Earth Girl Saves the Day

A Computer Game Prototype about Earth Hazards

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Abstract—**Earth Girl is the story of an Asian girl who can save her family and friends from natural hazards. The story is being developed as a computer game and animated short. This paper presents the design philosophy and a progress report on the single level game prototype, one that is meant to help players gain a better understanding of natural hazards through imaginative and fun game play. Earth Girl the computer game seeks to raise the regional awareness of Earth hazards while providing simple but engaging game play that is as fun as it is culturally sensitive and based on scientific fact.**

Keywords–computer game, serious games, game play, game prototype, animation, Earth hazards, Asian cultural traditions, Southeast Asia, Western Pacific.

I. INTRODUCTION

Earth Girl is a teenage girl who can save her family and friends from natural disasters. This fictional character fights to preserve the balance between human communities and the natural environment. The project seeks to raise awareness of Earth hazards in Southeast Asia and the Western Pacific region and is currently in production as a computer game (Fig. 1) and in development as an animated short (Fig. 2). The main goal of this project is to provide fun, instructive and simple game play that can be played on a browser while offering a high-level artistic and animation experience.
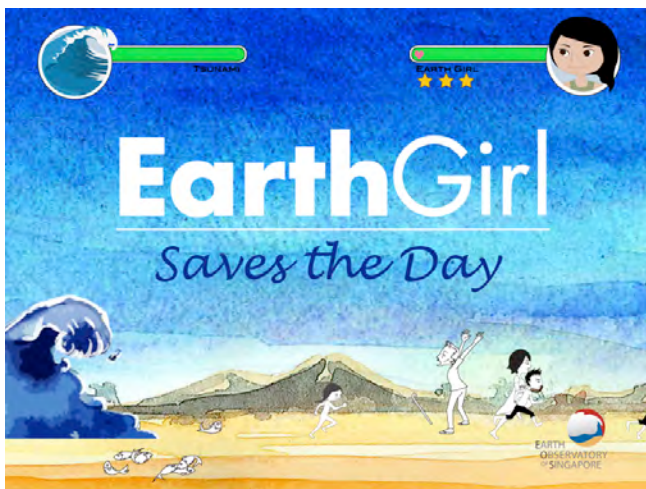

Figure 1.   Screen shot of prototype game play, with logotypes.

The Earth Girl project is an initiative of the Earth Observatory of Singapore's Artist-in-Residence program. 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]. The Earth Girl prototype core team consisted of two research assistants and myself, a few transient work-study students and a couple of freelance artists to complement the team. My primary role in the project is and was to provide creative leadership and to get the job done.

This paper documents the development process of the game prototype. It also covers some of the early design challenges and objectives, as well as some of the solutions chosen. For project updates please check the project blog at http://earthgirlproject.wordpress.com.

Figure 2.   Early concept art for Earth Girl, a pan-Southeast Asian preteen who loves spending time with her pet cat. Artwork by Victor Kerlow.

II. BASIC DESIGN CONSIDERATIONS

The original idea for this game came out of my interest in presenting complex issues to mainstream audiences. In this age of significant Earth hazards lives in the region could be saved when more people understand a few simple scientific facts. In addition we were also interested in coming up with a unique visual style that would be creative, fresh and engaging but relatively light in terms of file size. This is all easier said than done.

To my surprise the initial reception to the concept was not as enthusiastic as I had hoped for. Some of my science colleagues had serious reservations, for example, about the

scientific simplifications that would be necessary to bring Earth hazards into the context of fun and simple game play. Some of my gaming colleagues on the other hand felt that the learning component of the game could hinder the game play. I had reservations of my own about embarking on the design of a serious game as my experience with this genre was limited. My closest encounter with serious gaming was while working on edutainment titles at Disney Interactive. In addition our team was small and the resources limited. But I decided to go ahead as the potential for an original game increased in direct proportion to the challenges.

During the brainstorming stage we focused on the fundamental deliverables of any game. These are covered extensively in [2, 3]. We made sure that our deliverables were appropriately scaled to our production capabilities and pipeline. Some of the early design issues included the principal audience for the game, the game play style and the basic interface considerations, along with performance and animation issues.

A. Audience

Generally speaking the Earth Girl computer game prototype was designed to reach non-scientist individuals of all ages. But its primary audience is preteens and early teenagers, roughly between 8 to 15 years old, an age group that is usually quite familiar with the mechanics of multiple computer game genres. This audience is also quite adept at exploring new game formats and mastering challenges that are properly scaled to their abilities. In addition many of the preteens and early teenagers in some of the Southeast Asian and Western Pacific communities have a relative familiarity with the Earth hazards featured in this computer game as they are common throughout the region.

B. Game Play and Functionality

The initial intention was to take this project beyond the format of a traditional educational science game. The tone of the game is action, fun and learning: different from a traditional geography lesson about prevention of Earth hazards. During the early stage of game design I decided to focus on the emotional experience of the player, an approach discussed in [4, 5], and placed emotional impact above a purely rational understanding of the issues. Placing emotion above knowledge might seem like an unorthodox design approach for a serious game. But I thought it was appropriate 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.

The most challenging issue in crafting the game play was figuring out how to combine emotion and intellectual understanding. The guiding principle was to provide fun and active game play, as well as relevant information about minimizing the toll from Earth hazards. Multiple explorations were required before a suitable game play paradigm was found, one that splits a game level into three parts. The first and last parts are action-oriented, the middle one consists of a quiz that provides objective knowledge.

The basic game play paradigm in the first half of a level consists of placing Earth Girl in a potentially hazardous situation with her community is at risk. Her objective, and the player's task, is to save as many people as possible by reacting swiftly and effectively. The essence of game play in this first half is humanitarian even though the game play is based on physical action. A high score in the first half (i.e. number of villagers saved) provides the player with special powers in the second half.

The player moves on to a quiz regardless of the outcome of the first half. This quiz provides objective facts that reinforce the player's knowledge of the earth hazard in question. The player is allowed to continue to the second half of the level only after he/she solves the quiz successfully. Any special powers earned in the first half are activated and the player can "fight" the earth hazard. The second half provides action-based and fantastic game play.

In terms of overall structure, the game was conceptualized with one earth hazard per game level. Generally speaking the game play was kept simple and its default difficulty level was kept low in order to maximize the number of potential users. Players can modify the difficulty level in the Options Menu. In terms of game mechanics and basic interface this is a side-scrolling game with simple keyboard controls, using five keys and the space bar. Game feedback regarding player statistics is provided through dynamic status icons (Fig. 3), health bars, and summarized at the end of each section. Many significant cues, such as impending danger and suspense, are provided through the music soundtrack and audio effects.

Figure 3. Dynamic status icons echo Earth Girl's moves and status.

C. Performance and File Size

The game is meant to be easily playable online on average computing devices. Flash was chosen as the delivery format as it can easily be played on standard Web browsing software, and also because most of the core team was already familiar with it. The initial target file size per level was set at 4-5 megabytes. This size allows for good performance on a variety of devices as well as a somewhat refined style for art assets. Both performance and visual style are key objectives of the project.

D. Animation and Visual Style

A great deal of Earth Girl's personality derives from her game moves and the quality of her animation (Fig. 4). The style chosen is a combination of limited animation and well-chosen key poses. Since the game characters are displayed in a somewhat small size, readability of action was a key consideration throughout animation development.

Having a distinctive visual style was important as this can increase the uniqueness of the game. For the backgrounds I proposed a graphic style rendered with traditional watercolor technique. We settled on a drawing style that has cartoony and realistic elements.
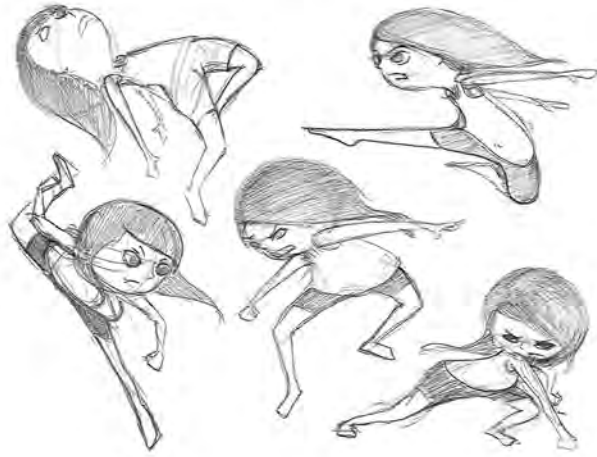

Figure 4. Earth Girl showing off her dynamic side. These motion studies are the core of the character animation. Poses drawn by Wang Rui Fan.

III. CHARACTER AND VISUAL DEVELOPMENT

During the early stages of the process the team focused on the major tasks of character and visual development, and animation testing. This was followed by programming and production of the prototype.

Character development is an essential step in the process of developing a character-centric computer game. The overall look and personality of Earth Girl were established and refined primarily through an exploration of poses and facial expressions. She is a smart and action-loving girl who cares about preserving her community and the natural environment. It was essential that these qualities came across in her appearance.

The development team considered a variety of personality traits, body proportions, facial features, clothing and hairstyles to best represent the personality of the young protagonist (Fig. 5). Two different solutions were chosen: a simple one suitable for the constrained specs of the Flash game, and a slightly more elaborate one that works for the genre and technique of the animated short.

In addition to Earth Girl the game also features several villagers and a few animals including: a cranky old man, a protective mother, a mischievous boy, a curious baby, a friendly street dog, and a pet cat. Earth Girl's pet cat is somewhat of a magical creature that can change sizes at will and helps Earth Girl accomplish some of her tasks.

Visual development for the game was centered around before-and-after scenarios for a variety of Earth hazards common in Southeast Asia and the Western Pacific. This includes, for example, earthquakes, volcanic eruptions, tsunami and typhoons. Members of the visual development team were asked to visualize a given location and a particular hazard, according to an established dramatic treatment. Some of the visual development artwork is showcased in Figs. 6-8.
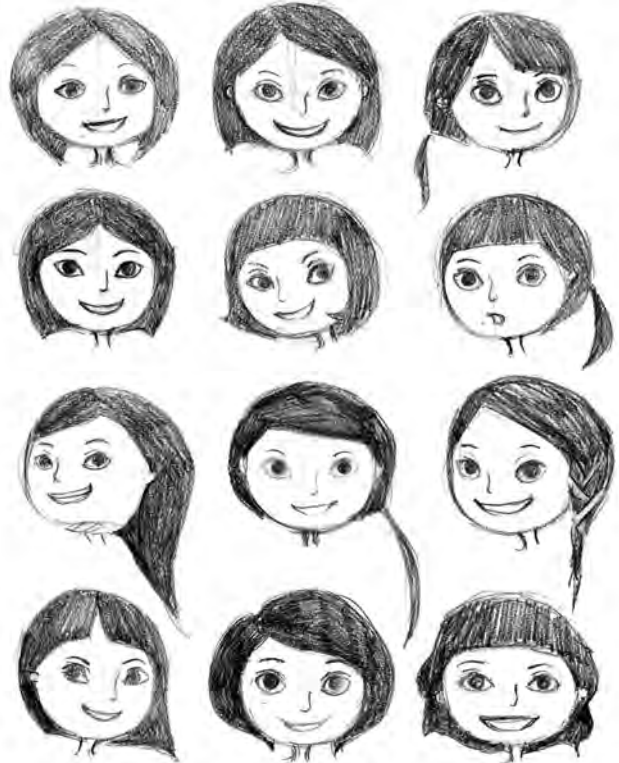

Figure 5. Early character studies to fine-tune Earth Girl's ethnicity and age. Artwork by Nur Aisyah Suhaimi.

Figure 6. Typhoon rains brings fear and flooding of rice fields. Visual development artwork by Calvin Chua Tin Giap.

IV. THE PROTOTYPE FOR GAME LEVEL ONE

The first level in the Earth Girl computer game is centered around a giant wave, or tsunami, an Earth hazard that has devastated the region for centuries. It was challenging at first to find the proper way to frame a tsunami in the context of a mainstream computer game that seeks to combine fun and instructional elements. Right from the start we discounted

anything too complex, fancy or very risky in terms of game play. We adopted as a guiding principle the likelihood that someone who had lost a loved one in a tsunami might play the game.

We realized that the only way to show a tsunami and its destructive force is to actually show some loss of life, and we found a stylized way to do this. We stayed away from scientific simulations and instead focused in creating a simple but engaging game play by using stylized representations and compelling storytelling. We were keen on using fighting action as a way to increase the game play appeal of this game and engage gamers. This was met with some resistance by our science colleagues who insisted that the only way to realistically fight a tsunami is through prevention and not by punching a wave.

Figure 7. A *kampong*, or small fishing village, is destroyed by strong waves. Visual development artwork by Nor Azman Rohman.
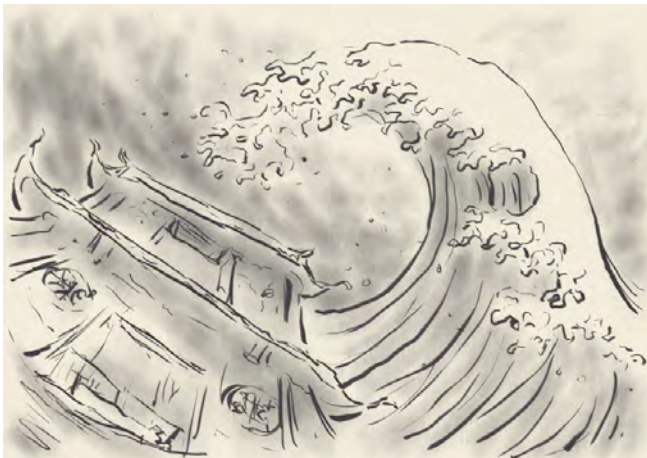

Figure 8. Killer waves in South China overtake a temple built meters away from the shore. Visual development artwork by Seow Kim Siang.

The scientists' suggestion proved valuable, and it led to the splitting of the game play into two halves within the level: a somewhat realistic and humanitarian first half and an action-oriented second half. We wanted to find a balance between the destructive harshness of real tsunamis and game play that was engaging but not too violent. The intention was neither to shock our primary audience, nor mislead them into thinking that a tsunami can be defeated with kicking and

punching. We had to address the issue of death, but we had to find a way to do it directly and gently. After some trial-and-error, we crafted a methodology that seemed to address everyone's concerns:

- Integrating the fun aspects and the educational aspects is a key deliverable of the finished game, but start by keeping the two distinct from one another.
- Split the game play into two parts. The first half emphasizes community awareness and disaster prevention, while the second half focuses on physicality and fun game play to defeat the disaster.
- Insert a quiz about n Earth hazards between the two halves of a level, so that players can get to the physical fun game play only after saving the community and correctly answering the quiz.

A. Saving the Community

The first part of level one is all about saving the villagers from being killed by the giant wave. A stylized receding tsunami exposes fish on the sea floor, and the villagers run to pick them. At this point Earth Girl makes her appearance (Fig. 9) and her job becomes to push and kick the villagers away from danger. Speed is of the essence, as a second wave lands on the beach and advances. The health of Earth Girl decreases every time a villager succumbs to the wave.

Throughout this level Earth Girl must also keep away from the tsunami in order to stay alive. The player continues to the next section regardless of how many villagers were saved, and is presented information about tsunamis in the form of a simple multiple-option quiz.
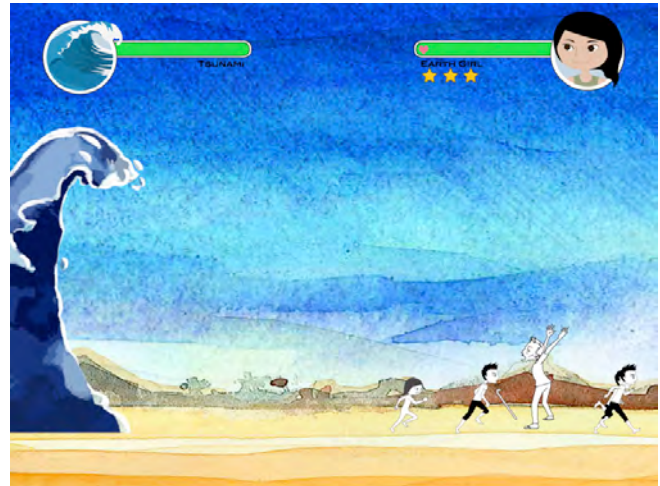

Figure 9. Earth Girl in the process of pushing villagers away from the tsunami. Each character behaves differently when confronted by the wave.

B. Defeating the Wave

Earth Girl gains special fighting powers if the player was able to save most villagers and correctly answers the Earth hazards quiz. These special powers include, for example, a force field, a smash punch, and a tornado quick (Fig. 10). Defeating the wave in the last section of the level is accomplished through classic game play of skill and speed.
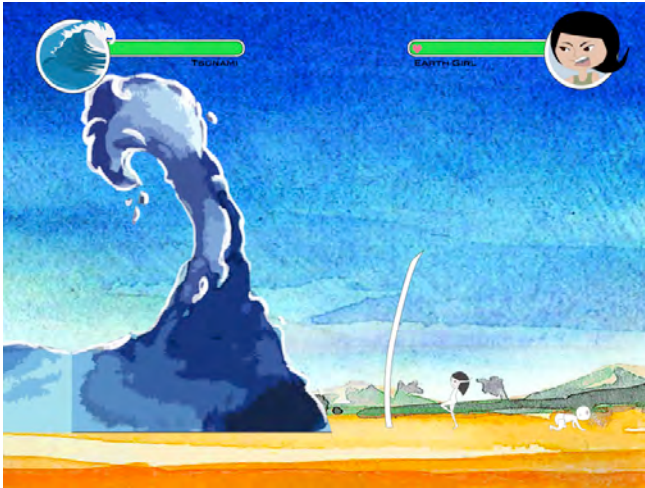
Figure 10. Earth Girl acquires a force field to stun the tsunami and save villagers after the player solves the Earth hazards quiz. Background and wave artwork by Nguyen Thi Nam Phuong.

C. Animation Sprites and Backgrounds

The characters were animated as cycles of Flash game sprites generally ranging between 2 to 6 frames. This technique is traditional but also highly efficient and delivers good quality animation. The frames were drawn by hand, scanned, assembled and timed digitally, and finally inked and colored. The wave was animated by cycling through 24 large bitmaps. This technique was neccessary to render the wave in a watercolor style similar to the scrolling background (Figs. 9-10). The technique is not as efficient or lean as small sprites but it is a viable compromise between the desired visual style, efficiency, and file size.

V.   BEYOND THE PROTOTYPE

The Earth Girl game level one prototype was well received during user testing. We are satisfied to have found a successful way to combine engaging action-oriented game play with instructional moments. Production is under way for another two levels of the game, following a similar methodology and structure. Level two is about typhoons and flooding, and level three deals with volcano eruptions.

The storyline for the Earth Girl animated short continues to be developed, including a time-traveling feature. This feature allows Earth Girl to help and interact with individuals from other times, particularly before disasters take place. For the animated short we are considering an Earth Girl that is slightly older than her Flash game counterpart. The story arc is also a bit more dramatic, with touches of humanity and humor (Figs. 11-13).

The animated story showcases Earth Girl's dramatic arc as she comes in contact with ancestors and friends who have endured a variety of Earth hazards. The storyline provides ample opportunity to show that understanding and using scientific knowledge can be a key element in surving an Earth hazard. The storyline also deals with issues of resilience and inventiveness in the face of disaster.

Figure 11. Earth Girl arrives as disaster strikes and takes a toll partly due to insufficient prevention. Artwork by Victor Kerlow.

Figure 12. Earth Girl inherited a magical wooden *kris* (Malay dagger) from her grandfather. She can use it to time travel across time and space. Artwork by Victor Kerlow.

Game Prototype Production Credits

Principal Investigator and Creative Lead: Isaac Kerlow. Research Assistant, Programmer: Muhammad Khadafi. Research Assistant, Lead Artist: Nur Aisyah Suhaimi. Background Painting and Effects Animation: Nguyen Thi Nam Phuong. Music and Sound Effects: Jeremy Goh. Producer: Isaac Kerlow. Character Animation: Mohammad Sufyan Alimon, Chen Siqin, Celestine Chia Jin Wen, Aisya Rila Bte Aliman, Nor Azman Rohman, Florence Sjah, Nur Aisyah Suhaimi, and Wang Rui Fan. Character Design: Florence Sjah, Nur Aisyah Suhaimi, and Wang Rui Fan. Storyboards: Victor Kerlow. Visual Development: Calvin Chua, Dominic Maximilian Foong, Victor Kerlow, Nguyen Thi Nam Phuong, Nor Azman Rohman, Seow Kim Siang, Hans Christian Sulistio. Game Design: Isaac Kerlow;

Clement Bey, Muhammad Khadafi, Jonathan Lian, Nur Aisyah Suhaimi, and Timothy Tan Jiat Meng.

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Figure 13. Earth Girl has the help of some pretty influential friends. Artwork by Victor Kerlow.