Differences in the Design and Implementation of Educational and Entertainment Video Games

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Introduction

A gap exists in the current paradigm between educational game researchers and mainstream game developers. The literature devoted to these two camps often attempt to answer the same questions and come to similar conclusions, but very few links, if any, exist to connect the two camps. Both Fullerton (2008) and Young et. al. (2012) find the need in their research to provide a definition for a game and have similar answers. Fullerton (2008) also makes mention of the research into 'flow' as first defined by Csikszentmihalyi (1990) which is also mentioned in research into education (Shernoff et. al. 2003). While there is a potential for overlap in these two fields of research, there is little in the literature that connects the two. Except for a brief speculative paragraph that makes no mention of any research, Fullerton (2008) gives no regard towards the idea that a game has any other purpose than entertainment in his book. This redundancy combined with a lack of any reference between the two camps is troubling for aspiring educational game designers, as they'll be ill equipped to deal with the specific rigors of creating games with an educational goal in mind. Young et. al. (2012) calls for collaborative partnerships among commercial game creators and a variety of other educational professionals yet no precedent is given as to how these collaborations can be formed. Studies akin to Mayer's (2014) and Plass et. al. (2009) give educational game designers lists of suggestions and principles to take based off of what has been shown to be effective methods in the games and visualizations the studies centered around, but do not look into the difficulty of implementing these suggestions into other educational games. This specificity need to be generalized so mainstream developers can more easily adapt their strategies to educational use.

This study looks to establish designer-centric research and create a list of guidelines that

can help video game designers enter the educational game design sphere. These guidelines will be based off of the differences between the design and development processes of educational and entertainment games, to help these developers adjust to developing games with the end goal of education. This study is a comparison of the documents, methodologies, and design decisions behind two different game projects: one with an educational goal and the other with a more standard entertainment goal. This comparison study was conducted at the conclusion of two separate game design projects. The research will seek to determine if the educational goals of a game introduce significant challenges to the design process and will seek to create a model or list of potential metrics for future game designers that detail the differences between educational and entertainment games. Specifically, the research question being answered is: What differences in production can be found between a game with an educational goal versus a game with an entertainment goal?

These designer-centric metrics will be necessary guides for increasing the practicality of educational game design, as there is a large and steadily growing amount of resources and suggestions available to designers from educational games research. This growing body of data along with the significant disconnect between resources offered by educational games research and entertainment game design resources and literature will limit the effectiveness of brand-new educational game developers unless steps are taken to introduce these developers to this different sphere.

Rationale

Current educational games research often gives models, lists of suggestions, and other

resources to designers to use in future processes. Ideally, game developers would go through these resources and weigh the impact of considering them during the pre-production process. These impacts can confer benefits to the design process at the cost of increased scope, the general volume of work, and changing or altering the goals that the designers have set for the game project.

Mayer (2014) and Plass et. al. (2009) provide listing of principles that are found in effective multimedia instruction, which can be extended into games as they can be considered a form of multimedia. Their suggestions run the gamut from how visualizations should be constructed and laid out to what aspects of game play should interaction focus on (Mayer, 2014; Plass et. al., 2009).

Garris et. al. (2002) provides a model of the game-playing process that looks at what goes into a game, what happens during the game play, and what should come out of the game session. The model calls for the game maker to first create instructional content and add in "game characteristics" (Garris 2002) in order to create a motivation loop that will keep student's engagement. These characteristics coincide with other suggestions and models for academic games, such as the suggestion given by Plass et. al. (2009) to include learner control-segmenting as a method for controlling the pacing of an educational presentation. Both authors agree that an important part of an interactive experience is giving a learner control over their progression. Even with significant overlap, there is still a large amount of suggestions and resources that designers will want to keep in mind. Garris et. al. (2002) gives six game characteristics, four kinds of user judgements, 5 kinds of learning outcomes, and a model with seven distinct steps. Plass et. al. (2009) gives a total of 11 principles that should additionally be considered. Similarly,

Mayer (2014) gives a further 12 principles into this pool of consideration. With a growing body of research, the total amount of resources that educational game developers will have to keep in mind can quickly become overwhelming.

With vast amounts of resources available and a wide difference of suggestions and features to try and implement, developers should be aware of what will be different as they take on the challenge of developing an educational game and find ways to handle what they will use in their designs.

As previously mentioned, a worrying disconnect exists between resources from educational games research and mainstream game design resources. With instructional content a central tenant to educational games design, educational games will have needs that differ from normal games (Garris 2002). Entertainment games and the body of resources surrounding them often do not discuss these needs and considerations that should be made to address them. One such consideration that only appears in educational game research is the need for a "debriefing" after the session students are introduced to a game (Garris 2002). Clear parallels can be found in other educational games research. Habgood and Ainsworth (2011) mention "reflection" as a part of their model of intrinsic integration, which is described as an activity that takes place after the game and closely resembles debriefing (p. 184). In contrast, the short section on the educational benefits of games given by Schell (2008) mentions some reasons games can be useful in education but does not include anything akin to debriefing nor any concrete principles to follow for designing educational games (p.443). Fullerton (2008) makes a single mention of educational games, only acknowledging their existence and considering their goals beyond the scope of the book (p.337). If developers only consider the entertainment-based sources, or do not have access

to educational game design research papers, they are very likely to completely miss these important design considerations.

This disconnect gives rise to the sentiments that Young et. al. (2012) state in their recommendations to game researchers:

In other content domains, there appears to be a disconnect between the possible instructional affordances of games and how they are integrated into classrooms. Games are often multiplayer and cooperative and competitive; they engage players in several hours of extended play, allow rich "hint and cheat" websites to develop around player affinity groups, and are played from weeks to years. However, most schools trade off extended immersion for curriculum coverage, individual play, and short exposures, goals that are not well aligned with engaging video game play. (p. 20)

While Young et. al. (2012) concentrated on how to take elements from other engaging games and use them in educational games, they reveal the disconnect between how games are created in contexts that ignore their use in the classroom. The description of a discreet difference between what current games can do, their "instructional affordances" (Young 2012), how they are used in the classroom, and the maligned goals show a pattern of games that are not strictly designed for classroom use.

Game makers cannot precisely predict what kind of impact their decisions will make on the final experience their game is to provide. This makes game design a "second-order design" problem because there is a separation between the mechanics that game makers create and how the player interprets and interacts with those mechanics (Zimmerman 2003). While all game designers encounter this issue, the main method of determining if the game has the intended

experience the designer wants to portray is through play-testing (Schell 2008). Play-testing is often difficult because the best people to play-test a game are those who have not seen the game being designed. However, these testers are only useful once because after the initial testing they have experiences and biases that will color their later experiences with the game (Schell 2008). Adding more considerations into the design of the game, like the aforementioned principles and resources that should be considered by educational game designers, puts additional strain into the later stages of development because more play-testing is needed to confirm that the designs have had their intended effects.

Methods

<u>Treatment</u>

Two game design projects were selected for observation for a period of one semester, January 27th, 2014 to April 30th, 2014. The projects were selected because they were occurring simultaneously, were being created in a similar university environment with similar resources, and included the researcher in their development teams.

The first game project was tasked with creating an entertainment game with an overall goal of making the game fun. For future reference, this game project will be labeled by it's title, *One Thousand Miles*. The game was designed to be a stand-alone program for Windows-based computers. The game play centers around trying to survive on a desert island and is single-player. The game focuses on the management and distribution of resources in order to survive and attract the attention of a rescue ship, but introduces additional challenges as other computer-controlled people are trapped on the island and each day the player has a chance of waking up as

one of these other characters instead of the original player character.

The development team behind this game project is comprised of 5 students from the computer science major at the University of Virginia and the project is being worked on as a class project. The project will have to meet strict deadlines and the overall grade of the project will be determined by how fun the game is after it is released.

The second game project is creating an educational game with the goal of being a supplement to a 5th grade Civil War curriculum, specifically for Agnor Hurt Elementary School. This project will be referenced as the *Civil War Project*. The game will be a web-based program programmed mainly in Javascript. The game play will center around exploring a game world set in the Civil War era and completing a variety of mini-game challenges. Exploring the world will allow the player to interact with computer controlled characters who will give information about the time period and occasionally offer these mini-game challenges. These mini-games are puzzles that aim to be fun on their own but also provide additional information to students on certain aspects of the Civil War. An example of one such puzzle would be the placement of troops for the greatest tactical advantage and correctly solving the puzzle gives insight into why battles took place in certain locations, which seeks to integrate the learning of where and when important Civil War battles took place while maintaining some historicity.

The development team behind this game project is comprised of around 20 students from a variety of different majors at the University of Virginia. This game project is being created on a volunteer basis through the Student Game Developers Club at the University of Virginia. The project is more loosely structured than the first project, but aims to have a viable product ready for release around the same time the first project will be releasing their game.

Research Methods

At a suitable point of conclusion for both projects near the end of the semester period of observation, all relevant documents related to the design and implementations of those designs into the game were collected for further analysis. Potential documents to collect include, but were not limited to: Game design documents, meeting minutes, references, resources, task lists, game scripts, game instructions, and play-testing session notes. This study was able to collect e-mails and other scheduling documents in order to create a summary of a time line of the development process for both projects, listed as Appendices A and B for *One Thousand Miles* and the *Civil War Project*, respectively. The two projects also provided play-testing documents that outlined a script to be followed during the session and notes on what was learned from the session, listed as Appendices C and D in the same respect as the schedules. Formal game design documents could only be collected from the *One Thousand Miles* project and will not be included in the comparison because there was no compatible document from the *Civil War Project*.

The schedules provide a time line for how long the various parts of the game development process last. Comparing similar tasks and the difference in the amount of time they take between the two projects can show which parts of production have more time invested into them. Fullerton (2008) defines 5 stages of production for video game development: Concept, Pre-production, Production, Quality Assurance (QA), and Maintenance (p 376). The concept phase includes initial planning and design for the game without working on content or code and it is colored blue in the appendices. The pre-production phase mainly includes work on the game in order to create a prototype or proof of concept before the bulk of the work is done and it is

colored green. Production is the work needed to make the game and is colored yellow. QA includes fixing issues in the product and play-testing in order to make sure the game has the desired effect or gives the desired experiences and it is colored orange. Maintenance can be disregarded because it is defined as any work done after release and the observation period of this research did not include anything post-release. Appendices A and B have been coded to include which events best fit with which stage of production.

The play-testing script provides a series of questions that members of the game development teams asked players participating in the play-testing session. Looking at the content of these questions gives a lens into what the developer's goals for the prototype given at the session was. These interim goals show what developers were focusing on creating at that point in time as well as what experiences they hoped to relay to the player. All of the questions asked could be found to fit into one of six categories and have been color-coded based on those categories: Feedback (red), Usability (orange), Quality (yellow), Accuracy (green), Tone (blue), and Feasibility (purple). Details of these categories have been included in the results. Notes taken during the play-testing session were included mostly for completeness' sake, but can also show how close the developers thought the tested prototype of the game was to the goals they hoped to achieve.

With this information, the differences between the two projects and the causes and costs of these differences can be inferred or speculated upon. Patterns and models can then be established as a method of concisely describing the found differences and from these patterns metrics can be developed that will aid future developers for the challenges of educational game design.

Results

The schedules show that considerably more time was given to the concept phase in the *Civil War Project* than in *One Thousand Miles*. The *Civil War Project* had a total of 28 days within the concept phase of production while *One Thousand Miles* needed 14. *One Thousand Miles* also needed significantly less time in the pre-production phase, 21 days compared to *Civil War*'s 40. The observation period ended during the production phase of the *Civil War Project*, after 16 days had elapsed. The game project The observation period for *One Thousand Miles* coincided with its release, so the project's production phase ended precisely 28 days after pre-production. In an effort to better align play-testing, both groups held their main play-testing session on the same day, regardless of where they were in production – labeled "Play-testing Session" in the appendices.

The questions asked during the play-testing session had many similarities between the two groups, however the *Civil War Project* had a far greater range of questions that they asked during the play-testing session. The developers of *One Thousand Miles* had questions that could fit into three categories: one category of questions include questions that tested the quality of the feedback the game gave players, with questions like "How has your characters status changed?" and "What kind of rules do you think governed these changes?" Feedback in a game can be defined as the elements of a game that a player experiences which imply changes to the underlying systems of a game (Fullerton 2008). The second category was questions about general usability of the game, examples including "What actions does this first view suggest are available to you?" The last category was questions about the overall quality of the game.

The *Civil War Project* developers also asked questions on usability, "What were your

impressions of the mechanics (moving and interacting with characters)?" and the overall quality of the game. This project also expanded their questions to include three more categories in addition to the two already mentioned: one being the quality of the information presented, its accuracy, and if it was included in a way that accomplished learning goals. The next category included questions that were asked about the feasibility of using the game in a classroom and whether certain features should be included to give teachers greater control over the presentation of content. T he final category of questions involved the tone of the game and if the writing and visuals helped to convey the time period the game was supposed to be set in.

Conclusions and Discussion

Metric 1 - Time

The schedule clearly shows in all completed stages of game development that educational games take longer to develop. When initially considering the production of an educational game, developers should significantly increase the amount of time they predict they will take on each of the stages of development, with the exception of the main production phase since the observation period did not include the entirety of the *Civil War Project*'s production phase.

Metric 2 – Consider the Students

The developers of the *Civil War Project* found that they needed to specifically ask questions about their intended audience and the environment the game will be released into. Educational game developers need to be aware of exactly where the information they wish to teach falls and design games based on the age range that information. To speculate further on the reasons behind why such a large emphasis was put onto these questions, not only do the SOL curricula behind the information being put into the game vary widely between age groups, but

also the appropriateness of game mechanics vary widely between age groups. What a 6 year old

learns in school is vastly different from what an 8 year old learns and by that same token the

kinds of game mechanics a 6 year old can understand is vastly different from what an 8 year old

can handle (*Designing for Youth*). Developers can very easily mismatch the age-appropriateness

of game mechanics to the age when the audience is supposed to be learning certain information.

<u>Metric 3 – Add to what you know</u>

Another pattern emerges from the overlap of what the two projects thought was

important. With the sole exception of feedback testing in *One Thousand Miles*, the *Civil War*

Project asked the same kinds of questions as *One Thousand Miles.* Generally speaking, the

projects had very similar development cycles. While an educational game project may need to

keep in mind many additional factors in their project, this does not seem to preclude anything

from entertainment game development. From this study, there was no specific technique or goal

that entertainment games could use that educational games needed to avoid.

<u>Discussion</u>

This research cannot conclusively prove that the differences in the goals of the game

design process was the sole reason these differences arose due to a number of confounding

factors. It is possible with closer observation and more complete documentation that these

differences can be conclusively explained, however this research was undertaken with

considerable restraints that prevented a completely thorough investigation. Another confounding

factor was the differences between the two projects. While it was convenient that two different

teams were working on game projects that could be observed, it may be more prudent to see the

same team working on two different projects in order to minimize the differences between the

two. In particular, the volunteer nature of the *Civil War Project* and *One Thousand Miles'* strict due dates, because it was a class project, may have had a large, confounding effect on the results of this study.

One particular weakness of the research methodology used is the use of Fullerton's stages for development. These stages were developed for professional game development, as Fullerton makes constant reference to the involvement of a publisher as an agent in the definition of the different stages. Neither of the two game projects had a traditional video game publisher working with them. Future research would find this particular methodology is more prudent when working with professional game development outlets.

To speculate on some of the challenges that more professional game designers may face: professionally working with a school district or similar body as a publisher or distributor may help not only with financing and access to resources to improve the accuracy of a game but will create its fair share of challenges. Developers and publishers tend to keep to strict time-tables when achieving the milestones in a game development project. Following a closer time-table may require a more careful examination of the time the project will take before the project even starts and this research has concluded that there is a significant increase in the amount of time it takes to develop a game with an educational goal. Developers will need to clearly communicate these additional needs.

In conclusion, this research aims to help not only game designers create more effective educational games by better preparing them for the game making process, but also allows an impetus for researchers and educational praofessionals to understand the design process in more practical terms. These three metrics for developers looking to create educational games can be

used to anticipate challenges to their eventual goals and reconcile the information missing from

entertainment-based publications on normal game design. By starting to bridge the gap between

educational and entertainment game design, this research also hopes to spur additional research

into the practicalities of the game design process and look into further challenges faced by

developers in creating educational games.

Many papers put inordinate focus on the after-effects of a single game or set of games

after they have been created and released. Few papers seem to recognize the contexts that would

be most helpful to developers.

Appendix A

***One Thousand Miles* Schedule Summary**

Pitch	**Feb 13th**	**Concept**
Conceptualization finalized	**Feb 27th**	**Concept**
Physical Prototype	**March 6th**	**Pre-production**
Alpha Prototype Complete	**March 21st**	**Pre-production**
Code Architecture Meeting	**March 21st**	**Pre-production**
Beta Prototype Complete	**April 4th**	**Production**
Play-testing Session	**April 9th**	**QA**
Work Meeting	**April 16th**	**Production**
Final Expo	**April 18th**	**QA**

Appendix B

***Civil War Project* Schedule Summary**

Pitch	**Jan 27th**	**Concept**
Introductory Meeting	**Feb 2nd**	**Concept**
Conceptualization Meeting	**Feb 9th**	**Concept**
Code Architecture Meeting	**Feb 16th**	**Pre-production**
Conceptualization Meeting	**Feb 23rd**	**Concept**
Prototype Meeting	**Feb 27th**	**Pre-production**
Prototype Meeting	**March 2nd**	**Pre-production**
Mid-Semester Expo Preparation	**March 19-20th**	**Pre-production**
Mid-Semester Expo	**March 21st**	**QA**
Prototype Meeting	**March 30th**	**Pre-production**
Prototype Meeting	**April 6th**	**Pre-production**
Play-test Scriptwriting Meeting	**April 8th**	**Pre-production**
Play-testing Session	**April 9th**	**QA**
Work Meeting	**April 14th**	**Production**
Work Meeting	**April 19th**	**Production**
Work Meeting	**April 27th**	**Production**
End Semester Expo Preparation	**April 29-30th**	**Production**
End Semester Expo	**April 30th**	**QA**

Appendix C

***One Thousand Miles* Play-testing Document**

Legend:

Feedback   **Accuracy**

Usability   **Tone**

Quality   **Feasibility**

One Thousand Miles: Play Testing

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ABSTRACT: We held a joint play testing session with a Student Game Developers group where we play tested our respective games with members of a Curry School class on educational games and simulations (EDIS 5500). Our team had a 30 minute playtest session with half of the class, 6 people total. We had two team members present for this session, so the class was again divided between the two of us. The class as a whole has a wide range backgrounds and experience with video games, though a majority have teaching backgrounds and more experience with educational games. The session was broken up into a 25 minute play session that followed the attached script followed by a 5 minute period for general feedback. We followed a script that was pre-written by our team to help us target specific information. As a result of this session, we have a better idea of the strengths and weaknesses of our game at this point; we have also uncovered some changes that need to be made immediately.

SCRIPT

Below is the script we used for both groups in our play testing session. Italic writing represents what our group members said; all-caps between brackets [] represent actions taken by our group members.

We're going to have you play through our game, One Thousand Miles. In the game, you are shipwrecked on an island with other survivors. You have to find food and stay warm in order to stay alive. While you're playing please remember to speak all of your thoughts out loud.
[OPEN GAME]
Before you start playing, we'd like to ask you a few questions:

- *What actions does this first view suggest are available to you?*

- *What goals do you immediately form?*

- *What questions do you have?*

- *Is there anything else that you are thinking at this point?*

OK, now we would like you to move around the map a bit. Remember to speak your thoughts out loud, any discoveries you make, or any frustration is great for us to hear.
[LET THE PLAYER WALK AROUND UNTIL NIGHT TIME. STOP THEM AFTER 2-3 MOVES DURING NIGHT]
[ASSUMING THE PLAYER HASN'T ALREADY COMMENTED ON NUTRITION AND WARMTH GOING DOWN]
How has your character's status changed during moving? What kind of rules do you think govern these changes?
Now we would like you to take some actions besides moving. The actions you can take are building fires [TELL THEM THE KEY FOR THIS), building shelters (TELL THEM THE KEY FOR THIS], *and foraging for food* [TELL THEM THE KEY FOR THIS].
First, we'd like for you to build a fire. Now move around the fire, going on and off the tile that contains it. (LET THEM DO THIS) *What conclusions can you make about fires?* [MAKE SURE THEY MAKE IT BACK TO DAYTIME WITHOUT DYING, ASK THEM TO WALK AROUND THE FIRE DURING DAYTIME SO THEY GAIN SOME WARMTH BACK]
Second, we would like for you to build a shelter [LET THEM BUILD A SHELTER, HAVE THEM WALK AROUND THE SHELTER AT NIGHT] *Based on everything that you've seen, what would you expect to happen if you built a shelter on the same tile as a fire?*
Finally, we would like for you to try foraging on a few different tiles. [LET THEM FORAGE] *What thoughts do you have about foraging? What rules do you think govern it?*
That's all we have for you to do today. Thank you for your time. We just have a couple quick questions and then you're free to go:

- *What stood out the most to you about the game? Positive and negative.*

- *Was there ever a point where you felt confused about the world, or uncertain how to proceed?*

- *If you were going to add something to the game, what would it be?*

NOTES FROM GROUP 'A'

Immediately after booting up the program, testers expressed some initial confusion about the purple dot as the player. While this was quickly resolved, the issue cropped up later as the game progressed and the player moved back towards the starting area. There was at least one instance where a mistake was made because the player could not recognize which dot was them, as the tester said something along the lines of "Oops, I'm not that one, I'm that dot." The easiest way to fix this is to continue with our plan to replace the dots with human character sprites, but ensure that the characters are distinct enough to easily tell them apart.

Actions available to the player were also not immediately obvious. While we later prompted the player's list of possible actions when we told them the controls, all play testers expressed immediate confusion on what to do.

The controls were unintuitive. The arrow keys being used to move the player around a tiled game was intuitive enough to not need any explanation, but other keys required prompting. One tester pressed the 'f' key and the 'w' key when trying to build a fire. This concern would probably best be eliminated by showing the controls on-screen. Later in testing, players would confuse keys and their associated actions (press the forage key when they meant to build a fire) and many asked for an on-screen guide.

The next concern was over the black tiles, as players did not know how to interpret what they meant. Our idea that it was a 'fog of war' was not obvious. One play tester interpreted it as "chance" squares and assumed that each tile had a chance to kill you. This assumption arose out of not realizing that different actions take different amounts of time, the tester later explained. They found it frustrating that it was not immediately obvious that, for example, building a shelter took a long enough time that the single action could kill the player. Play testers also did not notice, or did not tell us, the benefits of explored vs unexplored tiles (1 hour to traverse vs 3 hours to traverse). Some tutorial or other method of displaying the amount of time different actions take should be added to the game.

Play testers also foraged on tiles with 0 food, though as the play testing session progressed these mistakes became less frequent. While play testers didn't give direct feedback, one had to point out to another that they were attempting to forage a barren tile. A more noticeable system to tell the player how much food is available on a tile would alleviate this concern, and we were planning on replacing the text with a tree on each tile that would show the amount of food available.

The mechanics of fire seemed confusing to some of the play testers. One asked "How do I know where my fire is?" after it had gone out. While I was not able to ask for more details on this particular confusion - I'm guessing it was because they attributed some permanence to the fire and did not realize that the size of the fire on-screen was an indication of how much time it had left to burn. Play testers also did not figure out that pressing the build fire button on a tile that already had a fire would make the fire bigger until prompted. One play tester also had the initial conception that building a fire would replace a shelter.

Another play tester thought the goal of the game was to get to the other side of the island, as our map seemed horizontal and the player starts on the far left side. We're unsure if we want to explicitly state to the player that building fires will eventually attract a boat to rescue them, but more subtle hints like adding smoke to fires may help players eventually figure this out.

The largest feedback was to add some features that would increase the motivation of the player. While survival was an okay goal, players didn't understand why they were on the island and wanted more details in those regards. One play tester suggested an introductory cinematic or screen to give some explanation as to why the player character and a feature like this with the goal of helping players get into the magic circle -- whether it's a tutorial or introduction screen -- would solve this

problem. Motivation can be by implementing an idea we had earlier in the game's production to scatter items on the island that would tell a story. So, if the player finds a broken airplane wing, they'd be motivated to further explore the island and see if they could find other evidence of why the player is there.

Two main strategies arose between play testers. One camp would explore some number of tiles, build a shelter, explore all around the shelter, and repeat this process for as long as they could find food. One tester had a very similar strategy, but didn't build shelters because they could survive at night with only a fire.

NOTES FROM GROUP 'B'

The players in this test group instantly recognized the tile-based nature of the game, and identified the four directions (up, down, left, and right) as possible actions, though they noted no others. The players also knew that the purple dot represented their character. When asked about the goals, the players listed "staying alive" and "staying warm," likely because they noticed the status bars for Nutrition and Warmth. The players were then instructed to move around the island.

Predictably, the players used the arrow keys to execute a series of random movements, until a few hours of night passed. At this point, we asked how the status of both the game and character had changed. They did not note the shift to nighttime, or the fact that the tiles they had explored were now green. They did, however, acknowledge that they had lost food and warmth. When asked what they might do next, a couple players responded with "find food," while another said "build a fire."

At this point, we informed the players of the remaining available actions: build a fire, build a shelter, forage for food, and wait. When asked how they might perform any of these actions, the players could not form an answer. Eventually, one said "try pressing the space bar" (wait). The character did execute the wait command and wait for a game hour, though at this point the testers still did not understand the concept of time, so they thought nothing had happened. We had to tell them that the z, x, and c keys perform the forage, fire, and shelter actions, respectively. Upon hearing this, all testers explained that an on-screen guide would be very helpful.

The players next attempted to forage for food. They pressed the key, but nothing happened, so they concluded that their attempt had failed. They then built a fire to replenish their warmth. Unfortunately, they subsequently continued exploring (still nighttime) and after a few moves, were presented with the "DED" message. When asked what had happened, the players noted that they had died because they got too cold. The players restarted and played out a few more rounds of the game.

After playing through the game several times, the players actually became adept at staying alive. On their fourth or fifth play-through, they managed to explore more than 75% of the island. Perhaps they quietly believed that the winning condition was to explore the entirety of the island. The players were able to stay alive for a long time because they learned how to manage their resources, and to replenish their food or warmth long before they were close to death. They possessed a rudimentary understanding of the day/night mechanic, as they tended to remain in place once night came. They did not fully understand the logic of how the character lost food and nutrition over time. Because they did not totally understand the time scale, they saw no difference between moving into an explored tile (1 hour) versus an unexplored tile (3 hours).

In terms of positive takeaways, the players all noted that they enjoyed playing the game and the challenge of survival. They noted that the game was clean and concise, which enabled a positive experience. Once they figured out the time artwork, with the sun and moon moving across the top of the screen, they indicated that it was one of their favorite pieces of the game. When told after the play

testing about the switching mechanic we are working on, they were intrigued, and said that feature would make our game unique among desert island survival type games.

The play testers offered several helpful pointers on ways for us to improve the game moving forward. The first concern noted was the lack of a legend for key input, as discussed before. Another previously known issue was the fact that the human and AI character have the same purple dot sprite. The play testers did say they would like to be able to see the stats (nutrition and warmth) for the AI, to get a sense of how they are faring. Another addition to the UI they wanted to see was some indication of how much food is on an explored tile. In terms of general confusions, the testers reaffirmed that the time difference between explored and unexplored tiles was not clear. They also admitted to not knowing what a shelter does (and thus they rarely spent time building shelters), relying on fire for warmth. This actually alerted our team to an error in the warmth logic. At night, the player should only *gain* warmth if he/she is both in a shelter and by a fire. In the version of the game tested, players were able to gain warmth at night just with a fire, thus rendering shelters effectively pointless.

CONCLUSION

As a result of this play testing session, the team has identified numerous specific areas for improvement. The testers from Group B provided a number of minor suggestions, while the testers from Group A focused their thoughts on a few big picture concepts; this difference likely corresponds to varying levels of game-playing experience between the members of the groups. Combining the suggestions of both groups, here is a list of changes to be made as a result of this study:

- *Legend for actions available and their related keys*

- *Different sprites for human and AI, perhaps better sprites (faces)*

- *Introduction clip or tutorial to set the scene, perhaps explain controls and mechanics*

- *Fix logic for losing and gaining warmth*

- *Display status of AI*

- *Show food level of explored tiles on the map*

Most of the confusion tended to manifest as misunderstanding the meaning of certain aspects of the game. Some examples, as described in the Notes sections: not understanding the difference between day and night; not grasping the fog-of-war concept with explored and unexplored tiles; not knowing the difference between shelters and fires, or how they could be used together. The other main issue was the lack of an on-screen guide for available actions and the corresponding inputs. The addition of some type of introduction or tutorial (or a combination) would help with alleviating these concerns, as the common denominator is an incomplete transfer of information from the game to the player. Despite the shortcomings in this area, the play testers generally enjoyed playing the game. Their feedback affirmed that the core elements of our game are strong, and that we will be able to make constructive changes moving forward.

Appendix D

Civil War Project Play-testing Documents and Notes

Legend:

Feedback   Accuracy

Usability   Tone

Quality   Feasibility

Provided by Nicholas Lytle and Jessica Ya

Procedure:

We will spend ~3 minutes allowing them to explore the games main screen. During this, do not answer any questions besides mechanic questions (how do I move right? for example if they are stuck).

ASK THEM TO THINK ALOUD WHEN MAKING DECISIONS

Then questions about the main game:

1   What are your impressions of the music?

peaceful, out of place, not Civil War-esque

2   What are your impressions of the art of the characters?

harriet tubman looked like wearing Indian clothes rather than Civil War-esque; whether or not she was Harriet Tubman

Other people were the same – confusing who they were/their importance

3   What were your impressions of the dialogue?

unclear how to interact w/ characters/how to respond to questions

4) What were your impressions of the mechanics (moving and interacting with characters)?
5) Did you learn anything about this time period? Describe what you did/didn't.
6) Describe how successful (or not) the educational information was presented?

information not easily accessible/not very memorable

We will then move to the mini game version. Attached are rules for the game and example text you can say. Play 1-2 versions (however much you can in 10ish minutes) and then move to questions about game.

1) Describe the difficulty of the game/

Pretty easy; most difficult was committing to moves/choices; difficult b/c of paper version and computer version would give updated values of safe houses left

2) Describe the mood/feelings you felt during the game. Did you empathize with your character?

if had lost, and image of what happens of how you lose/lost every/fugitive slave law was

terrible
Context will help with empathy/integrated with game play
3) What strategies/if any/did you develop during the game?
just go for the goal as fast as possible
4) What are your thoughts on the mechanics of the game? The board game map, turn-based gameplay, for example.

4   Did you learn anything about the Underground Railroad? Describe what you did/didn't.
didn't learn much about underground railroad/ artwork/screens would be more descriptive/time span/specific facts about each state
6) Describe how successful (or not) the educational information was presented?
so much focus on goal of name → not much focus on educational value instead of day/night → sudden events that caused them unable to move/ codes that underground railroad used / codes to solve to help with moves

Finally, questions about overall experience:

1) Overall, how approachable would the games shown off be for children aged 9-12?
perfect for age group; mechanics easy to understand
2) What are your thoughts on the inclusion of a game system like this in a classroom setting?
nice that kids could take different paths and then discuss in groups and kids would have different experiences/sharing experiences in addition to learning experience. Some sort of reflection/discussion after game/teacher can discuss it after/collect what they learned

-As a system only playable in class.
-As a system playable both in and outside classroom.
-As a mandatory/nonmandatory assignment.
probably in class b/c assigned outside class isn't always done flexibility inside and outside class
-Where the entire game is opened from the start.
can start at game screen so you can find harriet tubman from railroad opening setting w/ character as runaway slave → move into game
-Where the teacher controls what content is open depending on where they are in the lesson.

3) In what other ways can SOL/non-SOL history information be conveyed in ways that were not demonstrated through the game.

Finally, use the last minutes or so just allowing them to add any last additional thoughts on the game/idea.

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