Earth Girl: A Multi-Cultural Game
about Natural Disaster Prevention and Resilience

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Abstract. *Earth Girl: The Natural Disaster Fighter* is an edutainment digital game featuring a girl who can save her family and friends from natural hazards. The scenario and game play are inspired by the challenges faced by communities living in the Asian regions prone to earthquakes, tsunamis, flooding and volcano hazards. The Earth Girl game is meant to help players to gain a better understanding of natural hazards through imaginative and fun game play. The game was developed in English and translated to Indonesian, Japanese and Chinese. It runs on any Flash-enabled browser and was user-tested in Southeast Asia with positive results and feedback.

Keywords: Earth Girl, natural hazards, disaster prevention, computer game, edutainment, serious games, casual games, game play, non-traditional education, game prototype, character design, character animation, emotional connection, pre-teens, Asia, cultural traditions, community, sustainability, resilience.

1   Introduction

The Earth Girl digital game was developed for a mainstream non-scientist audience of all ages and particularly for children between the ages of 7-12. The game seeks to increase the regional awareness of natural hazards while providing simple but engaging game play that is as culturally sensitive as it is fun. (Fig. 1). The project was inspired and informed by our 2009-2012 trips to resilient communities in The Philippines, Indonesia, Thailand and China. The main goal of *Earth Girl: The Natural Disaster Fighter* is to provide players of any culture with a better understanding of natural hazards through simple but engaging and fun game play. The game is coded in Flash and can be played on a Flash-enabled browser. Earth Girl is a village girl who can save her family and friends from natural disasters. This fictional character is inspired by people who live in hazardous areas throughout Asia yet manage to find a way to survive by being in tune with Nature.

The Earth Girl game is not a traditional science game but it is inspired by science. It is an initiative of the Artist-in-Residence group at the Earth Observatory of

Singapore (EOS), a Research Center of Excellence located on the campus of the Nanyang Technological University. The mission of EOS is "to conduct fundamental research on earthquakes, volcanic eruptions, tsunami and climate change in and around the region, toward safer and more sustainable societies" [1]. Interdisciplinary collaboration is at the core of this mission, and creating a game for children is a step in that direction. For project updates visit www.earthgirlgame.com.

Fig. 1. (Left) Main menu where players can choose a disaster. (Right) School girls in Banda Aceh, Indonesia, discussing the best strategy for rescuing a villager floating in the flood.

2   The Game Paradigm

The game paradigm of Earth Girl combines skill and knowledge. *Earth Girl: The Natural Disaster Fighter* is a game of awareness, preparedness and survival. It offers three levels of side-scrolling action, plus factual information delivered in the form of quizzes. Each one of the three levels presents a different hazard scenario (tsunami, flooding and volcano) and starts with a cinematic animated introduction that helps to contextualize the action.

Players move forward through the first part of each level by rescuing villagers. This is followed by a quiz that presents multiple-choice questions relevant to the hazard being played. Correct answers enhance the players' scientific knowledge and also provide Earth Girl with additional health to save villagers more effectively and/or special skills or super-powers to combat the hazard. Multiple explorations were required during the development process before a suitable game play paradigm was found, one that splits each game level into three parts. The first and last parts are action oriented, and the middle one consists of a quiz that provides objective information about the hazard at hand.

One of the biggest challenges of this project was finding the right tone to tell a story that can range from success to disaster. Players of the game, through Earth Girl, are able to save the villagers from death, or lose them all to a natural disaster. We stayed away from overly didactic or technical scenarios and naturally gravitated towards action-based dramatization. We were sensitive to depictions of death, touch on issues of preparedness and awareness, and occasionally infuse some dramatic situations with bits of humor when appropriate.

Another early challenge was finding the best way to present scientific facts about natural hazards to a mainstream audience in the context of fun and simple game play. We were interested in the tradition of edutainment and not in the traditional lecture/lab scientific game. We believe that the game provides engaging entertainment and it also fulfills an educational mission by reminding players the important role that awareness and preparedness play in surviving natural hazards.

Unlike the traditional educational formats of geography or science lectures this game focuses on the emotional experience of the player, an approach discussed in [2, 3]. The Earth Girl game uses emotional impact as a teaching tool instead of relying on a purely rational understanding of the issues. Placing emotion above knowledge might seem like an unorthodox design approach for a serious game. But we found it to be an effective approach since the essence of the game is about saving people. Emotion and instinct are oftentimes as powerful as rational intellect when it comes to pulling people out of harm's way. Adrenaline provides an immediacy that technical explanations cannot.

3   User Testing and Feedback

We conducted three stages of user testing and feedback, and throughout it we learned many valuable lessons. During the first stage of testing we watched children and adults play the game. This stage of testing took place in Singapore where children and pre-teens are used to interacting with hand-held devices, particularly Apple iPhones, and tablets. This early stage of testing helped us to fine-tune the level of difficulty regarding speed and intensity of challenges, and the number of keys required to play the game.

The second stage of testing was mostly about gathering feedback from the science experts at EOS. For these feedback sessions we used the early prototype of the tsunami level and in-progress versions of the flooding and volcano levels. We had talked to scientists informally earlier in the development process but this stage represented a more formal setting for exchanging opinions and points of view about our specific implementations of the original idea. These feedback sessions proved to be a good and fruitful exercise in interdisciplinary collaboration between sometimes clashing cultures. The majority of the feedback focused on scientific issues as the scientists' first-hand experience and understanding of games was limited. One of the scientists' main concerns was the issue of providing flawed information in the game that could lead players to making wrong assumptions about earth hazards. We made two significant changes to the original idea.

The first change was a compromise. We split each level in two halves, and we allowed some super-powers in the second half but not in the first half. This way we could offer a feature that is standard in most action games but we would tie it to the reality of survival. We made the amount of super-powers conditional on the percentage of villagers saved in the first half of a level. We also minimized the force of the super-powers so that in the volcano level for example players cannot defeat the hazard with super-powers alone, they must also directly save villagers. Fine-tuning

the right amount of fantasy and reality eventually helped to make the Earth Girl game engaging to play. The second change was an improvement. We enhanced the game cinematics in order to provide contextual information about the hazard.

The third stage of user testing and feedback took place when most of the functionality in the three levels was completed. This testing focused on playability, language and conceptual comprehension and it took place with school children in Singapore, Banda Aceh in Indonesia and rural Yunnan in China. Testing the game in Banda Aceh was an unforgettable experience as we knew that many of the kids in the classrooms were likely to have lost relatives in the 2004 Indian Ocean tsunami. We observed that children liked the flooding level because it provides for extended game play and it requires some strategizing in addition to action skills. The majority of the advanced players seem to enjoy the volcano level (Fig. 2). We translated the original game from English to Indonesian, Japanese and Chinese, and we had to work through a few language comprehension issues. This localization effort was significant and important to the overall strategy of reaching the widest possible audience.
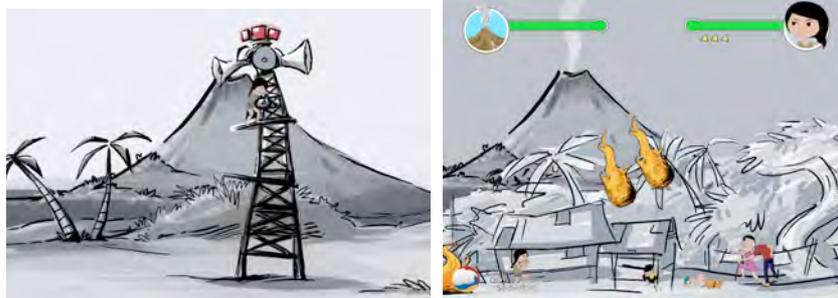
Fig. 2. (Left) In the volcano level cinematic Earth Girl sounds the alarm for the villagers to evacuate. (Right) The stylized representation of the flaming lava is not scientifically accurate but it helps to dramatize a volcano eruption in the context of a casual action game.

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