15). Survey 2: Q1. ExhibitEffectness: How encouraged are you to take action in regards to the issues raised in the exhibit? Q2. ClimateChangeAwareness: How much do you think climate change affects our everyday life? Q3. DeforestationAwareness: How much do you think deforestation affects our everyday life? Q4. InspiresDebate: How strongly do you think this installation contributes to debate about environmental issues? Q5. InspiresCare: How strongly do you think this installation affects your desire to care for the environment?

To evaluate the design of the game in the exhibit context more deeply, we conducted a second survey (n=15, Fig 10). Here we don't see a difference in the way the exhibit inspires debate vs. inspires caring action. However the demographics were strong advocates of climate action already, suggesting that we needed to collect more results from populations which were climate change skeptics or deniers.

5.2 Relations between care-taking games and emotional interactions

Although the majority of participants regard the virtual game as communicating care-taking in a long-term lifestyle, there still need more data on how these interactive storytelling implicitly affect and lead to pro-climate change awareness and actions. Based on the qualitative coding of responses from participants' surveys, we obtained some interesting results. For instance, participants developed a tendency to take care of the virtual pet for a long time while playing with it:" *I remember my old toy like this so that I can relate easily how we as humans need so much care*". And "*co-presence*", "*take-caring*" and "*interaction*" was frequently mentioned among all responses. Moreover, when asked to describe the game, the participants tend to always talk about the caring aspect first: "*[It's a] nostalgic experience that reminds me of caring for the earth*." Participants also listed the following as the most salient aspects of the exhibition: "*take care of him*," "*care taking of the avatar that represents forest,"* "*feeding food*," etc.

By building the care-taking relationship, participants found connections between the Chikyuchi pet's low health setting and deforestation: "*Care and attention to a single digital entity does not make much of a difference, a collective effort is needed*

to make a difference..." and "*Maybe Chikyuchi is a tree that needs care-taking or reforestation to help recover its health.*" These interpretations show that participants project an emotional reaction with the virtual pet on a human purpose level, e.g., "*The hopelessness of whatever behavior you are imposing on the creature, their condition will still be much more affected by the actual climate condition.*"

Interestingly, some participants were able to understand the mechanisms of the game without being told about it: "*the game can improve its mood which has a great change on its behavior (gesture), but no one cares about its health because nothing will change its appearance by improving health*." Note that no one told the participant about the meaning of the health and mood meters, but by playing the game for longer durations, she figured out how the meters work, i.e. that the health is never improved. This is consistent with the participant's understanding that a *long-term* style of care is needed to achieve the desired interaction, for when we ask audiences why the health appears to be low, one viewer answered that "*it should be a long term effect*." When asked to infer the causes, the subtler parts of intervention emerge from the implicit part of the interaction: "*it could be because the forest is destroyed and there is no repair to it; maybe Chikyuchi is a tree that needs company or reforestation to help restore its health*."

6 Conclusion

We designed and analyzed a climate action caring game, a project that involves the application of interactive storytelling in climate communication and its implicit influence. Therefore, the emphasis in our analysis is the implicit influence of the interactive caring game and how it affects participants' climate action activities. However, the gameplay experience and effectiveness may be discrepant by limited game functions and participants' experience duration. In the future, we need to investigate the long-term influence based on the virtual caring relationship and see its effect patterns of behavioral change. Our research mainly assessed participants between 18 and 35 years old, and did not collect enough data from the older users, and hence do not target populations who do not already agree with climate change advocacy. It may be that people of different demographics in terms of climate action advocacy may be differentially affected by these subtle forms of influence.

This research studied the use of implicit influences in purposive interactive storytelling in climate communication. Compared to storytelling visualization alone, narrative interactive games may help participants reinforce the mental connection that can alter their climate awareness in the long run and take pro-climate actions.

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Appendix

A digital prototype version of the Chikyuchi game:
https://www.figma.com/proto/vKqY2BMMQ1xYuhI0MHyL5a/ChikyuchiButtons?scaling=contain&page-id=0%3A1&starting-point-node-id=14%3A0&node-id=14%3A0

The GPT-2 generated text pretrained to twitter feeds used when Chikyuchi speaks:

- This project is called Terrains, and it's in danger. It’s a sad story to be told but an important story all the same.
- It's as if we've learned.
- Let’s figure out a way to reward those that have remained optimistic for the future of this species.
- Let’s figure out a way to reward those that have remained vigilant & keep everything alive.
- It is now or never. Please help us help you. A natural disaster is unfolding in a tragic way.
- I don’t think we should give up!
- We can do this, I believe, because nature is the source of so many of us.
- What I am doing right and what I have achieved despite unprecedented challenges.
- What I am doing right now is eerily all I’ve got.
- Never believe that you're too small to make a difference.
- Sometimes my brain reminds me of everything awful humans do.
- 1) We need to understand why it's happening 2) We need to stop it from happening. Sometimes it becomes necessary to patch things up.
- That’s the 1st thing when we wake up in the morning, is to be thankful to the Great Spirit for the Mother Earth.