

Creating Conversations

*Innovation through a Digital
Healthcare Scenario Tool*



Interactive Qualifying Project

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Abstract

Globally, healthcare systems are challenged by ageing populations, growing costs, and poorly designed policies. To promote discussion on these issues, the Danish Design Center created four physical scenarios to show what the healthcare system may look like anno 2050.

Following an existing game development process, this project translated the physical scenarios to a virtual format to reach a larger audience. While developing the final prototype, we created five principles to dictate the best implementation of game design techniques. The final video game prototype acted as a proof of concept, on which the Danish Design Center may determine the effectiveness of creating virtual scenarios.

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Executive Summary

By the year 2050, experts project that the global population of those aged 65 and older will double, reaching over 1.5 billion individuals (Hermes, 2010). This population boom will drastically increase the consumption of healthcare resources, further amplifying the challenges faced by healthcare systems worldwide (He, 2016, p. 67). These challenges, which include growing costs and poorly designed policies, have left doctors and patients unsatisfied with the level of care provided (Rabin, 2014).

Denmark is a current world leader in healthcare; yet, they too suffer from the same challenges as countries all over the world. (He, 2016; Mossialos, 1997). In Denmark, experts predict that by the year 2050, one in every four Danes will be 65 years of age or older (Krøigaard, 2016). With a healthcare system funded by taxes, the state and municipal governments in Denmark struggle to stabilize the system without increasing taxes over the 51% taxation cap (Olejaz, et al., 2012). To help lower the number of unnecessary hospital visits, the Danish government has created policies focused on increasing preventive care (Healthy Ageing in Denmark, 2012). However, a large number of these policies have failed due to their poor implementation. The Danish Design Center (DDC) believes that collaboration between key healthcare, policy, and business sectors will help Denmark prepare for the problems that will arise by 2050 and help to create more effective solutions.

In 2017, the Danish Design Center partnered with Public Futures to create scenarios to portray four potential futures of the Danish healthcare system anno 2050. Together they designed the scenarios to frame strategic debates, political dialogues and innovative development processes. From these discussions, the DDC aims to create solutions to better the healthcare sector and make a foundation for stronger economic growth in the Danish business sector (Svendsen et al., 2017).

At the time of this report, the Danish Design Center had begun construction on four rooms that physically represent the scenarios. Inside these rooms, people may experience healthcare in 2050 from the perspective of a patient, a relative, a supplier, or an employee. However, due to the fact that the DDC built the scenarios inside of rooms, they will not be able to reach a large audience.

The goal of this project was to create a video game to present the DDC's four scenarios to a larger audience in an interactive way. Unlike the physical rooms, we can publish a video game online and instantly reach anyone with an internet connection. Providing the scenarios to a worldwide audience will include people with diverse backgrounds and perspectives in the discussions, which may lead to innovative solutions. Working with the DDC, we created a video game prototype to educate players interactively on the learning objectives of one of the four scenarios.

Methods

Before we began the development of the video game, we completed a content analysis of feedback from an initial workshop held by the DDC. This analysis helped determine the elements of the physical scenarios that users thought were effective, which elements were not, and which elements they wanted to see more. These elements included exploration ability, consequence of choice, emotional connection, and development of scenarios. Based on these elements we determined a game format and began developing the game. To create the final prototype of the video game, we followed an existing method for video game design as described in “Design Methodology for Educational Games Based on Interactive Screenplays” (Prieto de Lope, et al., 2017).

The first step in the video game design process for serious video games was to identify the main learning objective of each scenario. The learning objectives later guided the creation of mini games. Next, we created the game world and an overarching narrative. We designed the game world to be realistic enough to give players a sense of familiarity within the game. We created the overarching narrative to allow the player to form an emotional connection to the player.

Next, the development followed two parallel processes. The first step in the parallel process was the development of a storyboard and the creation of characters. Both of these steps occurred simultaneously, and used elements from the overarching narrative. Next, we created an interactive screenplay and designed the scenes. The interactive screenplay developed character movement and character dialogue. The design of scenes included both audio and visual elements. Completing this process resulted in a video game prototype that we presented to our sponsors and advisors for feedback. After receiving feedback, we iterated upon the process described to create a final prototype.

Design Principles

During the iterative game development process, we created five principles that guided further development. These five guiding principles were **structure, simplicity, clarity of learning objectives, interactivity, and emotional connection.**

The **structure** of the video game determines how the player follows the story. There are two main structures in video games: linear and parallel. In a linear structure, there is a single storyline that the player follows chronologically. In a parallel structure the player may choose the order of the storyline.

The next principle, **simplicity**, informed our decisions on visual props and concrete elements in the storyline. These decisions included the omission of cars and other known technologies so that the player could imagine the technologies that may exist in the future. Allowing the player to add his or her own ideas increases the player’s engagement in the game which increases the effectiveness of the learning environment (Whitton, 2010).

The clarity of the games' **learning objectives** determines the way the game communicates the educational goals. We created clear learning objectives through the Balanced Design Method produced by the Education Arcade at the Massachusetts Institute of Technology. The Balanced Design Method is a three part framework for creating clear learning objectives for serious games while maintaining interactivity and player engagement (Groff, et al., 2015).

The two final principles, **interactivity** and **emotional connection**, both help to engage the player with the game. Through research, Plass and his colleagues proved that engagement leads to a better understanding of the presented material (2014).

Final Prototype

The principles developed in our project guided the development of the final prototype of the video game. The final **structure** of the video game follows a parallel structure with linear sub-stories for each scenario. The parallel structure allows players to choose the order in which they experience the scenarios, while the linear sub-stories maintain simplicity within each scenario. The *Most for Most* scenario follows a linear progression that includes two mini games and two periods of reflection.

The *Most for Most* sub-story also follows the principle of **simplicity**. We used plain visuals and dialogue to increase the players' ability to incorporate their own imagination and solutions. Simplification also resulted in the creation of an overall musical theme with a simple melody. The overall musical theme allows designers to add additional layers and alterations to the music so that the theme can fit different scenarios. We created the audio to work in conjunction with the visuals to convey the overall mood of the scenario.

We created mini games to present the **learning objectives** of the scenarios. The player can demonstrate an understanding of the learning objectives by completing try-and-fail tasks as part of a mini game. In this prototype, we created a try-and-fail task in a hospital mini game. In this mini game, the player has to heal as many patients as possible within a set budget. The player cannot progress in the storyline until he or she heals a target number of patients. This means that the player must understand the learning objective of the Most for Most scenario to progress.

The two final principles, **interactivity** and **emotional connection**, guided the creation of world maps and scenes, as well as the overall narrative. Interactivity within the world map allows the players to explore the game world and converse with non-playable characters. The emotional connection to the game manifests in the overall narrative. This narrative follows a family unit where the player is unable to help the father character in the healthcare system. Everyone has a family so the use of a family unit can span both cultures and generations.

The final prototype included both the aforementioned video game and a website that we developed as a launch pad for collaborative discussion on the scenarios. Through its design,

the website leads users to the video game and then to a forum. The forum serves as a platform for game users worldwide to discuss the scenarios and ideas present in them, thus contributing differing opinions and perspectives that may drive innovation in the healthcare system.

Recommendations

The video game prototype developed for the Most for Most scenario serves as a proof of concept and as a base on which to test the effectiveness of the principles developed throughout the course of the project. Based on the principles, we constructed a set of recommendations for the DDC to aid in the digital creation of the final three scenarios.

First, we recommend that the Danish Design Center conduct testing with a group that is statistically significant and representative of the target audience. Testing will determine if the tasks and principles we created are effective in engaging the audience and communicating the learning objectives.

If testing feedback is positive, we recommend the DDC continue the development of the storylines and structures of the other three scenarios, following the structure outlined in this project. To expedite their development, we created the overarching narrative for each scenario and a generalized structure on which to develop the storylines. The generalized structure includes a linear progression of mini games and reflection periods that the DDC can organize to create a story and associated tasks for the other scenarios.

Following the creation of the storylines and structures, the DDC should work to create visuals, audio, and dialogue that aligns with the moodboards and character personas created by Public Futures. Each of these elements should incorporate the five principles in order to create an impactful learning experience.

Conclusion

The final prototype created through our project surpassed the original goal. We created both a proof of concept video game and an online forum to act as a catalyst for collaborative discussion between key players in the healthcare system. We also tested the video game with a small student sample to determine the effectiveness of the developed principles. Finally, we presented the video game and website to our sponsors at the DDC for the further development of a digital version of the scenarios. At the final meeting with our sponsors, Sune Knudsen stated that, "this project has ended with more questions than it started with, but these questions will guide us towards a powerful solution."

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Chapter 1: Introduction

Aging populations, growing costs, and poorly designed policies currently challenge the global healthcare system, reducing their effectiveness. The generation born between 1946 and 1964 will amplify the effects of these issues by increasing the population of individuals aged 65 and older. This population will reach well over 500 million in 2010, and it is expected to rise to 1.5 billion by the year 2050 (Hermes, 2010). Healthcare systems will need to account for the increasing demand for resources attributed with a rise in the elderly population. Newer, more expensive technologies will also raise the cost of healthcare services. Globally, governments struggle to create effective policy solutions to address these concerns in healthcare (He, 2016).

The Danish healthcare system is a leader in socialized medicine, yet, it still faces the issues found globally, coupled with a lack of preventative care (He, 2016; Mossialos, 1997). Projections estimate that the population of individuals aged 65 and older in Denmark will increase to 25% of the population by the year 2024 (Krøigaard, 2016). This rise in the elderly population has contributed, and will continue to contribute, to the increased need for healthcare services. In Denmark, the elderly contribute little to tax revenue and thus add to the burden on those who do contribute. With a healthcare system funded by taxes, the state and municipal governments in Denmark are struggling to stabilize the system without increasing taxes over the 51% taxation cap (Olejaz, et al., 2012).

The Danish government has created multiple policies in an attempt to limit the number of unnecessary hospital visits and thus reduce excess healthcare expenditures. Large percentages of Danish citizens are physically unfit, drink excessively, suffer from obesity, and smoke (Healthy Ageing in Denmark, 2012). To combat unhealthy lifestyle choices, and to reduce subsequent healthcare resource consumption, the government has attempted to promote healthier lifestyle choices through education and other means (Healthy Ageing in Denmark, 2012). However, the majority of the policies created have failed to make a difference due to policy makers' weaknesses in understanding human behavior. The Danish Design Center believes that collaboration between key healthcare, business, and policy sectors will help to create more effective solutions for the future of healthcare.

Collaborative design has the ability to address fundamental design issues before they occur, by promoting discussions between the healthcare, business, and policy sectors. Scenario planning is a method often used in collaborative design. In scenario planning, futurology experts analyze current technologies and methods to create scenarios that are representative of potential futures (FutureScapes, 2011). These scenarios allow companies to explore potential problems

that may arise in the future, and help to develop conversations on these problems. These conversations support the creation of innovative solutions to address the potential problems before they occur.

The Danish Design Center's (DDC) Boxing Future Health (BFH) program has created physical models of four futuristic healthcare scenarios. The DDC built these scenarios for use in collaborative design workshops around Denmark. They state that "the scenarios are designed to be tangible enough to frame strategic debates, political dialogues, and innovative development processes" (Danielsen, 2017). However, since the scenarios are built inside of small rooms, they have a limited ability to reach and influence a large number of people.

The goal of this project was to create a video game to present Boxing Future Health's future healthcare scenarios in an interactive way, so that they may reach a larger audience. To create the video game prototype we followed a predetermined process as described in *Design Methodology for Educational Games Based on Interactive Screenplays* (Prieto de Lope, et al., 2017). This process included the creation of an overarching narrative, a storyboard, characters, an interactive screenplay, and scenes. The video game we created will be used as a basis for the DDC to iteratively develop their own serious video game.

Chapter 2: Background

In this chapter, we will start by exploring the relationship between global health concerns and those issues currently faced by Danish healthcare. We follow this analysis by investigating the importance of future planning and the physical scenario boxes created in BFH program by our sponsor, the DDC. The DDC created the physical scenarios inside of small rooms. While the rooms may be effective at portraying the current challenges in healthcare, their form limits access to them. To reach a larger audience, we explore a way in which we may digitize these scenarios to create an interactive game. This chapter provides the necessary information to understand the scenarios and game creation.

2.1. Current Problems in Global Healthcare

The past successes of health sectors worldwide has caused a new breed of issues to arise. Various dynamics stretch and challenge healthcare systems, including ageing populations, growing costs, and poorly designed healthcare policies. Industrialized countries, including the US, the UK, and Denmark appear to be especially affected. Each one of these concerns is in part due to the failure of the healthcare system to properly prepare for change.

The first major issue faced by the healthcare sector is the growing user base of those that heavily rely on health care services. In particular, the elderly population (65 and older) has expanded dramatically over the past decades due to a higher average human lifespan. This has raised the global population of those over 65 to over 8% of the total population (He, 2016). The rapid growth of the elderly population has created the largest rise in demand of care. On average, the elderly population requires the most hospitalizations per year. According to the *Survey of Health and Aging, and Retirement in Europe (SHARE)*, which surveyed 20,000 Europeans over the age of 50 across 11 countries, the peak ages of hospital use are between 75 to 79 (He, 2016, p. 67). This escalation in required care is often due to long term, chronic illnesses.

The increasing use of hospitals has led to an overburden on healthcare systems and caused the second major concern. This strain on the system leaves less time for doctors to spend on individual patients, leading to a high patient dissatisfaction. In fact, it is common for general practitioners (GP's) in first world countries to spend as little as 15 minutes with each patient because of the time crunch they feel to see as many patients as possible (Rabin, 2014). In the UK, The Health Foundation found that this stress is common in GP's, with 59% claiming that their daily jobs are extremely stressful (Martin, 2016). The growth in the number of patient

visits has also created stress in the doctor patient relationship. With more patients, there is less time to see each one, leaving less time for the creation of an empathetic doctor patient relationship. Less empathetic relationships with doctors have left patients feeling frustrated because patients feel they receive less quality care. Empirical studies linking empathetic doctor patient relationships with better health outcomes can explain these emotions. During the initial stages of examination, an empathetic connection with the patient can lead to the gathering of invaluable personal information and contributes to building a reliable and trustworthy relationship (Decety, 2015). Patients and doctors alike are dissatisfied with the amount of appointment time and lack of empathetic relationships. In fact, a recent study found that over 26% of doctors were dissatisfied with the time they spend with patients (Rabin, 2014). Patients have become increasingly frustrated with the quality of care they receive due to the inability of doctors to devote the needed time and empathy during appointments.

The rise in healthcare demand has also led to ballooning costs of government healthcare spending. In particular, long term conditions require the most care. In the UK, projections predicted that the number of people with long term conditions increased from 1.9 million to 2.9 million over a ten year span starting in 2008 (Montgomery, et al., 2017). This surge in long term care caused the UK's *Department of Health* to overspend their yearly budget by about £150 million (1.3 billion DKK) in 2016 (Montgomery, et al., 2017). Healthcare expenditures will continue to rise. In the US, projections show that the 8% of GDP spent on Medicare and Social Security in 2016 will rise to 12% by 2050 (Mather, et al., 2015). It is further estimated that by 2020 the population of countries including the UK, Germany and Japan will grow an average of 4%. In the United States, the baby boomer generation will cause the number of Americans aged 65 or older to increase from 13% to 25% of the population by the year 2060 (Mather, et al., 2015). Without intervention, the rapid growth of the elderly population will cause a crippling strain on the healthcare sector.

Policy actors in the European Union (EU) have attempted to address the problems arising from increased healthcare needs. For example, the EU currently facilitates the movement of practitioners across countries to allow for the fulfillment of higher demand of healthcare in the countries that need it. The National Health Service (NHS) in the UK has struggled over the past few years to fill permanent positions in healthcare. Specifically, in the social care sector, there is a 7.7% deficit in the workforce for domiciliary care services (McKenna, 2016). With a growing 65+ demographic in the UK, this deficit has displaced physicians from other sectors in healthcare in attempts to fulfill the demand of this service. The lack of an educated workforce able to deal with the increase in healthcare needs has become a global problem, and without

intervention, it will lead to lapses in the quality of healthcare on a global scale. The problems caused by a lack of workforce and the rise in demand for care has inflated costs and the number of poor doctor patient relationships, leading to higher patient dissatisfaction (Striegler, 2018). The problems outlined in this section are clearly present in Denmark, and in some cases, are even worse.

2.2 Current Issues within the Danish Healthcare System

Studies done by the US Census Bureau and London School of Economics concluded that the Danish healthcare system is a leader in socialized medicine, but it still faces the issues found globally in many other healthcare systems (He, 2016; Mossialos, 1997). Problems such as ageing populations, growing costs, and inefficient healthcare policies are evident within Denmark. Additionally, Denmark's healthcare system suffers from its own success, as it has created a generation of citizens reliant on it. Increased reliance on successful treatment methods has limited Danish citizens' motivation to pursue preventative care, as demonstrated by the increasing size of populations with unhealthy habits (Healthy Ageing in Denmark, 2012). Denmark's healthcare system has many successful aspects, but increasing stresses on the system may limit future success.

The ageing population in Denmark is at an all-time high and continues to rise. The World Health Organization (WHO) estimated that by 2050, about one in every four Danish Citizens will be over the age of 65 (Krøigaard, 2016). The growth of the elderly population may challenge the healthcare system's ability to devote larger amounts of money to the costs associated with ageing. Currently the Danish Healthcare System spends a third of yearly healthcare budgets on the elderly as they require the most hospital and doctor visits for issues such as trips and falls, cancer, and heart problems (Krøigaard, 2016). The increased healthcare spending on the elderly has inflated healthcare costs for all Danish citizens. In 2000, Denmark spent an average of 14,000 DKK (\$2,300 USD) per patient, today they spend an average of 31,000 DKK (\$5,200 USD) per patient (OECD, 2018). In 2007, to pay for the increased healthcare spending, Danish policy makers set the national healthcare tax to 8% on all taxable income (Tax In Denmark, 2008). The more people that use the municipal health systems, the higher taxes will become (Olejaz, et al., 2012). Raising taxes to cover future spending is not a sustainable solution for Danish healthcare. To address this issue, Denmark must find another solution.

Danish adults who do not maintain a healthy lifestyle can drive healthcare costs even higher. Unhealthy lifestyle choices include smoking, physical inactivity, and binge drinking. Over 21%

of the Danish population smoke, 35% are inactive, and over 48% are obese (Healthy Ageing in Denmark, 2012). Additionally, Denmark is rated 12th in the world for binge drinking (McCarthy, 2016.) To combat this, the government has deployed campaigns to encourage Danish citizens to take preventative steps towards self care. There have also been research efforts focused on incorporating higher levels of self care to fight the development of cancer and heart diseases (Olejz, 2012, p.13 & 29). Continuously increasing the budget to cater to those who are not properly caring for themselves is not a viable, long term solution. Preventative health measures may assist the system's ability to be continually successful (Healthy Ageing in Denmark, 2012).

Danish policy makers have attempted to address healthcare concerns through policy reform. In our evaluation it is difficult to determine the effect of these policies and to separate causation from correlation. However, we cite two anecdotes to show the previous failures of policy, and the ways in which the system could have avoided these failures.

First, in 2011 Denmark attempted to raise public awareness of preventative measures by creating a "Fat Tax". Policy makers intended for this tax to decrease the incidences of cardiovascular disease, thereby decreasing the number of doctor visits. Foods that contain saturated fats, including meat, were subject to a 16 DKK (\$2.9) tax per kg of saturated fat (Bødker, et al., 2015). However, by 2013, this tax only resulted in a 0.9% decrease in sales of fatty foods, and by 2015, the incidences of heart disease had increased by 0.2% (Jensen, J. D., & Smed, S., 2013). The Fat Tax was ineffective due to its creators' inability to account for consumer behavior. The Ministry of Finance had intended the tax to spread awareness of heart disease. Instead, the general public hardly heeded the tax. In the public view, the Ministry of Finance created the tax to raise money for the national budget without input from the Ministry of Health. The failure to create a policy consistent with human behavior led to an ineffective policy.

Second, in 2014, Danish Healthcare policy makers created an emergency hotline in an attempt to lower the number of hospital visits. They told patients without life threatening conditions to call the hotline to speak to trained staff members who would diagnose them over the phone and determine whether their ailment was worth the hospital's attention. The policy had good intentions; however, it did not account for emergencies that attendants could not diagnose over the phone. The hotline developed an infamous reputation due to the poor service that it provided to those in desperate need. For example, a young boy fell out of a tree and fractured his arm in two places, but the line attendant told the family not to go to the hospital. Eventually, the family brought the boy to the hospital after his bones had healed, resulting in

multiple surgeries to reset his arm. The need for extra surgeries could have been prevented if a nurse had been able to see the patient (Forrest, 2014).

These examples portray how the lack of communication between policy makers and between patient and healthcare professionals contribute to the growing dissatisfaction within the Danish healthcare system. Currently, Danish healthcare is extremely successful, with outpatient satisfaction rate of 96% and in-patient satisfaction rate of 93%. However, due to the lack of communication between policy makers, and other issues in the Danish healthcare system, numbers of complaints by patients increased by 27.9% between 2005-2009 (Pedersen, et al., 2011). This prompts the question: with such a high satisfaction rating, what is causing the growing number of complaints? The answer lies with the manner in which Danish hospitals care for their patients. Danes have such high expectations for their welfare system that when those expectations are not met, they feel a right to complain. Pedersen claims "Expectations from the population in general and patients in particular challenge the public health care system in many ways. Patients expect to receive high quality treatment, responsiveness to personal needs, to be informed, and to be involved in decision making – and on top of that they expect free services as the implicit 'payment' for their taxes" (2011). As the need for effective healthcare solutions grows, it will be important for creators to communicate with professionals to account for possible adverse outcomes. While the majority of Danes believe that their government is providing the highest quality healthcare it can afford (Pedersen, et al., 2011), there remain several examples that convey a different story, including the examples of the Danish emergency health hotline and the Fat Tax.

The Danish healthcare system has recognized the lack of patient involvement and has increased patients' access to information and choice of treatment method. This has particularly manifested itself through the technology sector with programs such as Health Technology Assessments (HTA) and Electronic Health Records (EHR). The HTA analyzed new technologies, such as methods, treatments, devices, and pharmaceuticals to learn how hospitals may improve attention to the patients' needs and wants (Sigmund, et al., 2009). The results of the HTA created a policy change that enabled patients to choose which hospital to visit. This meant privatized and foreign hospitals were now an option (Christiansen, 2012). Similarly, EHR's established a sense of control for patients, allowing them to view their health records as well as information on waiting times and the quality of various hospitals at their own leisure. The HTA and EHR gave patients greater control over their medical experience, lessening the government's decision making ability. As the power balance shifted from the healthcare provider to the patients, patients previously unhappy with their healthcare provider

could choose to switch to another (Vrangbaek, 2015). Hospitals and other health professionals now compete for the loyalty of patients, thus catering more towards their needs.

Promoting patient involvement through the introduction of the HTA and EHRs shows promise for the future of Danish healthcare; however, there are still many problems to face. A survey conducted by the Organization of Economic Co-Operations and Development argues that “managing healthcare spending may well be the largest fiscal challenge over the coming decades” (Olejaz, et al., 2012). Sustaining the universal welfare system of Denmark will demand continuous efforts to increase efficiency, particularly through adjusting organizational and cost saving practices. Promoting healthier lifestyles may be an important part in reducing demand on the healthcare system. However, before reforms will become effective, policy makers need to communicate with product designers and healthcare professionals. Communication has the ability to help these professionals understand the effect of changes before they occur, allowing them to better implement their solutions.

2.3 Tools of Collaborative Design

To address healthcare challenges discussed in the previous section, healthcare professionals and healthcare technology companies need to employ new tools to develop creative solutions. In the past decade, a process called collaborative design has become increasingly popular (Kvan, 2000). Collaborative design is most often used in computer science to support communication between designers and project managers. In this way, all parties involved can accomplish a task as a group, creating a solution that could not be accomplished by a single individual (Kvan, 2000).

Incorporating additional personnel and perspectives into the development of products is especially important in the healthcare industry, where each product has the ability to save lives. When industrial designers incorporate the doctors in their design process, they are better able to create devices that assist the doctor and avoid potential problems (Shah, 2007). To address the issues outlined in the previous sections, healthcare technology firms and doctors may benefit from collaborative design practices.

2.3.1 Future Scenarios

One effective tool with the ability to aid the discussions necessary in collaborative design is a method called scenario planning. Scenario planning is a way of discussing complex future issues in a qualitative manner to identify and prioritize risks and opportunities (FutureScapes,

2011). Experts create the scenarios by analyzing current market trends, technologies, and methods. This analysis is then extrapolated to create predictions of future market trends, allowing companies to control and shape the future, rather than react to it. By designing various scenarios, companies may also assess the risk of major reforms that were at one point deemed impossible. Thus, they may redefine the limits of what could be, for “the limits of the possible can only be defined by going beyond them into the impossible” (Clarke, 1962).

For example, in 2011, Sony teamed up with Forum for the Future to create predictive scenarios to analyze technology trends caused by climate change and find ways in which technology might help us live more sustainably (FutureScapes, 2011). The products of their analysis developed into the document *FutureScapes: The Scenarios*. The scenarios created were not concrete, rather, they were a tool used to challenge and inspire people to create solutions to current problems. Since then, FutureScapes ran workshops in London and Paris to spark innovative design ideas. The resulting products include Wandular, the Internet of Things Academy, and design forums where designers can collaborate on new ideas (Armstrong, 2017).

In 2012, the Danish Architecture Center (DAC) used similar predictive methods to imagine the ways in which architecture could contribute to the development of society in Greenland. In a paper titled *Possible Greenland*, in order to stimulate strategic debates, the DAC explored ways in which they could remodel the infrastructure of the airport, harbor, and communities. These debates discussed the ways in which Greenland could create infrastructure to attract tourists and serve migrating mineworkers, while still maintaining Greenlandic values (Jensen, 2012). This initiative resulted in projects that add modern developments to the Greenlandic landscape that solve the needs of new migrant populations and ageing infrastructure including work on a new airport and urban development (Brams, n.d.).

These examples demonstrate the ability of future scenarios to push personnel to participate in collaborative discussions. The next section discusses DDC’s Boxing Future Health project to create future healthcare scenarios, which the DDC will use to “detect new markets, develop new business models, and jointly create tomorrow’s healthcare solutions” (Svendsen, et al., 2017).

2.3.2 Boxing Future Health Scenarios

BFH is a program of the DDC that focuses on the interplay between design thinking and foresight. The DDC aims to create physical models of future healthcare scenarios to present to healthcare professionals, policy actors, and heads of business organizations who are influential

in the healthcare sector (Danielsen, 2018). By presenting these scenarios, the DDC aims to educate people so they may have productive discussions about new markets, business models, policies, and healthcare technologies. These discussions intend to refocus the efforts of policy makers and designers for the creation of products and services that cater directly to the needs of patients (Svendsen, et al., 2017). Identifying possibly critical issues will allow the healthcare sector to act on the future instead of react.

The DDC sought the help of a scenario development and futurology company called Public Futures to create depictions of future health scenarios. These scenarios focused around a single matrix targeting four main ideals, as shown in **Figure 1**. Two axes divide the matrix, each defining a dimension of the problem. Each quadrant created by the axes represents a scenario. The first dimension is the horizontal "what" axis. On one side of the axis is the "body" and on the other is "life." These two sides distinguish between the interaction of illness on the body and the interaction of the body with the rest of the world. The second dimension represents the vertical "how" axis. On one side is the collective, on the other is the individual. These two sides create a separation between public healthcare (the collective) and individual health care.

FOUR SCENARIOS

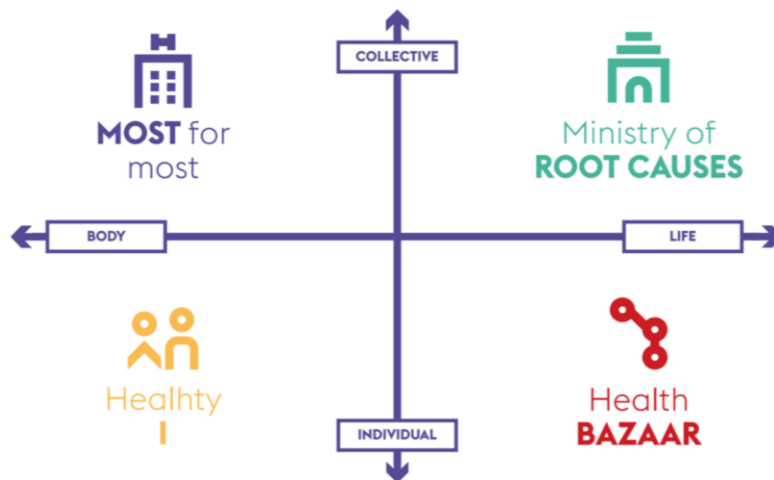


Figure 1: The Four Scenarios and the Two Dimensions (Svendsen, et al., 2017)

Public Futures also created moodboards and character personas, shown in **Appendix A**, which further developed the scenarios. The moodboards outlined sensory elements (ie. visual, sound, smell, feel, taste), the type of interaction between the workshop participants and the actors, and the main slogan of each scenario. The character personas outlined three characters with different ailments played by actors that the participants met in each scenario. The three

characters included a middle-aged woman with a broken leg, a young man with stress-related depression, and an elderly man with chronic diseases. For each scenario, Public Futures described the way each character interacted with the healthcare system.

The first scenario, titled *Most For Most*, is in the quadrant formed by the "collective" and "body." With this scenario, BFH aims to examine the interaction between individual patients and the system as a whole. They introduce the idea that healthcare is public welfare and is unable to help everyone. Only the patients with the most common diseases receive the most complete treatment, while those with rare disorders are a secondary priority. With this examination, BFH introduces the idea of acceptance to limitations to treatment. Society does not have the means to treat every disease, creating tough decisions about whom to treat.

In *Most for Most*, the ailments of each character in the persona document are common and therefore treated as routine. The descriptions for this scenario are given through the view of the doctor for each of the three patients. The description for this scenario portrays a standard hospital with linoleum floors and includes a characteristic scent of "hospital odor" and describes the interactions as "standard procedures", as seen in **Appendix A**.

The second scenario, titled *Healthy I*, is in the quadrant formed by "individual" and "body." In this scenario, BFH argues that individuals are mainly concerned with their personal health and they take advantage of all opportunities of wellness. The advancement of technology and the digitization of information has created opportunities of wellness. BFH also argues that hospitals seek to take advantage of the new technologies in order to expand their role in the lives of citizens but that they have largely been limited to a public utility.

In *Healthy I*, the persona descriptions explore each character's ailment in a more innovative manner, alluding to various future technologies that may exist. Public Futures wrote the descriptions for the three characters for *Healthy I* from the perspective of an innovator, pharmaceutical company, and insurance company. The moodboard for this scenario aims at presenting the healthcare system for *Healthy I* as an environment for innovative production. This includes visuals of various health gadgets, the smell of a new car, and the idea that healthcare is about developing oneself.

The third scenario, titled *Ministry of Root Causes*, is in the quadrant formed by "collective" and "life." In this scenario BFH examines the effect of policy on life. Society has the ability to create a healthy environment by eliminating sources of illness and creating sources of health. An

individual's health is greatly impacted by their interaction with biological, psychological, and environmental conditions. This transformation to a healthier environment arrives through the implementation of new policies and a new focus in healthcare. Policy contains the potential for changing society to create a healthier environment for everyone. Healthcare now focuses on how our environment shapes us and how individual health is a dynamic relationship between human biological, psychological, social, and environmental conditions.

In *Ministry of Root Causes*, the scenario explores the three characters' ailments in terms of their underlying causes. The three viewpoints for the *Ministry of Root Causes* descriptions are a hospital director, the ministry, and the voice of the local community. The moodboard for this scenario aims at portraying the idea of a lifestyle change that avoids habits that are detrimental to one's health. Public Futures shows this environment through visuals of a "controlled savannah" environment with lots of greenery, the smell of soap and freshly cut grass, and the taste of healthy snacks such as carrots and asparagus.

The fourth scenario, titled *Heath Bazaar*, is in the quadrant formed by "individual" and "life." In this scenario, BFH examines health in a holistic way. "Health is more than the body and the mere absence of disease" (Svendsen, et al., 2017). In the *Health Bazaar*, there are endless possible ways of approaching health and individuals focus more on searching for what type of health paradigm suits their needs. Health and illness are lifelong pursuits of experimenting with the different lifestyles in order to learn which one works best.

In *Health Bazaar*, the three patient stories became an exchange of dialogue between separate people. These dialogue exchanges explore the idea of accepting the ailments as having a deeper meaning with which the characters must come to terms. The perspectives for the dialogue descriptions are of the citizen/patient for the first two personas, and of the character's own perspective for the final one. Each of the dialogue sets, as well as the moodboard for this scenario, look at health in terms of finding the meaning behind one's life. This gives a much more spiritual approach to health.

These scenarios outline the potential evolutions of healthcare that may exist in the future. Each scenario targets a specific section of healthcare; only when looking at all of the scenarios together do they create a picture of a possible future. Boxing Future Health's mission is to share this picture with as many influential personnel as possible, to create discussions that may in turn shape the future. As an IQP team, it is our mission to create a virtual tool to represent these scenarios in an interactive way so that the scenarios may promote discussion.

2.4 Video Game Design

One method of presenting healthcare scenarios is through an interactive video game. In a video game, players can take risks and test hypotheses about the outcomes of their actions without the fear of real life consequences. These actions in a video game can also elicit instant feedback that allows for self assessment. Instant feedback provides the player with the opportunity to decide whether their actions had a positive outcome or if they want to choose a different path to test a new hypothesis and its potential consequences (Papastergiou, 2009). In the case of the healthcare scenarios, “positive outcomes” may include reduction of cost and reduction of hospital waiting times.

“Serious games” are a style of game which have become increasingly prevalent in workplace and educational environments (De Gloria, et al., p.1, 2009). Serious games are video games focused on improving learning and are developed with “specific outcomes in mind that will result in measurable, sustained changes in performance or behavior” (Kelly, 2013). One may also see this “measurable change” in the implementation of new education methods within companies. Studies have shown a 40% increased retention rate in students when they complete the task themselves or through simulation versus when they watched someone explain a task while doing it (Kelly, 2013). This lends evidence to the potential effectiveness of presenting the BFH scenarios through an interactive video game. While serious video games can be a helpful tool for education, they are still subject to the expectations of the players. Often serious games fail to create the quality of gameplay and concise presentation of material required to motivate players to keep playing.

When designing serious (educational) video games there is often a lack of balance between the “real” and the “abstract.” People play video games because they are looking for control and autonomy over a situation and to feel as though they are making a contribution to society that cannot be found in reality (Reeves, 2017). One could fulfill these player needs through the incorporation of fantastical worlds. However, Reeves (2017) claims that excessive fantasy can limit the amount a player learns from their decisions in the virtual world by making it more abstract.

In order to create a captivating serious video game, game designers should follow a standard practice for developing serious games. An example of this method exists in *Design Methodology for Educational Games Based on Interactive Screenplays* (Prieto de Lope et al., 2017). The steps in this method include the choice of a game format, construction of a

storyboard, and creation of characters. It is also important to include interesting components, such as plot twists and well developed dialogue, to the game. These interesting components will arise with the development of the game design steps, and through the creation of the story and character involvement.

In order to achieve the right level of interactivity while maintaining clear learning objectives, we used a method called Balanced Design. There are three parts that make up the Balanced Design Method: a content model, a task model, and an evidence model, as shown in **Figure 2**. The content model focuses on the educational objectives of the game and answers the question “what complex knowledge, skills, or attributes are targeted?” (Groff, et al., 2015). The next model, the task model, focuses on what tasks the player can perform to keep them engaged while imparting the necessary information. This model answers the question “What are key tasks in the game, and how will the situations be structured to obtain the kinds of evidence needed?” (Groff, et al., 2015). The final model, the evidence model, calls for the player to prove mastery of the skill over the concepts presented to them. This part answers the question “What behaviors and performances will be used?” (Groff, et al., 2015).

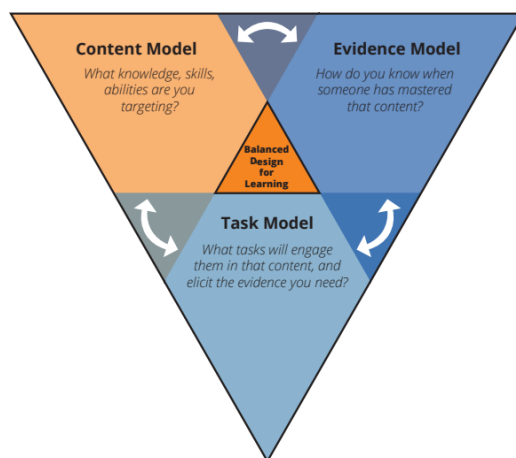


Figure 2: Balanced Design Process¹

2.4.1 Game Format

The choice of a game format determines how the player interacts with the story and what elements will be the most important. Three of the most popular game formats that one can

¹ Reprinted from “Better Learning in Games: A Balanced Design Lens for a New Generation of Learning Games,” by J. Groff, J. Clarke-Midura, V. E. Owen, L. Rosenheck, & M. Beall, 2015, p. 12 (<http://education.mit.edu/wp-co>)

use for a serious game are role playing games, adventure games, and strategy games, with the popularity rankings of 3rd, 5th, and 7th respectively (Entertainment Software Association, 2016). The other popular game formats are shooter games, action games, sport games, and fighting games with the popularity rankings of 1st, 2nd, 4th, and 6th respectively; however, these game formats do not lend themselves to serious games.

In role playing games, the most important elements include the setting, the character advancements, the ability to explore, and the quests (What Makes a Great Role Playing Video Game, 2016). Similarly, adventure games include exploration, but they also include puzzles and narratives (Bronstring, 2012). Strategy games have their own set of important elements. These elements include decision making, predicting outcomes, rewards and consequences for correctly and incorrectly predicting opponents' moves, and a progressive reveal of information (Kapp, 2014). Once the game developer chooses a game type, the key elements of the game format drive the creation of the storyboard.

2.4.2 Storyboard

After choosing the game format, the next step is to create a video game storyboard. Storyboards are commonly used in the TV and film industries to visualize the sequence of a scene, but they can also be used for the development of video game scenes (Ohler, 2005). Storyboarding starts with an initial idea of how the story will progress, also called the storyline. This storyline is then broken into scenes. Designers then create initial drawings of the scenes. The designers then pair the drawings with scene descriptions and the actions for each scene. These pairings are then laid out in chronological order following the storyline. The final result of this method is the storyboard. In a storyboarding design lab at Cornell University, professors present students with the method and details behind each step of storyboarding. For example, the article states that in the initial drawing, "your scene should focus on both the relevant user interface...and the part of the scene that may change" (White, 2013). The development of scenes, such as the initial sketch and actions of the player in the scenes, begins after the development of the game world.

World Building:

In order to create an engaging game, designers must thoroughly develop the game world. Creating a world with details such as government, climates, and social norms can help create an immersive game that makes the player experience more engaging and educational (Novak, 2017). A well developed world also serves as a tool to give context to player actions. After designers develop the setting of the game, they should create an overall outline of the game.

Development of Choice:

A storyboard can outline one of two general gameplay forms: linear gameplay or nonlinear gameplay. Linear gameplay contains one fixed storyline with a fixed ending. In linear gameplay, every time a person plays the game they will experience the same path. Linear gameplay creates a movie-like experience meant to immerse the player in a life-like adventure (Legler, 2015). Alternatively, non-linear gameplay, or choice-based gameplay, allows the player to influence the story line and affect the game's conclusion. Non-linear gameplay allows the player to have a sense of control, but this sense of control is limited by an illusion of choice. Game designers make use of the illusion of choice in order to eliminate the total number of stories and dialogue options they must create.

Choice is the most important tool in game design, as it connects the player to the story, giving them a sense of agency (Alborov, 2017). However, it is impossible to create an unlimited number of choices. Every time a choice appears there must be a storyline following each option. For example, if a game has three choices each with two options, there will be eight distinct endings, as shown in **Figure 3**. In order to limit the number of developed storylines, game designers use a concept called the illusion of choice. **Figure 4** outlines the effect of using the illusion of choice. In this scenario, when the player is presented with a choice they have two options leading to two separate events; however, no matter the option they choose, the choices resolve to the same conclusion. Using this illusion, game designers are able to give the player the feeling that their choices have an influence on the end result while still following one main storyline.

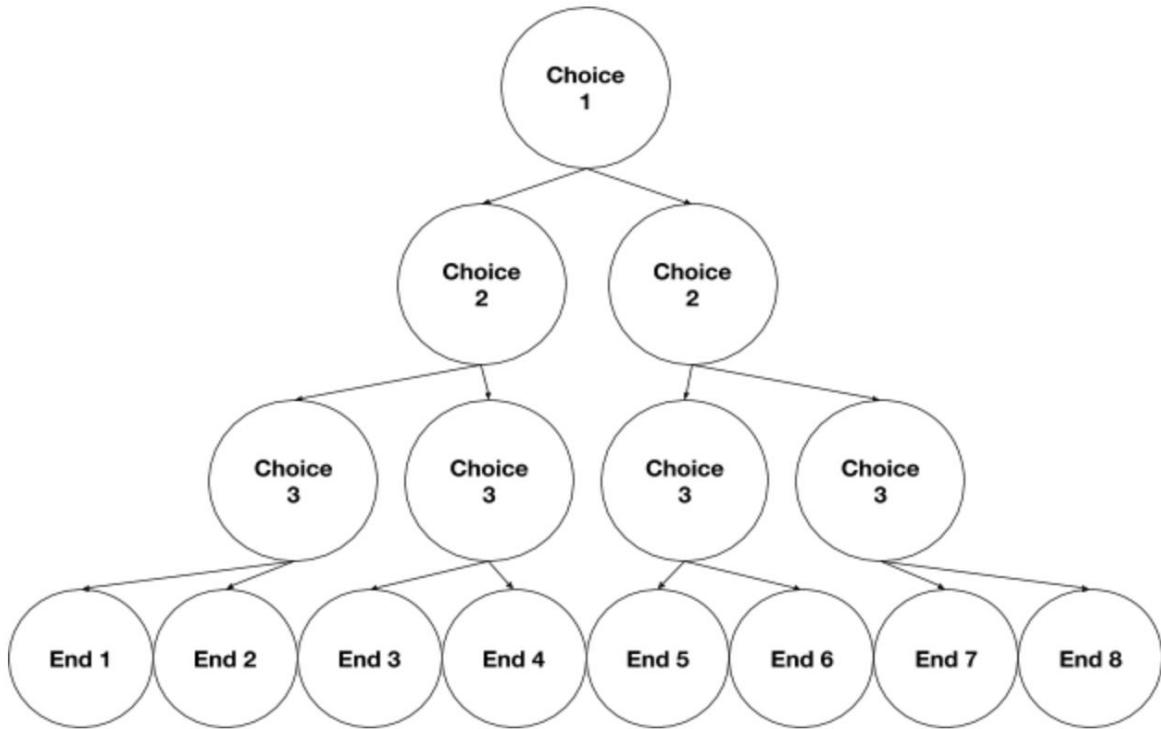


Figure 3: Exponential growth of endings

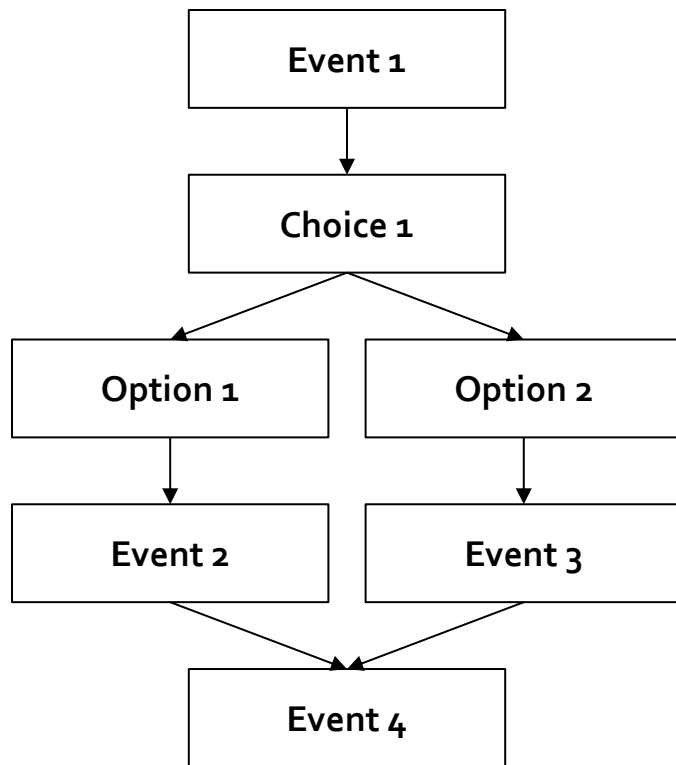


Figure 4: Illusion of Choice

In video games, it can often be more effective to have the player feel like they have a choice than for them to actually have one. In fact, too many choices can often lead to increased anxiety, stress, and dissatisfaction (Schwartz, 2004). This effect is called the paradox of choice (Schwartz, 2004). Using the illusion of choice to limit the effect and number of decisions made by the player will further help to avoid the paradox of choice.

Game tasks must be carefully developed so that they allow the player to have control in the game without creating an excess of choices. Tasks may include quizzes, memory tests, and time-limited problem solving. To promote higher order thinking, tasks should include a system of rewards and goals to motivate the player extrinsically. The narrative must also prompt tasks and have a concrete feedback system (Marchand, et al., 2013). Once developers complete this stage, they move on to character creation since characters typically provide the tasks to the player through dialogue.

2.4.3 Character Development

Once designers have created a full storyboard, they will develop further details including the creation of characters in the game. The characters in serious games fall into three main roles: teachers, learners, and helpers (Wang et. al, 2009). There are also two main types of characters in the game: those that are player controlled and those that are not player controlled (NPC). In serious games, the player controlled character serves as the learner and performs tasks that have educational value. The NPCs use dialogue to act as teachers and helpers, thus linking the game experience with in the game learning.

The design of characters for serious games can be divided into four main stages. These stages are analysis of educational function, basic character description, feasibility of creation, and concept design (Wang et. al, 2009) as shown in **Figure 5**. Through these stages, designers can create characters to fit various educational functions to reach educational goals set for the player by the game designers.

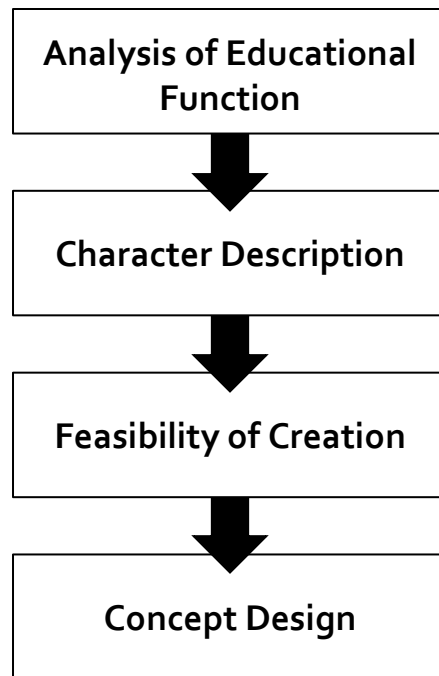


Figure 5: Character Development Process

The characters use dialogue to become teachers and helpers. Farokhmanesh states that dialogue is one of the most effective ways of interacting with the various characters in the story to achieve the educational goals (2014). Dialogue in video games exists as a guide for players to keep the story moving and to promote player involvement (Farokhmanesh, 2014). Writing dialogue for video games is particularly difficult as the conversations must continually advance the story and provide only necessary information. One practice used when writing effective dialogue is to keep the character lines concise. Players want to be involved in the action, not reading long dialogue; “you’re very likely to lose the player if all your lines are long” (Kantilaftis, 2016). To keep the dialogue short, the information presented must be necessary to the development of the story. A video game may have a world with intricate lore and background, but if the information is not pertinent to the gameplay, it should not be included in the dialogue (Kantilaftis, 2016; Slabinski, 2013). Effective dialogue also helps to illustrate character traits, creating NPCs that are memorable and keep the player engaged in the story.

2.4.4 Emotional Design

In addition to dialogue, theories presented by Richard Mayer (2014) in “Cognitive Theory of Multimedia Learning” and by Paul Ekman (2016) in “What Scientists Who Study Emotion Agree About” show methods to engage and emotionally immerse the player in the game and to communicate learning objectives effectively. Mayer’s theories outline the effect of visual and auditory design to enhance the effect of learning. The theories are as follows:

1. There are two separate channels (auditory and visual) for processing information
2. Each channel has a limited (finite) capacity
3. Learning is an active process of filtering, selecting, organizing, and integrating information based upon prior knowledge

Designers use these theories to develop guides to create the visual and auditory aesthetic of video games.

Hillman suggests that there are six universal emotions; happiness, sadness, fear, anger, surprise, and disgust (2014). In general, an emotion is a response to a triggering event or experience (Ekman, 2016). Two of the most effective ways to trigger emotional responses are through visual and auditory design.

Visual Design:

The visual design of the world and the objects in the world can drastically change the emotions the player feels. For example, Plass (2014) found that saturated and warm colors increase pleasure and excitement and that round and face-like features can induce positive emotions. The same study also found that positive emotions and a positive experience lead to higher comprehension and motivation in players (Plass, et al., 2014).

Emotional responses to visuals were concretely tested in another study completed by Mayer and his research team (2014). They tested the educational effect of two games. The first game used simple black and white graphics and the second game used colorful, human face-like graphics². The researchers used these games to teach college students how viruses cause colds. In subsequent tests, the group of students given the game with the colorful graphics outperformed those given the game with the black and white graphics. The students given the colored graphics were better able to understand and retain the material presented (Mayer et al., 2014).

² The pictures used in the study can be found at the URL <https://doi-org.ezproxy.wpi.edu/10.1016/j.learninstruc.2013.02.006>, on page 130.

Audio Design:

Sound can work in conjunction with visuals to increase a game player's understanding of educational material (Shilling et al., 2002). Effective audio design cues the player that there is an area or object of interest nearby, provides instant feedback, and triggers emotion (Lovato, 2017). As an example of a cue, when the character approaches a major fight in the game *Titan Souls*, a foreboding and tense soundtrack begins to emerge. The music then reaches a climax when the character enters the fight chamber. The change in sound tells the player that the character is approaching an area that is different from the main map and the mood of the sound indicates a challenge.

Sound effects can also provide instant feedback based on the actions the player makes. This feedback includes sound effects such as varying footstep sounds with the material the player is walking on, swords clashing, and variance in engine sounds based on the acceleration input of the player when driving a vehicle. While these sounds may not elicit emotions from the player, they are key in connecting the game to the player's expectations. Many of these are sounds that the player hears while moving around the real world, thus making them important to help "set the pace and immerse the player" (Lovato, 2017).

While sound effects can help mentally immerse the player in the game; the overall musical theme for characters and locations can help to set the mood and trigger emotions from the player. A game that has done this particularly well is the Legend of Zelda game, *Breath of the Wild* (Brown, 2017). The game is set in a ruined kingdom where the main character, Link, has lost all of his memories. The sounds accompanying specific scenes in the story are melancholic and many of the song themes allude to the soundtracks of previous games in the Zelda series. Incorporating previous song themes provides a sense of nostalgia for those who have played each of the games in the series and allows the original theme to shine, even with a melancholic twist (Brown, 2017). Thus the tonality, or characteristics of a piece of music based on the relations between notes (*dictionary.com*, n.d.), helps the player become immersed within the game emotionally. The same song played with different tonality can elicit different emotions as shown by the *Breath of the Wild* soundtrack.

Using the same musical theme in similar scenes also helps to connect the desired emotional response across each scene. An example of using a recurring theme for an emotional response appears in the *Resident Evil* series. The gameplay is very tense and aims to make the player feel unsafe. However, when the player enters a room where they can save the game, they are safe from the monsters in the game. This room is then treated as a safe zone, so hearing the

musical theme that plays in the save room elicits a tension release and feeling of safety for the player (Christensen, 2016).

In the Legend of Zelda example, the tonation of the game sounds was used to trigger a sad, melancholic, feeling for the player. In "The Craftsman: the use of sound design to elicit emotions", Neil Hillman proposes four distinct sound categories based on their functions: the logical, the abstract, the temporal, and the spatial (Hillman, et al., 2014). The logical sound area describes sounds that have a specific meaning (eg. dialogue, commentary, ringtones, sirens). Each of these sounds has a distinct message. The abstract sound area describes sounds that have less clear meaning, those that add to the atmospheric feeling of the scene (eg. room tones, sound effects, scene scores). The temporal sound area describes the evolution of time within the story, developing the rhythm and pace. The spatial sound area describes the position of the sounds within a three dimensional space (Hillman, et al., 2014). The sounds in *Breath of the Wild* described above are an example of abstract sounds that add to the atmospheric feeling of the scene. To trigger emotions effectively, sound designers emphasize certain sound areas and relate them to different emotional responses including suspense, hope, shock, and despair. These responses were quantified³ and the data was used to compare the different responses related to the sound areas (Hillman, et al., 2014). Designers use this technique to create a music score that increases the effect of the visual narrative.

Each of these three aspects of audio design (cues, feedback, and emotional triggering) intertwine to create an auditory experience for the player. Effective audio design provides a balance between each aspect, and allows different sounds to exist in the foreground as necessary to create the right amount of player immersion and emotional connection to the game and the characters. Audio, when used in conjunction with stimulating visuals, makes the game come alive and provides engaging audio stimulation for the player (A Beginner's Guide to Video Game Sound Design, 2018).

2.4.5 Iteration

After completing the final steps in the video game process, game designers must return to the early stages to ensure that the format, storyline, and characters align. This cyclical design process, called iteration, uses educated trial and error to establish the best method of presenting the key points of the game to the player (Van Slyke, 2008). **Figure 6** provides a visual representation of this iterative process for educational video games.

³ A graphical representation of these data can be found at the URL <http://www.ingentaconnect.com/content/intellect/ts/2014/00000007/00000001/art00002#>, on page 21.

Game developers employ this method of iteration not only in the initial game design, but in prototyping and testing as well. Once developers create a prototype of a game, they find testers to play the game and provide feedback. With this feedback, developers can evaluate the effectiveness of their game based on predetermined criteria that fit their needs (Luton, 2009). In the case of an educational video game, these criteria may involve the educational value of the game and the entertainment level.

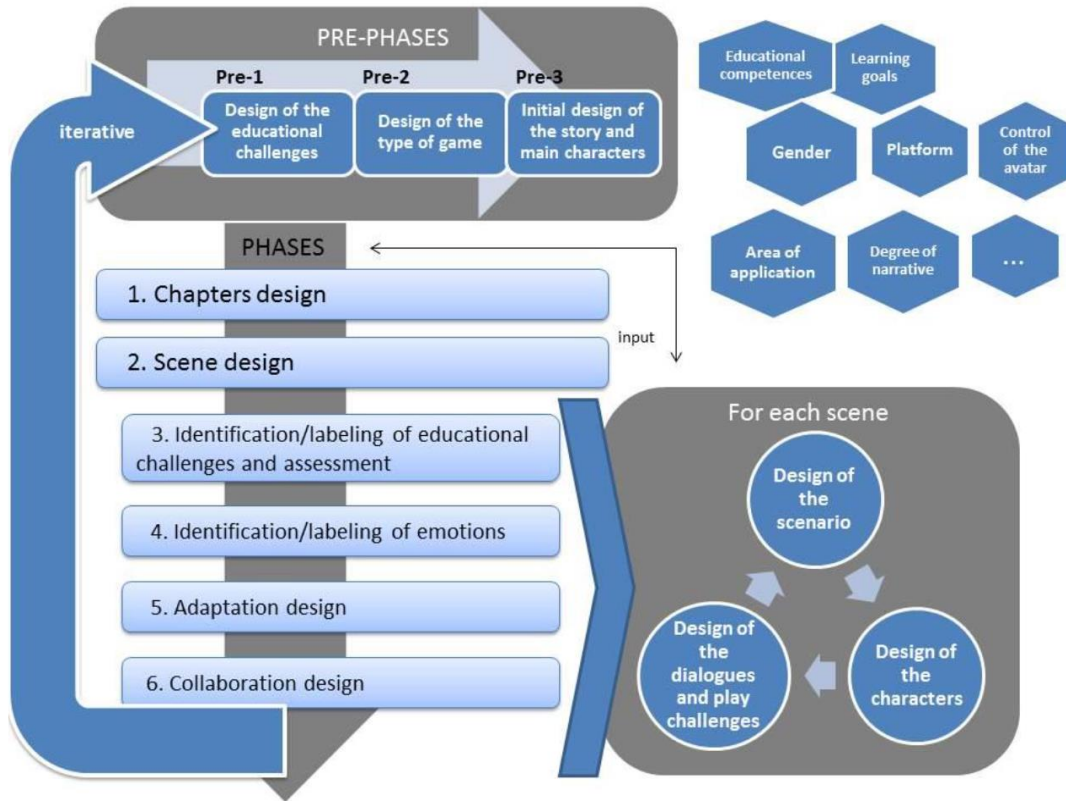


Figure 6: Methodology based on interactive screenplay (Prieto et al., 2017)

To digitize the future scenarios created by the Danish Design Center, this IQP investigated the creation of an educational video game and developed an initial prototype. The team accomplished this task by using the processes discussed previously in an effort to promote critical thinking on the previously created BFH scenarios. By creating a serious game from the scenarios, the scenarios made by Boxing Future Health are highlighted and easily accessible to healthcare companies.

Chapter 3: Methodology

The goal of this project was to create an online gaming tool to present BFH's future healthcare scenarios in an interactive way so that they may reach a larger audience. The DDC in conjunction with the group Public Futures defined the scenarios by mood boards and character personas which they provided to us. The DDC will present the tool to business organizations, health professionals, and policy actors to promote discussion. These discussions aim to promote collaborative design as a tool to aid in the creation of better products and services in healthcare. We used a sequence of tasks, following the video game design process as laid out in the background and in *Design Methodology for Educational Games Based on Interactive Screenplays* (Prieto de Lope, et al., 2017), to design the game. Since game design is an iterative process, we revisited initially completed tasks as we progressed.

The iterative process we followed appears in **Figure 7**. In the figure, each box is a stage in the game design process that we followed for the creation of our prototype. As shown in the figure, we conducted many of the steps simultaneously. First, we created a game world to act as a neutral backdrop. Next, we created an overarching narrative and storyboard, including characters. Finally, we created an interactive screenplay with details for the design of the scenes in the gameworld. Based on feedback from our sponsors and team discussion in each stage of the process, we either progressed to the next task, or backtracked to re-evaluate previous ideas. Our tasks were as follows:

1. To determine a gameplay format to best engage the user
2. To create the prototype of the video game
 - a. To create a game world
 - b. To create storyboards for the video game using the mood boards and personas provided by DDC
 - c. To create characters based on the personas provided by DDC
 - d. To create an interactive screenplay
 - e. To develop scenes and world maps
3. To revise the video game iteratively based on feedback from the DDC, users, and our advisors

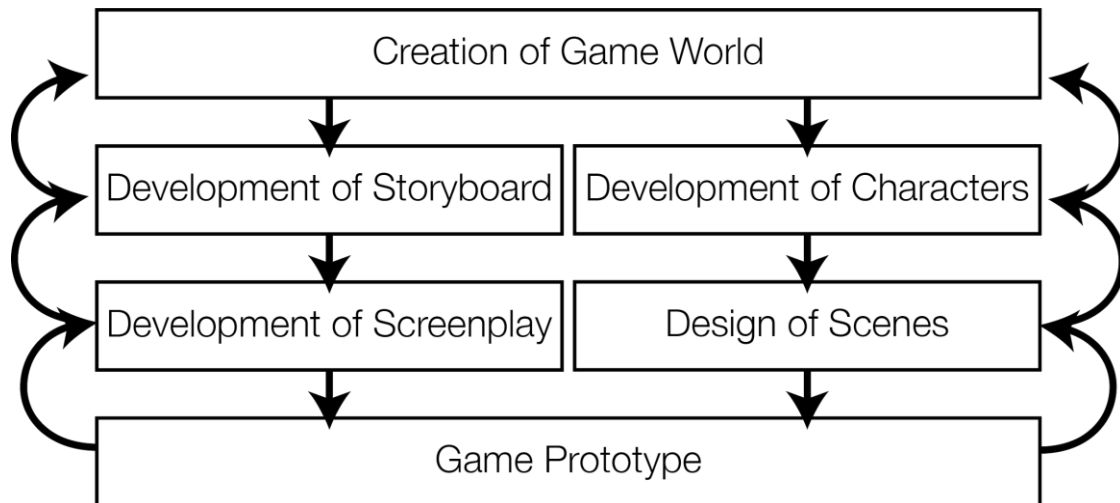


Figure 7: Iterative Process for Video Game Development

3.1 Task 1: Determine a Gameplay Format

The first step of the design process was to determine the game format. Different game formats include role playing games (RPG), adventure games, and strategy games. Each game format has its own elements, such as exploration ability, character advancement, puzzle solving, and rewards and consequences.

In order to determine the most important elements to include in the video game we performed a content analysis of the feedback from a workshop held by BFH. The workshop began with a brief introduction to the scenarios. The participants were then lead through four rooms, each of which represented a separate scenario. After completing a room, participants took a 15 minute reflection period before entering the next scenario. The workshop ended with a facilitated discussion on the lessons learned in each scenario and participants' experiences. At the end of the workshop, participants completed forms, similar to the one shown in **Appendix B**, to identify the workshop's issues and opportunities for growth.

The content analysis consisted of highlighting key words and phrases in the feedback with different colors based on category, shown in **Appendix C**. The parts we highlighted fell into five main categories, as shown in the **Appendix C** key. We established the different categories by reading through the feedback of the DDC workshop and finding the commonalities between comments. We highlighted the keywords and phrases that fell into each commonality in different colors. These commonalities then became the five different categories. We tallied up how many times each category appeared in the feedback. The name of this process is inductive category development (Mayring, 2000). **Figure 8** shows this process. We used the main ideas present in each category, and requests from our BFH sponsors, to determine the

most important gameplay elements that we included in our video game. These gameplay elements created the basis of a weighted decision matrix shown in **Figure 9**. The matrix allowed us to choose a game format based on a score calculated from the weights and applicability of each element.

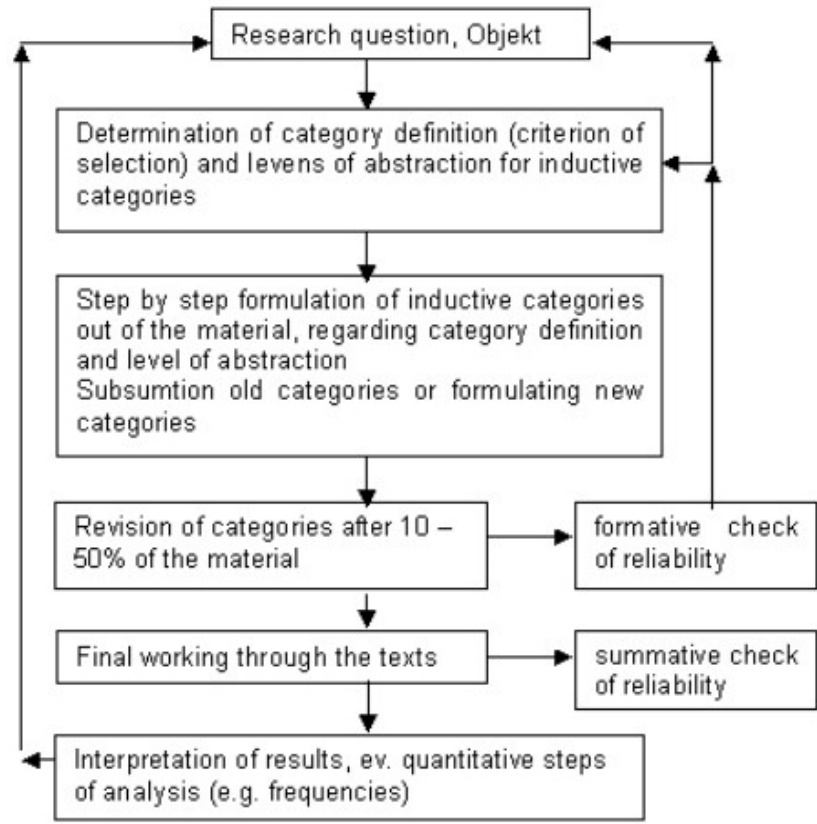


Figure 8: Step model of inductive category development (Mayring, 200, pp. 15)

	scale from 0-1 of least to most applicable							
	Exploration Ability	Communication of Educational Points	Emotional Connection	User Engagement	Development of Scenarios	Consiquence of Choice	Total	Rank
Weight								
Role Playing Games								
Adventure Games								
Strategy Games								
Action Games								

Figure 9: Format Weighted Matrix

After selecting a gameplay format, we used a weighted matrix to determine the software that would facilitate the most efficient prototype creation quantitatively. We took into account the gameplay format, our skill level, and necessary features. We determined these necessary features to be ease of use, range of available features in the software, price, reference

materials available, and compatibility with different computing platforms. We used these features as the headings in the weighted matrix, as shown in **Figure 10**. Once we determined the game format and the game software, we began to create the initial prototype of the video game.

	Ease of Use(i.e. Coding, drag and drop)	Quantitative EOU	Prototyping speed	Range of Tools	Price	Normalized Price	Reference Material	Compatibility	Total	Rank
Weight										
RPG Maker MV										
Game Maker Studio										
Construct 2										
Stencyl										
FlowLab										
Adventure Game Studio										

Figure 10: Software Weighted Matrix

3.2 Task 2: To create the initial prototype of the video game

The initial prototype of the video game required the creation of a game world, a storyboard, a screenplay, characters, character storylines, and scenes and world maps. Before we began, we identified the major educational goals and the theme of each scenario as stated in the initial scenario description document provided to us by our BFH sponsors. The educational goals can be seen in **Appendix D**. We used the educational goals as checkpoints to create a basic storyline and used the requested gameplay elements, determined from the workshop feedback, to guide the story between the checkpoints.

Task 2a: To Create a Game World

We created a game world to give our audience a sense of familiarity in the video game. We based the game world on elements most commonly found in the countries where BFH planned to use our game. The elements we used can be found in **Figure 11**. However, in order to make the game more universal we incorporated elements from other countries similar to the audience determined by BFH.

To find other countries to use as models, we looked for commonalities in economic systems, political systems, education levels, core values, life expectancy, and standards of living. We used the dimensions of the Human Development Index (HDI) as a model for quantitatively analyzing countries. These dimensions include: long and healthy life defined as life expectancy at birth, knowledge defined as literacy rate and school enrollment rate, and a high standard of living as measured by GDP per capita (UNDP, 2015, p. 11). Utilizing the HDI, and the criteria that produce that index, we chose ten countries in addition to the audience determined by

BFH. These countries include Norway, Australia, Switzerland, Germany, Denmark, Singapore, Netherlands, Ireland, Iceland, Canada, and the United States (UNDP, 2016, p. 198).

These countries were then research and analyzed to provide a foundation to create a relatable world for users with many different cultural and ethnic backgrounds. The different aspects of countries that we analyzed are shown in the first column in **Figure 11**. We looked for overlap in these categories in order to create a unique yet generalized basis to design a country for the game world. Creating a unique world that encompassed the commonalities between these countries made the video game more relatable across a wide array of nations.

Region	Heavily populated "super city"
City	Glasston
Landforms/Style	City, large parks, mountains
Economic Structure	Capatillist
Climate	Currently spring
Political Scene	Monarch with a parliament and prime minister
Religions	Christianity, Islam, Judaism, Atheist
Lanuage	English
Unemployment	5%
Common Hobbies	Running/jogging, Soccer, Gym
Average Level of Education	High School Graduates

Figure 11: Qualities used to Design the Game World

Task 2b: To Create Storyboards for the Video Game

After designing the game world, we first created an overall narrative for the video game, then we created storyboards for each scene. The structure of the video game narrative depends on how we developed choices in the game. As discussed in the background there are two main game formats; linear and nonlinear. The choice of game format was dependent on the key game elements included in the game based on the workshop feedback.

After we determined the overall narrative and the structure of the game, we began to create a storyboard. We derived the initial storyboards from the moodboards, and personas created by Public Futures, shown in **Appendix A**, for Boxing Future Health's physical scenarios.

Task 2c: To Create the Characters

As we created the storyboard, we simultaneously created characters to drive the story. We developed these characters to elicit strong emotions from the player and to create meaningful connections. Developing strong connections with characters helps to engage the player and allows for a more effective presentation of information (Prieto et al., 2017). We followed the method for character development described in the background, using personas provided by the Danish Design Center and Public Futures as a base. Steps included analyzing the function of the character, writing basic character description, determining feasibility of creation, and designing the initial concept (Wang et. al, 2009). We based the number of characters created on the number of roles needed to present the scenarios.

Task 2d: To Create an Interactive Screenplay

After creating the storyboard and characters, we wrote an interactive screenplay that encompasses dialogue, audio and visual cues, setting descriptions, character movements, and actions performed by the player. The dialogue for each scene in the storyboard was written out along with the actions and movements of characters. Audio and visual cues were added later and were worked into the character movements. The purpose for making the screenplay in this fashion was to clarify all details necessary for each scene in the game, making it easier for us to code the game in the software. In particular, developing the dialogue in the screenplay facilitated the game coding process significantly.

We wrote the dialogue for each scene by following the key points outlined by Helen Kantilaftis, Director of Marketing at the New York Film academy (2016). These points include:

1. Use concise dialogue to push the story
2. Make backstories optional
3. Focus on the interaction with the Non Player Characters

Developing effective dialogue creates an emotional connection between the player and the game, increasing their interest in the presented material (Prieto de Lope et al., 2017). We wrote the dialogue as a traditional film script, indicating who was speaking and their mood.

First, we wrote the dialogue for the main storyline, then we added dialogue for branching storylines. An interactive screenplay was then drafted from the dialogue.

Task 2e: To Develop Scenes and World Maps

Next, we designed an overall game map and individual scenes. The individual scenes defined both the static and dynamic parts of the environment. The static parts of the scene include the overall atmosphere as well as the individual objects in the scene. The dynamic parts define the interactivity of the game (eg. ability to pick up objects) (Prieto de Lope et al., 2017). We designed the environments from pre-existing templates, and adapted to utilize staging as an aid for evoking emotions. We also developed an overall world map, which consisted of the placement of individual scenes.

In an effort to use the staging details of the scenes to aid in eliciting emotions, we spoke with a psychology professor, who we shall refer to as Professor X, from a local university in Copenhagen. This professor has expertise in the cognitive effect of gaming. We discussed the use of visual and auditory stimulation to portray the emotions of the scenes to the player's subconscious before presenting the emotion to the conscious mind through character interaction. The set of questions that we asked the Professor X can be found in **Appendix E**.

According to Professor X,

“Central fixation that is where we have the best resolution and highest speed of process. So we have done a study where we have looked at processing speed from the center and in certain eccentricities out from the center and we found that the processing speed declines with eccentricity as you might expect” (Anonymous, personal communication, March 28, 2018).

The central fixation of objects and characters within a game aids in the processing of information. We kept this in mind when designing scenes and world maps by ensuring the central focus of that scene was in the center of the screen to ensure faster processing and understanding by the player. The ability to process this information quickly and easily aids in the user engagement in games (Anonymous, personal communication, March 28, 2018).

3.3 Task 3: To Revise the Video Game Iteratively Based on Feedback

Once we created the prototype, we presented the information to our sponsors and received feedback on the continuity and direction of the game. We then addressed the feedback to

create a new iteration of the game following the procedure outlined in the previous section. Iteratively developing the game ensured that the story met the previously developed criteria.

We then tested our game. The set of testers included eight students from the WPI Copenhagen Project Site. This group of testers was sent the prototype game to play and we asked them for their reactions using the questions in **Appendix B**. These questions were used to evaluate the progression of gameplay and the effectiveness of the educational material. We used the feedback from our sponsors and testers to make edits to the game that were possible in our remaining time. For those edits that we could not make, we wrote recommendations to the DDC for the further development of the game.

Chapter 4: Design Principles

To create the video game, we first decided on a gameplay format, game creation software, and a game world. Once we chose these elements we iteratively developed the storyboard, characters, interactive screenplay, game visuals, and game audio. Based on the feedback received from the iterations, we created a set of guiding principles and techniques to aid in the creation of the final prototype. The gameplay format and overall structure of the game world were separate from these principles as they were static elements of the game, and received few changes.

4.1 Determining a Gameplay Format

The first task completed was to determine a gameplay format. To choose the format we analyzed feedback from a BFH workshop, shown in **Appendix C**, hosted by the DDC which outlined the major elements requested by users, shown in **Figure 12**. Our sponsors also provided feedback on the elements they deemed the most important: exploration ability, emotional connection (especially through dialogue), and consequences of choices.

	Emotional Connection	Educational Points	User Engagement	Futurism	Developed Scenarios
Number of Appearance in Workshop Feedback	11	9	25	8	13

Figure 12: Workshop Feedback Categorization

Then we combined elements requested by the workshop users and the elements requested by our BFH sponsors into six key elements to incorporate into the final video game prototype. The six most important elements were:

1. Exploration ability
2. Emotional connection, especially through dialogue
3. Consequences of choices
4. Educational points
5. Developed scenarios
6. User engagement (eg. puzzles and quests)

The user request for user engagement provides evidence to support the theory that people learn best, and are most engaged in a task, when they do the task themselves rather than see the task done (Kelly, 2013).

Next, we created a weighted decision matrix to determine the most effective gameplay format for the elements that we needed to include. We considered four gameplay formats based on their popularity and applicability to our game. We gave these formats a value between 0-1 for the six most important elements, based on information found through research on the different game types. Each game element was then given a weight. We gave the elements requested by our BFH sponsors the highest weights first, followed by the elements that appeared most frequently in the workshop feedback. The values and weights appear in **Figure 13** of the weighted matrix. The weighted matrix determined that a Role Playing Game was the most effective format for this project.

scale from 0-1 of least to most applicable								
	Exploration Ability	Communication of Educational Points	Emotional Connection	User Engagement	Development of Scenarios	Consequence of Choice	Total	Rank
Weight	0.15	0.2	0.15	0.2	0.1	0.2	1.00	
Role Playing Games	1	1	0.8	0.8	0.8	0.5	0.81	1
Adventure Games	0.2	0.2	0.8	1	0.9	0.9	0.66	2
Strategy Games	0.2	0.2	0.2	0.5	1	1	0.5	3
Action Games	0.3	0.6	0.6	0.5	0.8	0.5	0.535	4

Figure 13: Weighted Matrix for Gameplay Format Decision

After we decided on a gameplay format, we used a weighted matrix to determine the most effective software to use. Due to our team’s limited knowledge of coding and game design, we decided ease of use, prototyping speed, range of available tools, and amount of reference materials available were the most important characteristics for our game software. We also looked at the software price and the software’s compatibility with different operating systems. Each software was then given a score from 0-10 based on information from their respective websites. As shown in **Figure 14**, the matrix determined that RPG Maker MV was the preferred software for this project.

0= Coding only 5=drag and drop 10= both										
	Ease of Use(i.e. Coding, drag and drop)	Quantitative EOU	Prototyping speed	Range of Tools	Price	Normalized Price	Reference Material	Compatibility	Total	Rank
Weight		0.2	0.25	0.2		0.05	0.2	0.1	1.00	
RPG Maker MV	Both	10	10	8	\$80.00	6.0	10	10	9.40	1
Game Maker Studio	Both	10	6	10	\$150.00	2.5	10	10	8.62	2
Construct 2	Both	10	7	6	\$199.00	0.0	8	5	7.05	3
Stencyl	Both	10	5	3	\$0.00	10.0	5	5	5.85	4
FlowLab	Drag and Drop	5	7	1	\$0.00	10.0	2	5	4.35	5
Adventure Game Studio	Drag and Drop	5	4	4	\$0.00	10.0	1	5	4.00	6

Figure 14: Weighted Matrix for Software Decision

4.2 Creating a Game World

The first step in creating an initial prototype was to create a generic world in which the game would take place. To create the world, we considered our audience, where the DDC will use the game, and what their world might look like. The method for choosing countries to base the game world off can be seen in the methodology. We wanted the game to have aspects that were familiar to the player since we are presenting abstract concepts and futuristic ideas. As stated by our sponsor, the DDC's target audience for the BFH video game includes Denmark, the European Union (EU), and United Arab Emirates (UAE).

4.3 Principles and Techniques

We presented iterations of the video game to the BFH team for feedback at several touchbase and milestone meetings. We used the feedback to create guiding principles. We used these principles when creating the next iteration of the game. We have included the five principles we determined to be the most important, and the techniques we used to develop the principles.

Principle 1: Structure

We created the structure of our video game to allow for the implementation of the six key game elements described in *Determining a Gameplay Format*. The structure of a video game outlines the way in which the player follows the story. There are two main gameplay structures; linear and nonlinear. Linear gameplay is easier to create as it leads the player chronologically through the story in a movie like fashion; however, it limits the effect of the player's choices. Since one of the key game elements was the consequence of choice, we decided to use a nonlinear structure in which the players can choose their own paths. To limit the number of choices present in a nonlinear game we implemented the Illusion of Choice as described below.

Technique 1: Control of Choice

We used the illusion of choice to control and to limit the number of branching paths in the game. BFH and Public Futures created four scenarios. One can see each of the scenarios through four different perspectives, or personas, leading to 16 unique paths for the player to take. Each path also included subsequent choices that affected the overall story. In order to avoid the Paradox of Choice, in the first iteration we created one main storyline that progressed linearly through each scenario, decreasing the total number of possible

conclusions. The linear structure is shown in **Figure 15**. We also utilized the Illusion of Choice technique in order to give the player the feeling that their actions had an effect, while avoiding creating too many complicated branching storylines which would confuse the player.



Figure 15: First iteration of structure

After presenting the first iteration of the video game to the DDC, our sponsors suggested that having a set sequence for the scenarios could influence the player’s thoughts about the benefits and consequences of each scenario. We decided that it would be best for the player to choose the order in which they experience the scenarios. This way, different players could have different experiences with the scenarios and thus bring new ideas to discussions. The second iteration of the structure is shown in **Figure 16**.

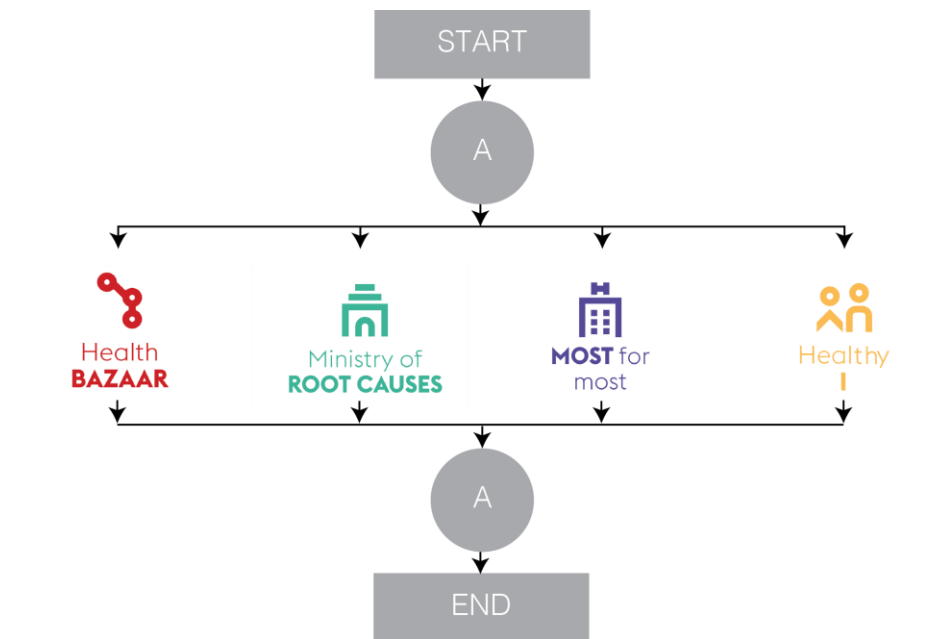


Figure 16: Second iteration of structure

In the second iteration of the structure, the players begin in a neutral starting area where they are able to decide which scenario they want to explore. To limit the number of choices present, we created linear storylines within each scenario as shown in **Figure 17**. In this structure, the player moves through a series of mini games, after which there is a period of reflection. By controlling the number of possible endings, we avoided overwhelming the player. After

completing the selected scenario, the player returns to the original neutral area where they choose the next scenario to experience.



Figure 17: Scenario structure

Principle 2: Simplicity

The overall simplicity of the game was one of the most important principles we learned through discussion with our sponsor. During Touchbase 1, Anne Danielson specifically stated the importance of a simple narrative, with simple elements. Creating a simple game with only necessary elements allows room for the player to add their own experiences and ideas, which increases the player's engagement in the game, subsequently increasing the effectiveness of the learning environment (Whitton, 2010).

Technique 1: Concise Dialogue and Character Backstories

One of the most important techniques used to simplify the game was to make the dialogue and character backstories concise, providing only necessary information. Using this technique gave the player enough information to bond to the story emotionally, while still leaving gaps for their own imagination to fill in. We used this technique extensively throughout the interactive screenplay for the *Most for Most* scenario. For example, the goal of one of the mini games we developed was to portray the efficiency of the policies in *Most for Most*, and how easy it is to cure patients with common illnesses but how difficult it is to cure patients with rare diseases. In this mini game, players were only provided with the necessary information to complete the mini game, such as ailment and treatment needed. This allowed for brief dialogue between the player and NPC's that clearly conveyed the main points. Eliminating unnecessary information helped to keep the player focused and engaged on the task at hand (Slabinski, 2013). Dialogue that conveyed the themes and the personas of the scenarios was left to optional interactions between the player and the NPCs. In this way, we gave the players control over how much of the additional story they wanted to see.

Technique 2: Remove technology

Another important technique we used was to remove as many future technologies and props as possible. We do not have the qualifications to analyze and extrapolate technology trends. Even if we had the qualifications, including potential technologies would be counterproductive

since it would lead the player to make conclusions about the future rather than to imagine the possibilities.

In the first iteration of the video game, we included specific technologies, such as cars, and specific medical procedures. In a discussion with our BFH sponsors, Anne Danielsen suggested that including these types of technologies could bias the player and limit their imagination, reducing their ability to create unique solutions to real world problems. In the second iteration of the video game we removed all unnecessary references to both current and future technologies and methods in both the physical landscape and the dialogue.

Principle 3: Creation of Learning Objectives

In order to inform the player about the key elements of each scenario, we needed an effective method to present the information. We based the learning objectives for our game on Boxing Future Health’s initial scenario descriptions produced by Public Futures shown in **Appendix D**. We then used the Balanced Design method as described in the methodology to determine how the player would demonstrate mastery of educational goals presented in the scenarios.

Technique 1: Clarity of Scenarios

We created clear beginnings and endings for each scenario in order to clarify the separation between the learning objectives of each scenario. The first iteration of the video game progressed linearly with each scenario combined in the main storyline, shown in **Figure 18**. Due to the connection between different scenarios, it was difficult to tell where one scenario ended and another began. Without a clear distinction between the scenarios, it was difficult to separate the benefits, consequences, and goals of each scenario. After discussing the first iteration with our BFH sponsors, Kathrine Storm stated that if the player progressed through all the scenarios via a single storyline then the game prototype would not communicate the learning objectives of each individual scenario distinctly.

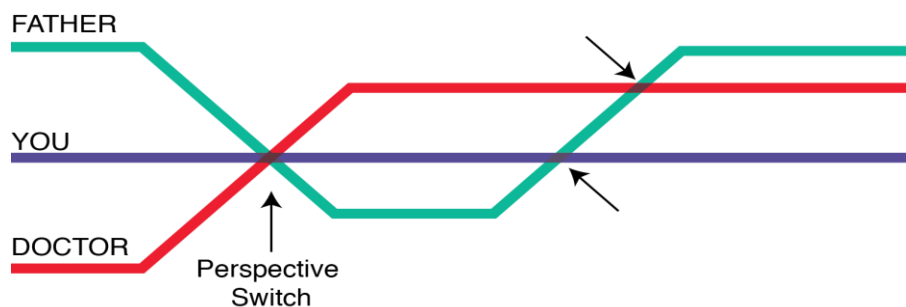


Figure 18: Linear storyline

In the second iteration, we created clear separations between the scenarios. We used a period of reflection to mark the end of one scenario and the start of another. The reflections provided the player with the chance to think about what happened in the previous scenario, and how it compared to the different scenarios, before starting on the next one. This is shown in **Figure 19**. In this structure, the player starts at the first A where they are given the choice of which scenario they wish to enter. They then play through the scenario and the combined reflection, ending at the second A. At this point they are transferred back to the first A, where they are given the choice of the next scenario they want to enter.

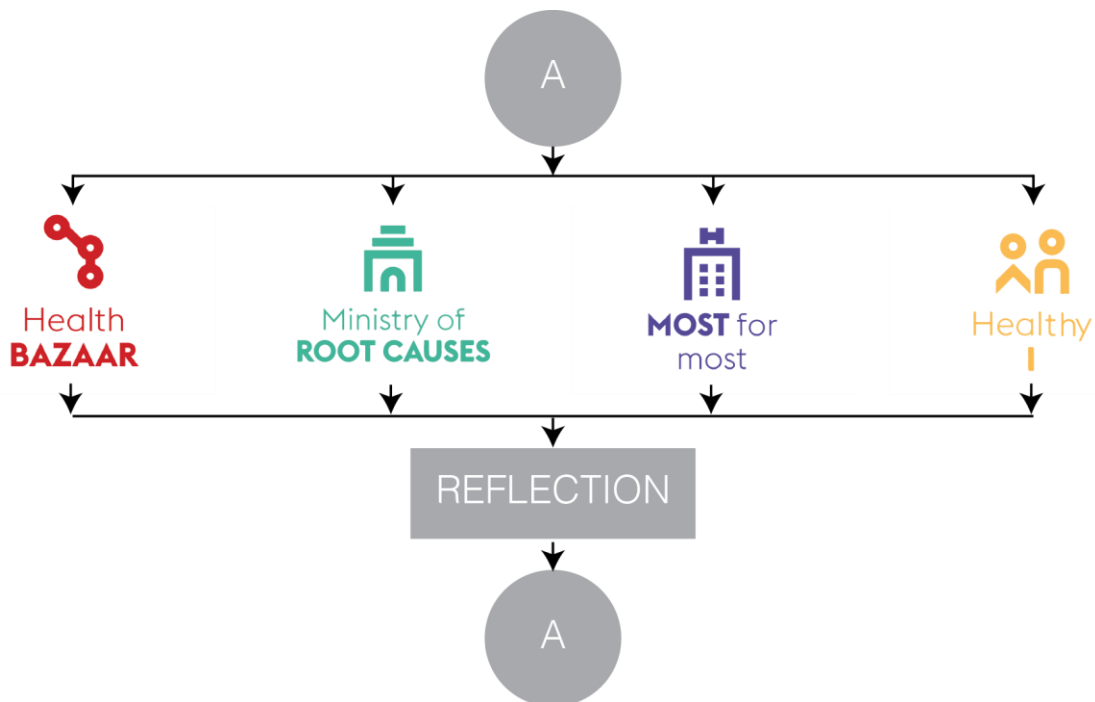


Figure 19: Storyline with reflections

Technique 2: Mastery of Learning Objectives

In order to understand the effectiveness of the tasks and the player’s mastery of the learning objectives, we created a feedback system. This system consists of a website where players can post their ideas on a forum and reflect on their experiences from the game. This website allows for collaborative discussions between game players regardless of geographic location. The combined effect of reflecting on the presented material and partaking in collaborative discussions acts as our evidence model portion of the Balanced Design method. These “co-reflections” between players enforce the critical thinking process “in order to reach new intersubjective understandings and appreciations” and engage participants to think deeply and personally (Yukawa, pp. 206, 2006). The reflections and discussion players engage in after a scenario reinforce the lessons learned from the tasks players completed. We based the

reflection questions on the form given to participants after BFH's workshops of the physical scenarios. The questions on the form are shown in **Appendix B**.

Principle 4: Emotional Connection

Another key principle is that an emotional connection to the characters and the game helps to engage the player, which leads to a better understanding of the presented material (Plass, et al., 2014). We used four design techniques in particular that helped us to design the game to create an emotional connection: audio design, visual design, dialogue design, and character design.

Technique 1: Audio Design

When considering the emotional connection that we wanted the player to have with the game, we looked extensively into the use of audio design. We found multiple examples of effective audio design and found that their success, especially in Pixar movies, was due to the use of themes. In these movies, audio designers begin by connecting a musical theme to an emotional event. They then reused the same theme every time they wanted to elicit a similar emotion without visual aids (Sideways, 2016). This effect adds depth to the story that would not exist otherwise.

We also found that altering a theme by changing the auditory elements was a valuable way to manipulate emotions about a location, scene, or character. An example that inspired us was that of Tarrey Town from the *Legend of Zelda* game, *Breath of the Wild* (Nintendo, 2017). The first time the player visits Tarrey Town, the background music is a hopeful sounding, one dimensional, light piano melody. As the player leads new people of different cultures to live in this town, new elements are added to the song, such as a horn melody and wind instruments. At the end of the story, the song becomes full bodied, encompassing the themes from each of the races and cultures, while still including the underlying hopeful piano theme (Brown, 2017).

By using similar techniques for audio design, we aimed to elicit a connection between the player and multiple characters and the scenarios. We achieved this emotional connection through the use of themes for locations and situations. We used a single theme for the neutral park setting, shown in **Figure 20**, and added slight alterations in the theme when the player moved to the *Most for Most* park, show in **Figure 21**. A similar use of audio included a single theme for reflection periods, thus indicating to the player that they are entering a time for reflection when the theme reappears. We also incorporated the ticking of a clock and faster music when the player was completing timed tasks or when character-specific events had a

time aspect. This auditory cue motivates the player to take action as it instills a sense of urgency in the current situation within the game. This use of sound design also works closely with the visuals in the game to immerse the player emotionally (Mayer, 2014).

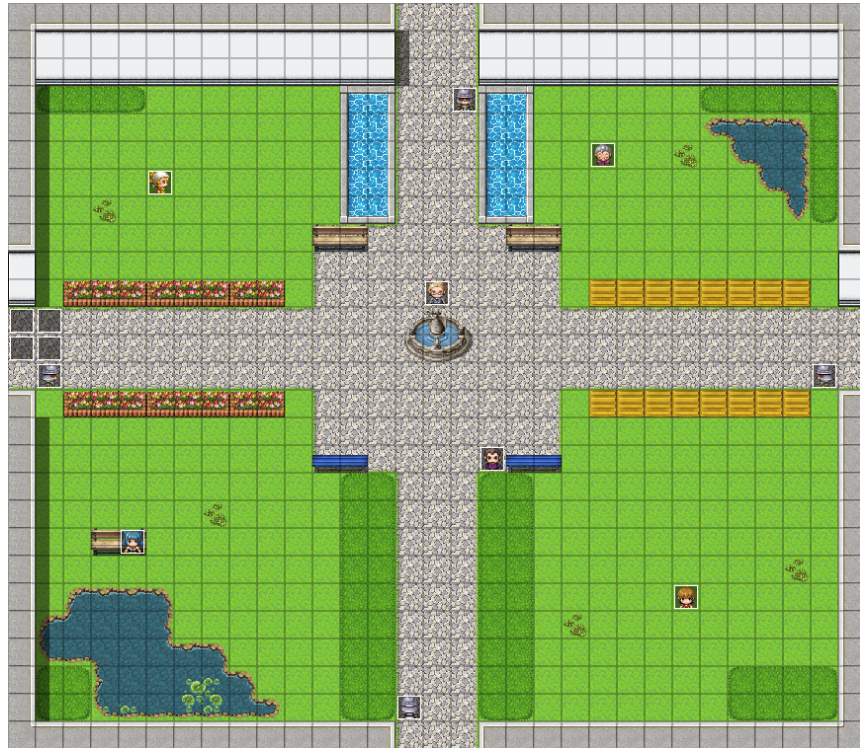


Figure 20: Neutral Park

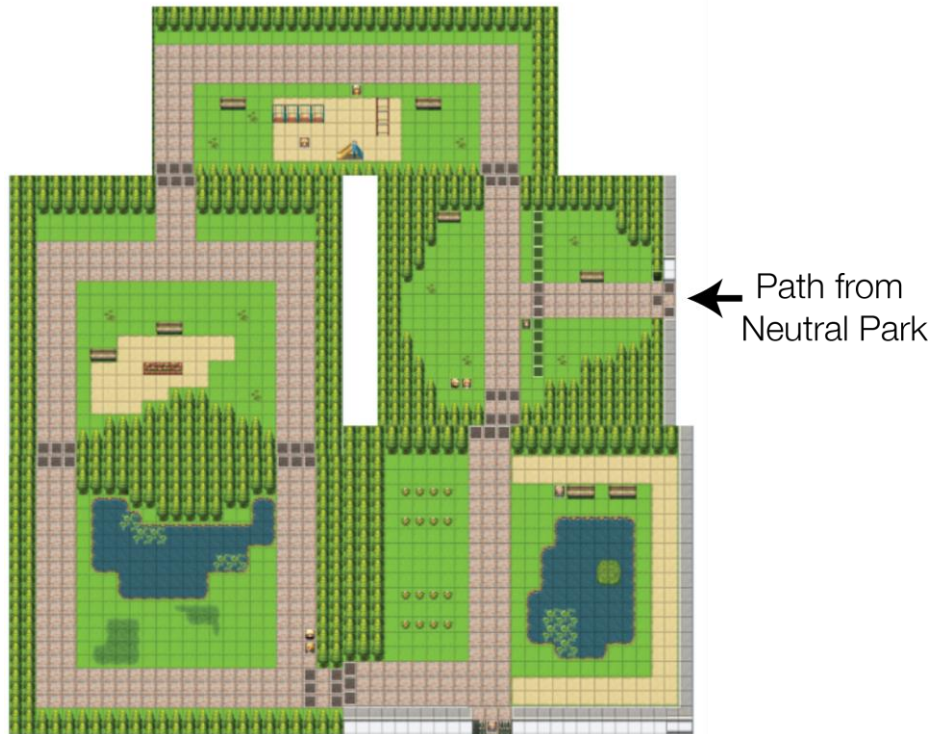


Figure 21: Most for Most Park

Technique 2: Visual Design

In accordance with Richard Mayer's "Cognitive Theory of Multimedia Learning" (2014), we created the game map and individual scenes to work in conjunction with the audio to elicit specific emotions from the player. We used the moodboards created by Public Futures, shown in **Appendix A**, as a foundation for the visual design. The emotions for the *Most for Most* scenario include frustration and desperation due to an urgent desire for treatment.

In the *Most for Most* scenario, the scenes we created were crowded and cramped, as shown in **Figure 22** for the hospital mini game. In this scenario, everything is efficient and optimized to keep healthcare within a budget. This had to balance with simple visuals without futuristic technologies to allow the player to use their imagination of what may exist in the year 2050.



Figure 22: Scene Map for Hospital Mini game

Technique 3: Dialogue Design

After researching the importance of a strong storyline in maintaining an emotional connection with the player, we designed our dialogue. Originally, our research findings determined that by giving a complete picture of the story, with few plot holes in it, the player would be emotionally engaged. However, this meant that the player would not be able to influence the story and use their own imagination.

Through discussion with our BFH sponsors and our advisors, both Anne Danielson and Holly Ault stated that the dialogue had included too many concrete factors. Outlining the whole story through the dialogue gave the player too much information to process and left little room for individual interpretation. This contradicted the goal of the scenarios. The scenarios present abstract concepts that people can view in different ways. Additionally, an emotional connection gains strength when the player becomes invested in the game (Ekman, 2016). Limiting the player's ability to fill in the gaps makes it difficult for them to have a stake in the success or failure of the game.

In the second iteration, we structured the dialogue to drive the story and the associated tasks. We cut out the excess so that the dialogue stated only the information needed to complete the learning objective, leaving more room for interpretation. An excerpt from the dialogue created can be seen in **Appendix F**.

Technique 4: Character Design

We used character design to help develop an emotional connection between the player and the game. We achieved this emotional connection to characters through familial ties. In the game, the core characters the player interacts with are the main character's family members, each of which has a medical condition. Providing these types of emotional ties made the game more relatable. The creation of non-player characters (NPC's) was vital to create the game's emotional connection and story progression. The NPC's acted as teachers and aids throughout the game to convey the learning objectives. They also deepened emotional connection by interacting with the player through dialogue. We developed all the characters as part of our iterative process, and thus many of them changed throughout each iteration.

Originally, we interpreted all three personas that BFH and Public Futures provided as playable characters. BFH used these personas in their physical scenario workshop. We decided to digitize the personas and make them all playable characters. This meant that the player could play as a 37 year old with stress related depression, as a 64 year old with chronic illnesses, or as a 47 year old with a broken leg. We assigned these personas personality traits and appearances to create final characters.

After altering the story structure for our second iteration, we also altered the characters based on our BFH sponsor's feedback. BFH asked us to explore more dialogue, especially between the player and other characters. This required that we change the way characters interact. In the second iteration, we turned the 47 year old with a broken leg into the main character's aunt. We also created a brother to the main character who took the persona from the 37 year old that suffered from stress related depression.

The iteration of the characters allowed us to evaluate whether they establish the important emotional connection. After multiple iterations we eventually found that characters that the player relates to through a familial unit provide the strongest emotional response to the game.

Principle 5: Interactivity

The feedback from the workshop held by BFH stated that users wanted more interaction within the scenarios between themselves and the environment and characters. This interaction was important since it allowed the player to immerse themselves in the game and let the player feel like they had more control over the world and how they viewed it. In order to increase the interactivity of the game, we developed four techniques.

Technique 1: Choice and Consequence

The first technique we used to increase the interactivity of the video game was to develop choices with consequences. In the physical workshop created by BFH, the host leads the attendees through a narrative in a movie-like fashion. In game development, this is a linear story progression. The first iteration of our video game followed the same format as the physical scenarios, leading the player through a set storyline. This initial iteration did not allow the player to make choices that had clear consequences to the overall storyline, which limited their interaction in the game. In the second iteration of the game we created a parallel storyline with mini games. The parallel storyline allowed the player to choose the order in which they experienced the scenarios. The mini games gave the player a sense of control over the game world, to make their actions have an effect on the progression of the story.

Technique 2: Creation of Tasks

The creation of tasks started with the Balanced Design method. The first part of this method was to create clear and concise content models. For us, these content models were the main themes of each scenario as outlined by the DDC. Based on these themes, we then designed tasks that focused on learning specific parts of each theme.

Our in-game tasks most often took the form of mini games, or small stories within the game with distinct goals. We used tasks so that the player learned through doing instead of through reading dialogue. The first iteration of the video game screenplay contained many cut scenes. A cut scene is a movie-like scene added to a video game which does not allow the character to respond other than by multiple choice questions. The cut scenes limited interactivity and, subsequently, an emotional connection. As a result, we included too many unnecessary pieces of information in the dialogue that obscured the necessary content.

To make an interactive game, we created a set of tasks to ensure the player met certain learning objectives while maintaining a high level of engagement and interactivity. We used the Balanced Design model to design our tasks. The Balanced Design model asks the question "what are key tasks in the game, and how will the situations be structured?" (Groff, et al., 2015). Answering this question resulted in the development of tasks such as problem solving in a specific timeframe and try-and-fail tasks. We used these tasks to challenge the player's understanding of the scenarios.

For example, in one of the mini games, the player faces a challenge where they must heal a specific number of patients within a budget. In order to pass the game, the player can only heal the patients with low budget requirements. Without knowing this fact, the player might heal patients that are more costly, which will end with them failing the mini game and having to repeat it until they pass. This mini game is in the *Most for Most* scenario with the goal of teaching players that they may either heal many patients with common ailments, or few patients with rare ailments.

Technique 3: Exploration

Exploration is the ability for the player to walk around an environment to discover elements which do not directly relate to the main story, but which develop the game world. This gives the player a sense of control, allowing them to choose the extent to which they explore. The environment is broken into static parts and dynamic parts. The static parts of the environment include props and non-character objects that the player can interact with throughout the story. For example, in the game the player must take certain paths to move through the story; however, there are also paths that will not progress the player through the story, shown in **Figure 23**. These “unnecessary” paths allow the player to explore the world and uncover smaller details which develop the game world.

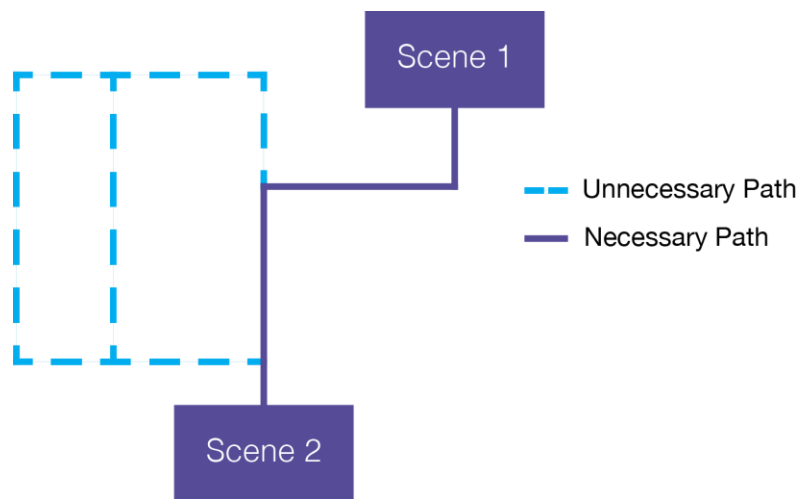


Figure 23: Necessary and Unnecessary Paths

The dynamic parts of the environment are the NPC's with whom the player interacts. These include two types of characters; teachers and helpers. For example, the Doctor character in the first iteration is a teacher who leads the player to the main lessons of the *Most for Most* scenario. The Doctor is an example of a necessary character since he is necessary for the player

to progress through the storyline; however, there are many unnecessary characters. The player is not required to talk to any unnecessary characters, but doing so helps to develop the world.

Technique 4: Reflection

The overall goal of the game was to prompt the player to think about the future and the problems that they may encounter. In order to give the player time to think about the scenario and to develop their ideas, we created a set of open ended questions. We based these questions on the questions asked after BFH's Workshops, shown in **Appendix G**. The player's conscience character asks the player these questions in the game. From the beginning of the game, the player's conscience will act as a guide, to help when the player is stuck, and as a teacher, to explore the educational content of the individual stories and scenarios. The conscience as a character is effective because it represents the embodiment of the player's thoughts and thus helps us to guide the player's thoughts and emotions in the way we need to in order to present the message of each scenario clearly.

Chapter 5: Final Prototype

5.1 Video Game

The principles we developed throughout our project guided the development of the final prototype. The final prototype of the game uses a parallel structure with linear sub-stories for each scenario, as shown in **Figure 24**. Each sub-story includes simplified visuals and dialogue that increase players' ability to incorporate their own imagination and solutions. The parallel structure allows players to experience the scenarios in any order and the linear sub-stories maintains simplicity within the scenarios. The *Most for Most* scenario follows a linear progression that includes two mini games and two periods of reflection, as shown in **Figure 25**. The scene labeled "A" in both **Figures 24** and **25** refers to a "neutral" area where the player can choose which scenario they want to enter. After the completion of each scenario's storyline, the player returns to this area to enter the next scenario of their choice. The commented game code following the gameplay from the start through the *Most for Most* scenario to scene "A" is found in **Appendix H**.

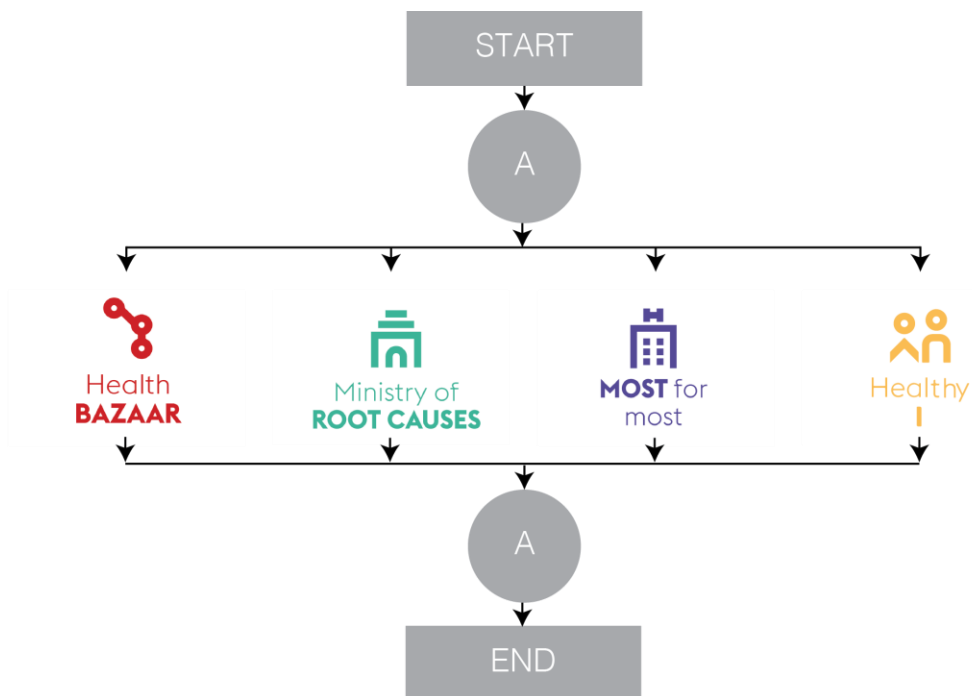


Figure 24: Final Game Structure

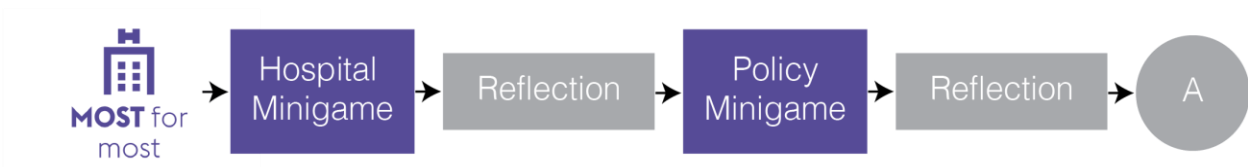


Figure 25: Most for Most Scenario storyline

Upon entering the game, the player begins by meeting their conscience, a character named “Alex.” Alex introduces the player to the game and the idea of the four future healthcare scenarios. In this intro, the player also inputs their name and learns that Alex will help guide them through the scenarios. This sequence of events occurs automatically when the player enters the game⁴. This introductory event ends when Alex transfers the player to the neutral park map.

We simplified the audio and visual elements of the introductory scene so the player could focus on the information that Alex provides on the scenarios and game play. The Introduction room, shown in **Figure 26**, has a blank grey floor, to suggest the idea that it is a neutral area. The audio in this section begins the neutral park theme that continues to play when the player enters the neutral park map. The neutral park theme is a simple melody consisting of an oboe with a piano backing. The simple theme for the introduction and neutral park allows for more layers to be added to the music so that the theme can be altered to fit the different scenarios.

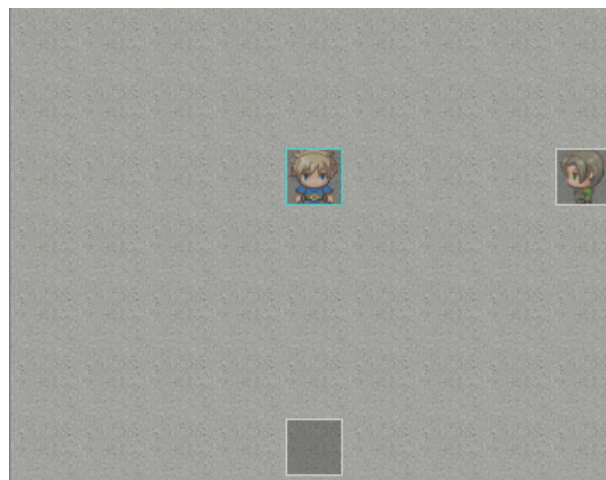


Figure 26: Introduction Scene

The theme for the introduction and neutral park has a tempo of 100 beats per minute. This tempo is the most natural pace for walking and adds to the feeling that the neutral area is a

⁴ An event that occurs without action from the player is an “Autorun event”

casual park. The theme for the neutral park area is titled "Neutral Park Theme" and was written by Heather Cummings.

After the introduction, the player enters the neutral park, shown in **Figure 27**. Parks and communal areas have existed for thousands of years, and will exist for thousands more. Thus, a park provides the best entrance to the scenarios without influencing the player's ideas of the future. The structure of the neutral park also mimics the matrix created by the DDC and Public Futures for the four scenarios. In this way, the four paths make up the two axes of the matrix with the visuals lining the paths corresponding to elements in the moodboards for each scenario. For example, there are purple and red flowers lining the path to the *Most for Most* scenario.

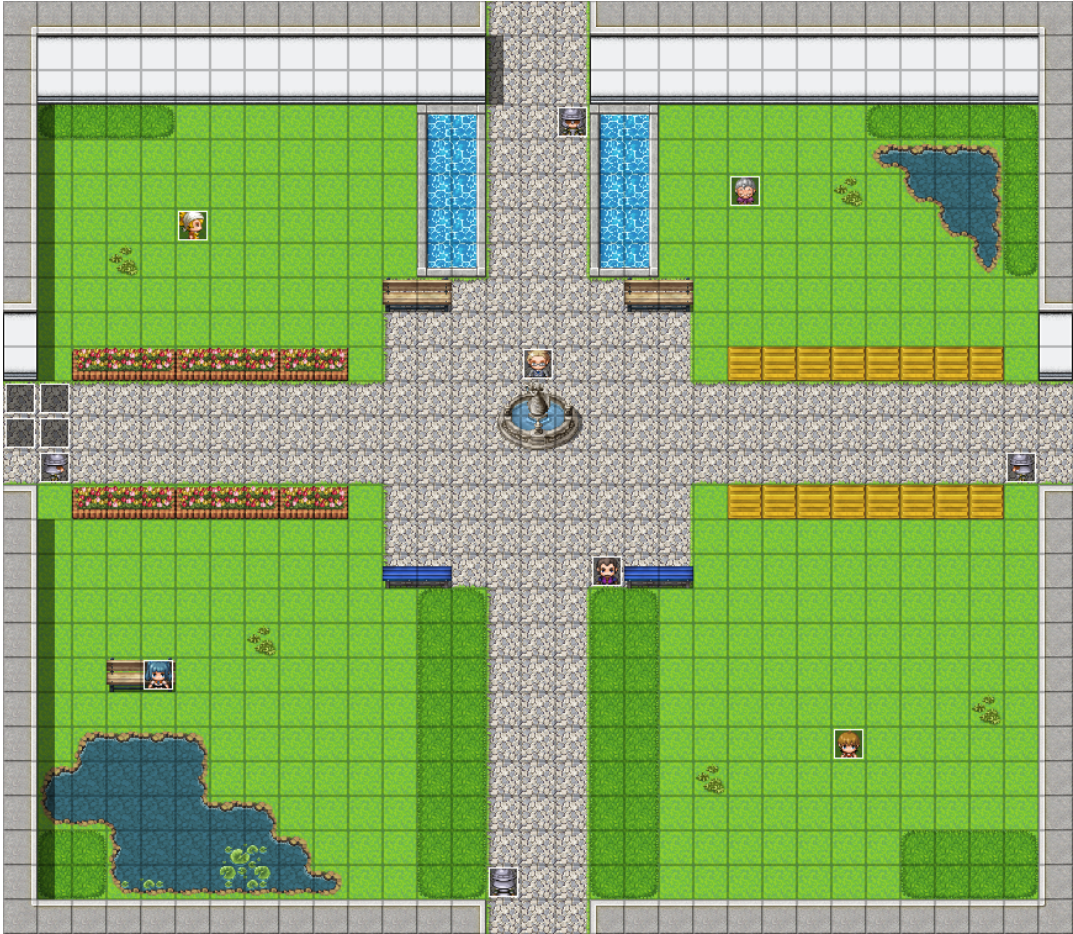


Figure 27: Neutral Park Layout

Once the player arrives in the park, the father character provides a tutorial to teach the player the controls⁵-- how to move and interact with the world. Through dialogue, the father also prompts the player to walk over to him and interact with him. When the player presses the action button while standing next to and facing the father, a set of dialogue appears. This dialogue from the father raises four questions, corresponding to the four scenarios. After the father's dialogue is completed, Alex informs the player that they may enter one of the four scenarios by following one of the four paths. At the end of each path the player is automatically transported⁶ into the scenario after a gatekeeper briefly stops them to inform them of which scenario they will enter.

In this prototype, we developed the *Most for Most* scenario. Players can reach this scenario by following the path that leads to the left side of the neutral park map. The first map in the *Most for Most* scenario mimics the neutral park but with altered colors and textures to convey the mood of the scenario, shown in **Figure 28**. The audio in this section works in conjunction with the visuals to convey the mood of the scenario. The audio in the entrance park is an altered version of the "Neutral Park Theme". The rhythm was altered to have more notes to begin the idea that *Most for Most* is cramped without enough room. The theme in the *Most for Most* park is called "M4M Park Theme" written by Heather Cummings.

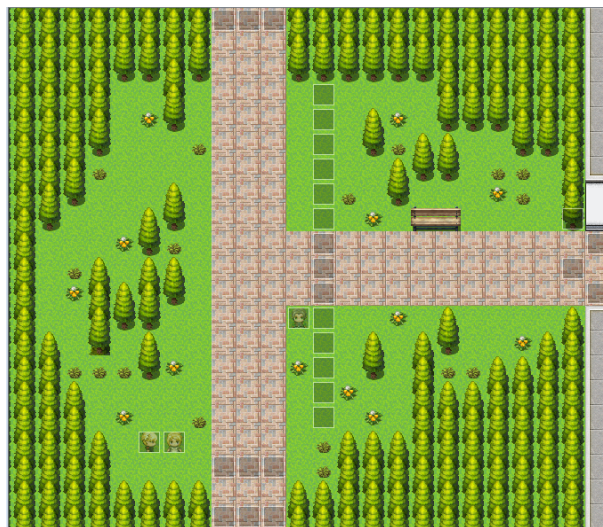


Figure 28: Most for Most Entrance Park

⁵ The game controls are: use the ARROW KEYS to move, press and hold SHIFT to run, and press ENTER to interact with characters.

⁶ When the player steps on certain tiles in order for an event to occur such as a transfer to a different map, it is a "Player Touch" event.

Once the player enters the scenario, Alex automatically informs them that they have entered the future. In the *Most for Most* storyline, the father character has difficulties with a rare breathing disorder and the player must lead him through the healthcare system of this scenario. To begin this story, Alex stops the player when they step on a specific tile⁷ in the first park map, shown in **Figure 29**. Alex then informs the player that they must find their father. The player must then walk around the park until they find the father character. We designed the overall park map to lead the player to the father character no matter which path the player chooses to take from the entrance, shown in **Figure 30**. Since the player can choose a path that does not directly lead them to the father, they have the ability to explore the world and familiarize themselves with the game controls before entering the main storyline of this scenario. Once the player reaches the father, they must interact with him using the action button. The dialogue that appears when the player interacts with the father informs them to bring the father to the hospital. This prompts the player to enter the first mini game in the scenario.

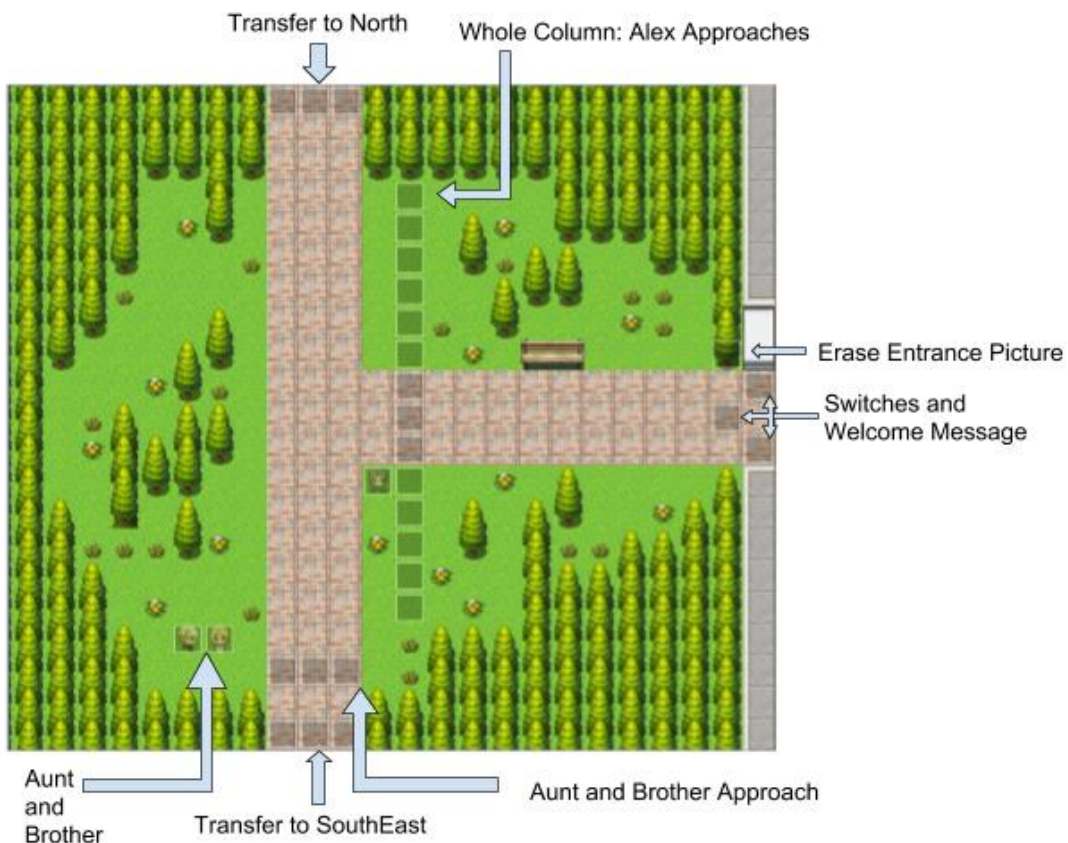


Figure 29: Event Tiles in Most for Most Entrance Park

⁷ The specific event tiles are shown on the figures as grey squares.

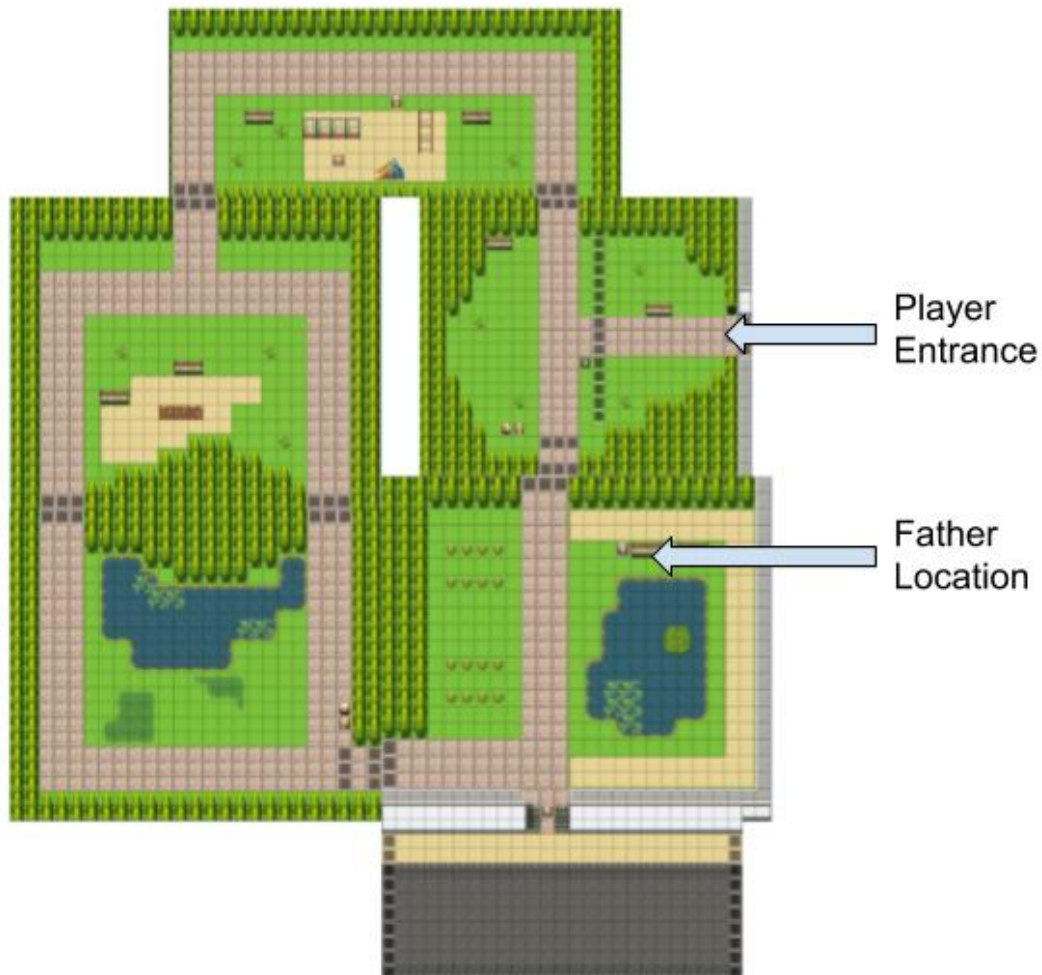


Figure 30: Overview of Park Map in Most for Most

The first mini game that the player enters in *Most for Most* is a “Hospital Mini game”. In this mini game the player must use a specified budget to heal as many patients as they can. **Figure 31** shows the map for this mini game. The visuals in this scene show a crowded waiting room to represent that there is not enough room in the budget to provide for all healthcare needs. The lack of decoration and technology is in accordance with the principle of simplicity, to allow the player to use their imagination and decide what may exist in the future. The audio in the background of the hospital, before the mini game begins, also follows the principle of simplicity, as it is a basic melody using only a synthesizer with a keyboard. In the theme for the

hospital, titled “Malte Junior” by Lobo Loco⁸, there is a slight beeping sound in the background that mimics the sound of a heart monitor. This adds to the ambience of a hospital scene.



Figure 31: Hospital Mini game

When the player takes their first steps in the hospital map, a receptionist rushes over to inform the player that they must help assign the budget to patients. The receptionist’s dialogue also informs the player that they have a budget of 100 gold coins to use on the patients and that they should use that amount to heal as many patients as possible. The receptionist then returns to her desk. A display appears on the top left corner of the screen which shows numerically how many patients the player has healed and how much money remains in the budget, shown in **Figure 32**. The player can then walk up to the various patients in the waiting room and interact with them using the action button. The patients’ dialogue tells the player what ailment they have and how much it costs to heal them. The player can then choose whether or not to help that patient.

⁸ The audio not composed specifically for this game by Heather Cummings was taken from audio clips that are License free and Royalty free, making them free to use in the game without infringement.



Figure 32: Hospital Mini game Display

There are two types of patients in the hospital, those with rare ailments and those with common ailments. The common patients require much less money for treatment than the rare patients. In this way, the player may either help many common patients, or few rare patients. However, the player can only pass the mini game and continue through the story if they treat a certain number of patients. This forces the player to treat only the patients with common ailments. If the player does not complete the mini game by healing a required number of patients, they return to the beginning and must start the mini game over again. The goal of the mini game is to show the player the limits of treatment—that not everyone can be treated, but the majority can.

When the player begins the hospital mini game, the audio switches to a mysterious track. This audio adds to the seriousness of the player's decisions. The theme that plays for the duration of the mini game is titled "Puzzle Game 3 Looping" by Eric Matyas.

Once the player successfully completes the Hospital Mini game, the receptionist automatically speaks to the player and tells them to go through the door on the left side of the map to speak to the doctor. The doctor is alone in a small room, shown in **Figure 33**, where the player interacts with him using the action button. The doctor's dialogue reiterates the key idea behind this mini game, that those with common ailments get treatment and those with rare ailments do not, and informs the player that the hospital cannot treat the father character. The doctor then presents two options for the treatment of the father and tells the player to return to the hospital waiting room to present the options to the father character. We chose to keep the Doctor's Room silent to highlight the seriousness of the dialogue between the doctor and the player.

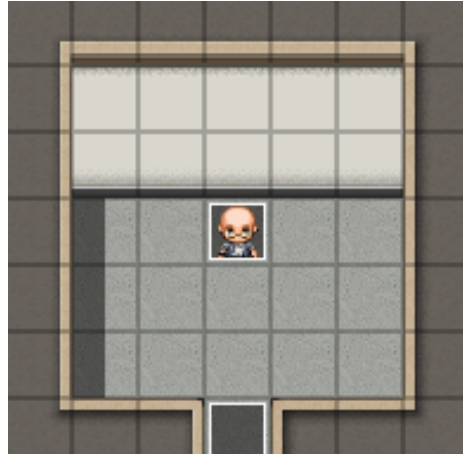


Figure 33: Doctor's Room

Before the player can re-enter the hospital waiting room, they are automatically transferred to a reflection room, shown in **Figure 34**. In the reflection room, Alex approaches the player and tells the player they should take time to reflect on the ideas of the Hospital mini game. Four pictures then appear on screen one after another. Each picture shows an open ended question that we created to urge the player to think about the shortcomings of the scenario and possible solutions while a light piano theme titled "Introspection" by Eric Matyas plays in the background. The player can choose how quickly the pictures appear and disappear by pressing the action button to switch the picture. After all the pictures have appeared on screen, the player is automatically transferred back to the hospital waiting room.

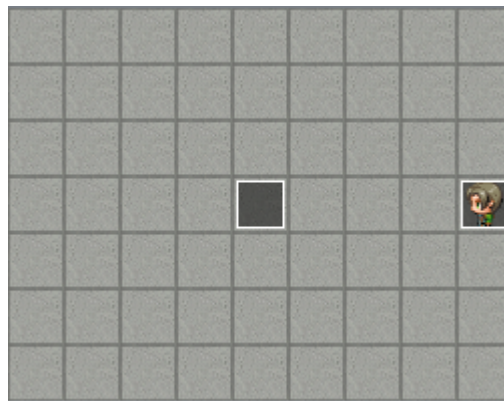


Figure 34: Reflection Room

After the player enters the hospital waiting room for the second time, Alex again prompts the player to speak to the father character. A question mark then appears over the fathers head automatically to remind the player where he is in the room. After interacting with the father character, the father leaves the hospital to return home and Alex tells the player to go to a

town hall meeting at the capitol building. The player can now leave the hospital and transfer to the capitol building where they will now participate in a “Policy Mini game”.

The second mini game in the *Most for Most* scenario refers to the policies in place that created the healthcare system. The goal of the mini game is to show different opinions that the characters have about the healthcare system in place. This mini game allows the player to see both the benefits and consequences of the *Most for Most* scenario. When the player arrives in the capitol building, shown in **Figure 35**, a question mark appears over the policy maker character to indicate who the player should interact with. When the player crosses the room and interacts with the policy maker, he assigns the player the task of gathering the opinions of people who are there for the town hall meeting. Similar to the Hospital mini game, a display appears in the top left corner of the screen, shown in **Figure 36**, which displays the number of opinions that the player has gathered. The player can now follow the hallway to the top of the map to the auditorium where the characters have gathered.

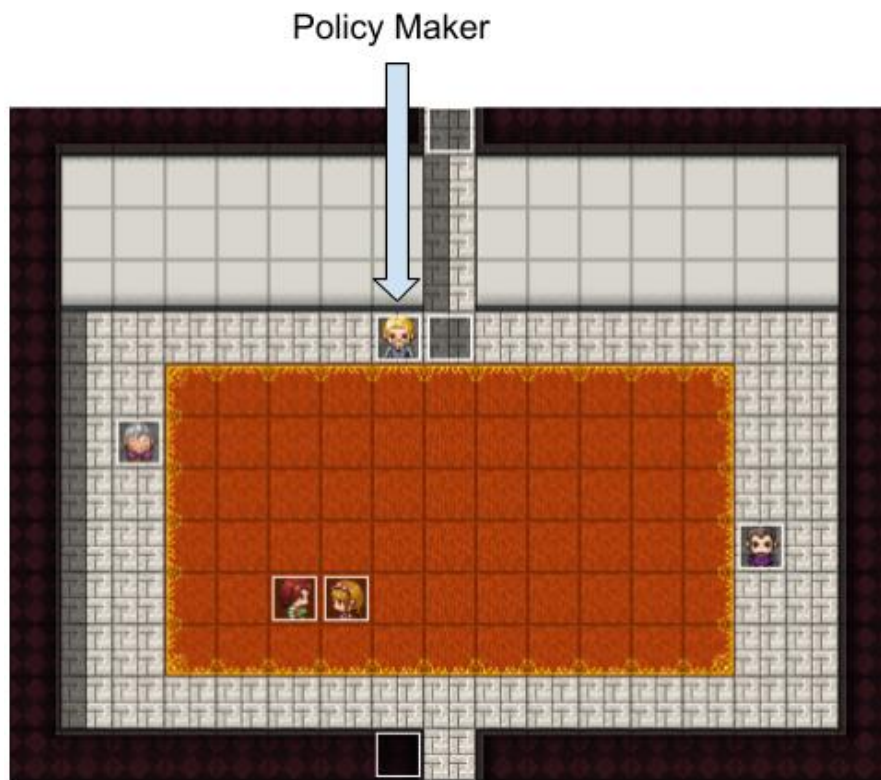


Figure 35: Capitol Building Main Room



Figure 36: Policy Mini game Display

We based the other visuals in the capitol building main room on the colors associated with the *Most for Most* scenario such as the use of red and velvety textiles. Thus, we chose a red rug as the main floor. For the audio, we wanted to highlight the benefits of the *Most for Most* scenario with this mini game so we chose an upbeat theme titled "Happy Days" from Purple Planet Music. Choosing a happier theme created a disconnect between the audio and dialogue based on shortcomings of the system and a strong connection between the audio and the dialogue on the benefits of the system. This way the player would have a greater connection to the benefits presented.

When the player enters the auditorium, shown by **Figure 37**, they see a crowded gathering of characters who each look significantly different. The wide variety of characters enhances the idea that there are a wide variety of opinions on the healthcare system. The player must walk around to the different characters and interact with them by pressing the action button to gather their opinions. Each character has a different set of dialogue that appears on screen that shows a different experience with the healthcare system, some opinions show the benefits of the system and some show the consequences of the system. The player completes the mini game when they have gathered at least eight different opinions.



Figure 37: Capitol Building Auditorium

Upon the completion of the policy mini game, the player enters the last reflection of the scenario. After the player gathers the eight opinions necessary to complete the policy mini game, the policy maker character appears on stage automatically and begins a town hall meeting by presenting questions to the audience. These questions serve as the open ended reflection questions for the player on the scenario as a whole. After the policy maker presents the questions to the player, the player transfers back to the neutral park. When the player returns to the neutral park, Alex prompts the player to continue discussing the reflection questions in a forum on a website we created, or to continue on to the next scenario.

For the purpose of testing this prototype and receiving feedback, we prompt the player to fill out a survey and discuss the game in a forum with other players. The survey will serve as an outlet for feedback on the game, which developers can use during the creation of future iterations. The survey and forum are shown in **Appendix I**. The forum will provide a place for game users from all over the world to discuss the ideas present in the different scenarios as well as each user's individual contexts and opinions on the healthcare systems.

5.2 User Journey and Website

The final video game prototype is one part of a complete user journey. We created an example user journey map for our two main user groups: students and professionals. Both maps are shown in **Appendix I**. We created the maps to show a possible method for incorporating the video game into a classroom or a professional workshop with the aim of provoking thoughtful discussion.

As shown in **Figure 38**, each user journey map contains three major sections. The first section is an introduction. In this section, a moderator introduces the audience to Boxing Future Health and the four scenarios. After the introduction, the players proceed to the website shown in **Appendix H**. The website acts as a launchpad for the experience section of the user journey. Through its design, the website guides the player to an online version of the prototype video game, as well as further information on Boxing Future Health and the scenarios. After the players complete the game, the moderator prompts them to discuss their experience. This discussion can take place in person or on the forum contained in the website.

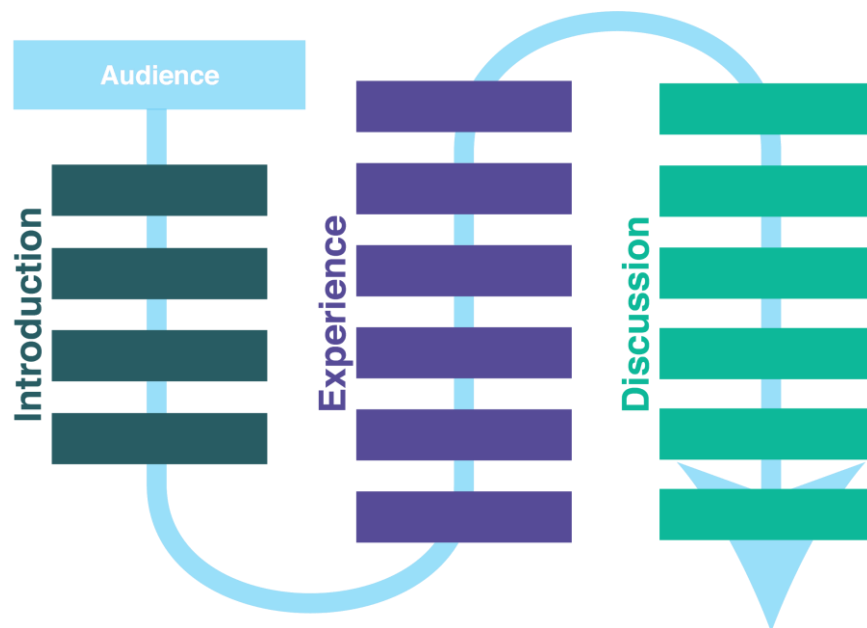


Figure 38: User Journey Map Template

The forum is a critical section of the website. Anyone can post their questions and ideas to the forum and reach a worldwide audience. It gives users the space to explore their ideas and solutions and reflect on the video game experience while seeing the experiences and opinions of others around the world.

5.3 Testing

We conducted testing with eight students from Worcester Polytechnic Institute (WPI). The testing showed us if the game successfully conveyed the learning objectives of the scenarios. Students played the game prototype without guidance from the team. After completion of the game, we prompted them to fill out the google testing survey shown in **Appendix I**. The responses to the form are shown in **Appendix J** and are color coded according to the key shown in the appendix.

We analyzed the feedback using the same content analysis method used in determining the game format, as described in section one of the methodology. **Figure 39** shows the results of the feedback analysis. We divided the feedback into six categories based on keywords in the questions. The six categories are game progression, tasks, emotional connection, interactivity, visuals, and clarity of themes. The two columns, labeled as “effective” and “ineffective”, display the number of responses that stated if the game sufficiently prepared the tester to answer the question or not. For example, the responses to the “Clarity of Themes” questions show that the game clearly conveyed the themes present in the *Most for Most* scenario. On the other hand, the responses from the “Tasks” question demonstrate that the tasks created for the game were confusing and will require further development.

We recognize that the feedback we collected is neither representative of the desired audience or a large enough sample size. However, this feedback serves as a proof of concept for both the method of collecting and analyzing the testing data.

Category	Question	Effective	Ineffective
Game Progress	What are your thoughts on the game and how you progressed through it?	5	3
	How was the speed of game progression? Did the story move too fast or too slowly?	4	4
Tasks	Were there places that you were confused on what to do? (please provide specific points in the game)	3	5
Emotional Connection	Throughout the game, where did you feel most connected to the story? How did you feel?	7	1
	How interactive was the game?	5	3

Interactivity	Were there points in the game where you felt it lacked interactivity? If so, in what way do you feel you could have been more engaged?	4	4
	Were your interactions with characters in the game engaging? Was there enough interaction with characters? Did you feel connected to any characters in particular?	4	4
Visuals	How did the visuals make you feel?	6	2
	Are the visuals in the game engaging?	6	2
Clarity of Themes	What do you think are the themes/ideas present in the game?	6	2
	Were the themes/ideas of the scenario(s) in the game presented to you clearly?	7	1

Figure 39: Testing Feedback Categorization and Effectiveness

Chapter 6: Conclusion

The goal of this project was to create a video game to present the Danish Design Center's four future healthcare scenarios in an interactive way so that they could reach a larger audience. Based on a pre-developed process, we created a prototype of an educational video game for the *Most for Most* scenario. While iteratively developing the final prototype, we created five guiding principles. These principles help create a game aligned with the wishes of our sponsor and potential users. We divided the conclusions according to these guiding principles.

The game **structure** regulates the player's ability to influence their game experience. The game structure provides the framework that guides the player through the game. We used a parallel game structure with linear sub-stories, which allows the player to choose their own path of gameplay, while still limiting the number of possible outcomes for each scenario.

The **simplification** of game elements allows for an international user base to apply their own imaginative ideas in game play. The future is unpredictable, thus we did not include detailed game elements in order to give an unbiased view of what the future will look like. Deleting unnecessary features from the dialogue, characters, and visuals created a generic game that allows many populations to apply their own cultures, backgrounds, and solutions. Leaving gaps for the user to fill in with their own ideas also increases emotional engagement and increases the likelihood that the player will understand the presented educational concepts (Grip, 2017).

The **clarity of learning objectives** leads to clear communication of the educational goals. Using MIT's method of Balanced Design, we created objectives and tasks to form clear distinctions between the educational goals of each scenario (Groff, et al., 2015). Creating distinctions between the scenarios allowed the player to better compare and contrast the benefits and consequences of the scenarios.

An **emotional connection** and **interactive** gameplay leads to user engagement and, subsequently, a strong understanding of the learning objectives. We created audio themes for each scenario, which added depth to the game's story and provided a method to connect to the player's emotions. We also used visual design in accordance with Richard Mayer's "Cognitive Theory of Multimedia Learning" (2014) to work in conjunction with the audio to elicit specific emotions from the player.

We also created a series of tasks to engage the player further in the story. These tasks were most often mini games, or smaller stories, with distinct learning goals. These games give the player choices and options, giving them the illusion that their actions had an effect on the game narrative. For example, a player has a choice of two treatments for his father, but no matter what the player chooses, the game always returns to the same ending. By emotionally connecting the player to characters and interactive experiences, we were able to engage the player in the narrative, leading to a better understanding of the presented material (Plass, et al., 2014).

In this project, we created a prototype video game for the *Most for Most* scenario, a website that included an online forum, and the overall narrative and generic structure for the other three scenarios. The final prototype of the video game and the website will serve as a proof of concept on which the DDC may determine whether to continue the development of the virtual scenarios. We also created a set of five principles to help analyze the success of stages in the development of the final video game prototype. Although we created the principles to analyze a video game, they may also be useful when analyzing BFH's physical scenarios.

The final prototype created through our project surpassed the original goal. We created both a proof of concept video game and an online forum to act as a catalyst for collaborative discussion between key players in the healthcare system. We also tested the video game with a small student sample to determine the effectiveness of the developed principles. Finally, we presented the video game and website to our sponsors at the DDC for the further development of a digital version of the scenarios. At the final meeting with our sponsors, Sune Knudsen stated that, "this project has ended with more questions than it started with, but these questions will guide us towards a powerful solution."

Chapter 7: Recommendations

Due to time constraints, this project focused on developing the *Most for Most* scenario. The prototype developed will serve as a proof of concept and as a base on which to test the effectiveness of the principles developed throughout the course of the project. This section provides recommendations for testing as well as for developing the rest of the scenarios.

7.1 Structure

Overall Structure

We recommend that the three other scenarios follow a similar structure to the one developed for *Most for Most*. The linear sub-story structure, shown in **Figure 40**, lessens the amount of work for the developer while still creating a dynamic and engaging story. We have already created the overall structure, and recommend that our sponsor use a generalized structure for the rest of the scenarios. The blue line in **Figure 41** shows the development that we have completed during the course of this project.

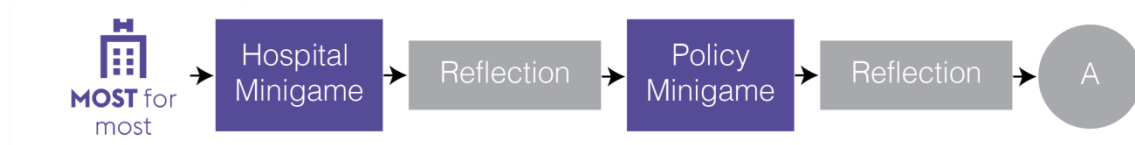


Figure 40: Linear sub-story

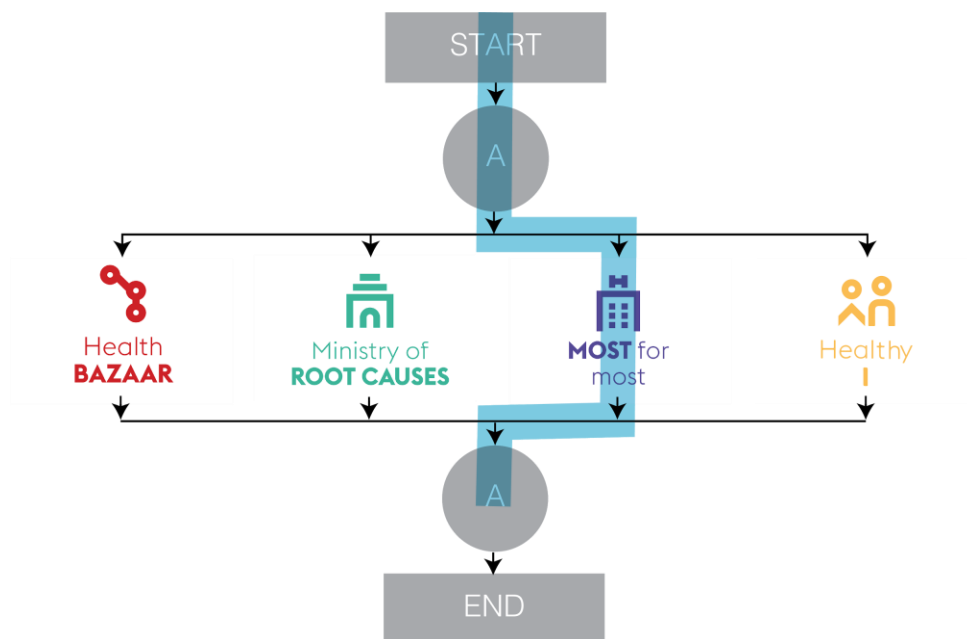


Figure 41: Development recommendations

Generic Storyline Structure

Due to time constraints, we were unable to create the interactive storyboard for three of the scenarios. However, to assist the DDC, we created the overall narrative and a generic structure to guide the creation of storyboards for each scenario. The generic structure, shown in **Figure 42**, provides guiding questions to prompt discussion between future creators. We created the structure to streamline the development of tasks and reflections and to help avoid roadblocks. We based the overall narratives on the descriptions and mood boards, shown in **Appendix A**.

In this structure, there is an entrance to the scenario that sets forth questions that we used to set up the *Most for Most* scenario in the game, as seen in **Figure 42**. After that, there repeats two boxes labeled "Box B" and "Box A". Box B represents the mini game structure. These boxes represent the mini games used as tasks throughout the game and reflection periods, respectfully. The mini game representation provides questions that can help the game designer set up tasks that will clearly portray the learning objectives. Box A is a guide for reflection periods. The reflection representation describes how we designed a reflection period for the game and also explains when a reflection period is necessary. Developers can use these two boxes as necessary until they complete the creation of the scenario. The questions and further descriptions of each box are shown in **Figure 42**. Finally, the exit box aids in creating a smooth transition from the scenario back into the neutral zone of the game by ensuring the player has mastered the learning objectives and is ready to reflect on and discuss the scenario as a whole.

After the development of this generic structure, we wrote three storylines, one for each remaining scenario. These storylines are intended to pair with the generic structure for the continued creation of the game. We recommend our sponsor, the DDC, to use the pairing of the generic structure and these storylines so that the main educational goals we set forth for the game remain present throughout its continued development.

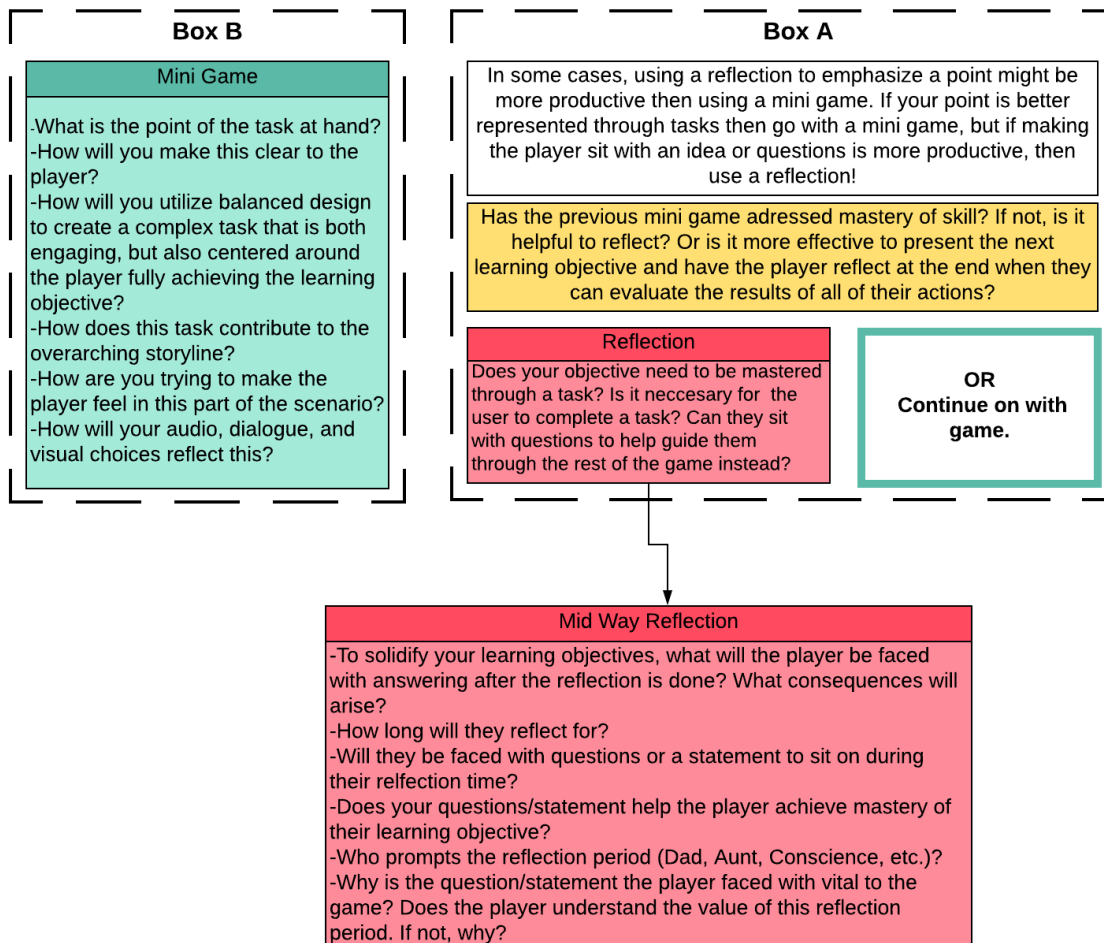
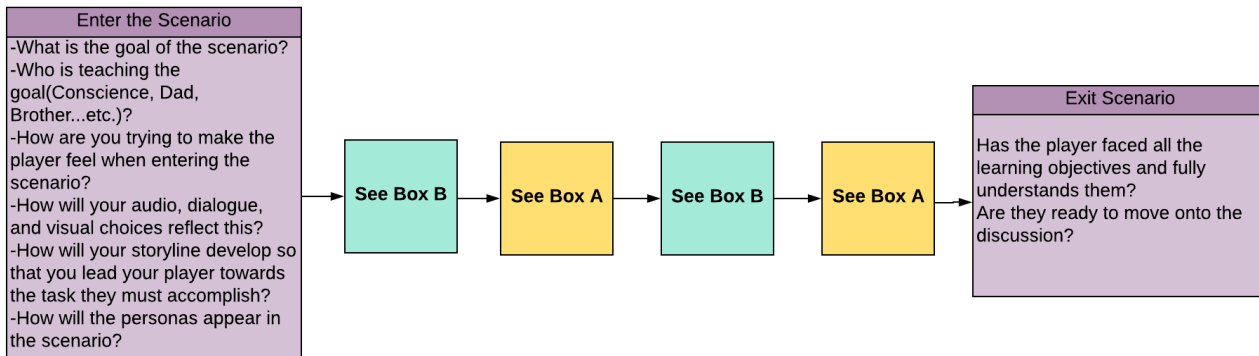


Figure 42: Generic Structure

Healthy I:

The father character's breathing issues have become worse over the past couple of years. His health insurance costs are very high due to his poor health so he has difficulty affording it. He is too sick for the new technologies to help him find a cure, so he can only take minor preventive measures to help himself. Unfortunately, the father character does not have many opportunities to improve his health due to his chronic illnesses. Knowing the breathing condition is a hereditary disease, the player must appear for testing to see if they will also contract the disease. The result is that the player will contract the disease.

The society in Healthy I prioritizes continual improvement and optimization. Society focuses on innovation, individualization, new discoveries, digitization, and bettering the human form. This attitude of society is obvious through dialogue and visuals. The player gains the opportunity to alter his genes to eradicate the potential of developing the breathing condition. The player then receives multiple opportunities to "improve" themselves. If the player focuses on altering their body composition, they may face consequences. He has become a less valued citizen due to his inability to improve his health condition. There is a disconnect between the player's character and his father as the player has to come to terms with the fact that his dad does not fit into this new society.

Ministry of Root Causes:

In 2050, the number of days in the year with little sunlight has grown due to an increase of cloud coverage. Through AI trend analysis, there has been a rise in depressive states due to the limited sunlight. This has taken a toll on the economy, environment, urban development. The brother character's company helps the government to install new technologies throughout the city to help alleviate this problem. The technology demonstrates the ability to boost moods, and as a result boosts society's ability to grow.

The player's brother has a mental illness that was severely affected by the limited sunlight. He aims to make people happier through the technology his company offers. His poor experience with his health problems positively adds to his determination to help others.

To positively influence society as a whole, the government has mandated all citizens to install these technologies. The government argues that this will positively impact families all across the city. However, many citizens cannot afford the technology. This has caused strain for many households. Throughout the scenario, the player learns that even though the brother character believes in the mission for a better society, others do not like the way his company has been imposing their expensive technologies on everyone in the city. He learns that there is not just one way of making society happier. As this scenario focuses on the impact of the needs of the

people on society, the player and their brother will have to face altering the offered technology to make it affordable for all. This scenario is about understanding the many sides of solving a city wide problem that impacts mental health of many citizens.

Health Bazaar:

Health Bazaar begins with a morbid undertone as the player's father is severely ill due to his breathing problems. Since the father character's breathing problems are hereditary, the player must realize that the key to staying healthy is to understand how societies all over the world have stayed healthy for thousands of years. Traveling to various societies in an attempt to live the best life possible so that the illness that plagued the player's dad does not happen to the player. And if it does, the player feels that they have lived a fulfilling life and accepts the illness as it comes. It's a journey of discovery. For example, visiting Buddhist monks might be a scene or mini game. Every society the player visits will have different attitudes and perspectives on what the role of health is in their culture. Different audio, visuals, and dialogue will be key for every new area the player visits.

7.3 Testing

In this project we tested the final prototype with eight students. However, to get statistically significant data, the Danish Design Center will need to test the prototype with an appropriate sample of the target audience. Testing should occur whenever there are major changes to the gameplay to determine if the changes are an improvement to the game or not. We were unable to complete testing with a group of users from our target audience due to time constraints; however, we created a survey and a method to analyze feedback. The survey is shown in **Appendix I**.

7.4 Task Development

The Danish Design Center needs to conduct user testing on our final prototype to determine the effectiveness of the five principles and the content models. If the feedback proves that the task models do not match the content models for each scenario, the DDC should then redesign the tasks. Developers should account for user feedback, and repeat the process of task creation until tasks are both engaging and match the content model of each scenario.

7.5 Dialogue

We recognize that we did not have the background to write engaging and emotional dialogue. Therefore, we recommend that the dialogue in the game, including dialogue for the scenes

already created, should be rewritten to better engage the player and elicit various emotions. The dialogue should be both realistic and concise so that it conveys the necessary information. To determine the effectiveness of the dialogue, we suggest BFH conducts testing as mentioned earlier.

7.6 Audio and Visual

To develop the last three scenarios we recommend that developers create a musical theme for each scenario based on the emotions they want to convey. By developing a theme, audio designers can manipulate individual elements of the music (eg. tempo and instrumentation) to fit various situations, while still connecting the scenario with the underlying theme.

The theme present in the music should also appear in the visuals in order to create a seamless game without a cognitive disconnect for the player. The theme should influence elements such as the colors and use of space to represent the mood of the scenario.

Developers should create the visuals for the future scenarios based on the moodboards and other documents that the DDC has published. Developers should consider whether the 2D game format produced by RPG maker MV is efficient in conveying the scenarios. If not, a 3D game format might be ideal. We recommend for a video game designer to help the DDC decide which game format is best.

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Appendices

Appendix A: Moodboards and Personas

The moodboards and personas shown in this appendix were created by Public Futures. Public Futures is Denmark's leading future researcher, specializing in social and policy development. They use methods to interpret current trends in order to create scenarios, concrete examples of possible futures. The scenarios are not meant to predict the future, rather, they are meant to create a better basis for decisions in the present (Olsen et al., 2017).

The Danish Design Centre used the moodboards and the suggested sensory elements to create physical rooms. For example, the room created for *Most for Most* was circular with a low ceiling meant to make the participants feel cramped. The cramped feeling was meant to represent the limitations of the healthcare system, its inability to fit everyone. The DDC then used the personas to create stories for the people that workshop participants encountered (Svendsen et al., 2017).



Figure 43: Most for Most Moodboard (Olsen et al., 2017)

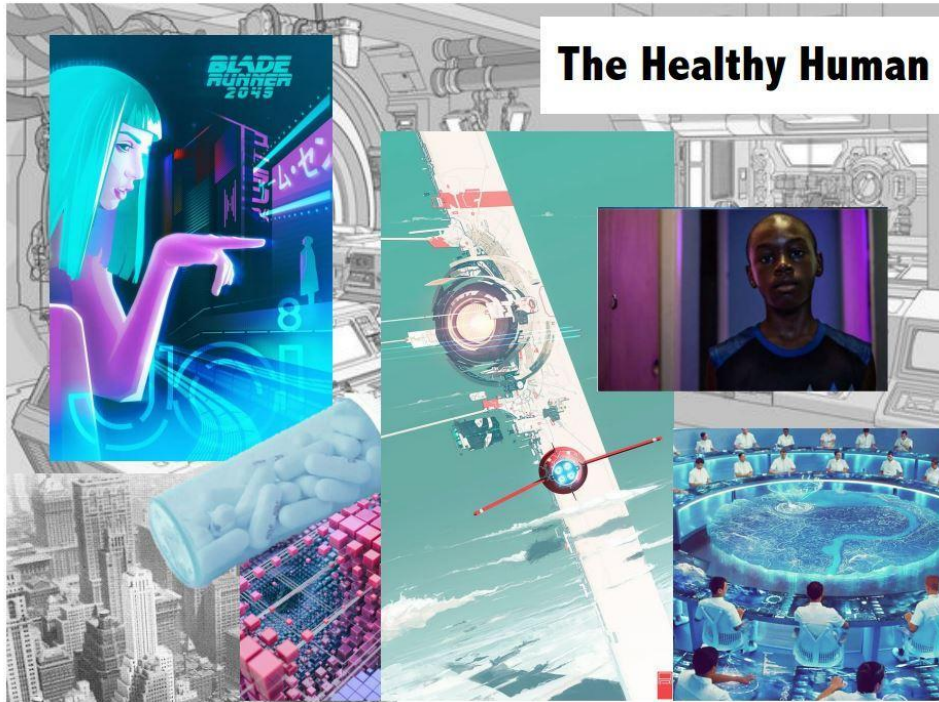


Figure 44: Healthy I Moodboard (Olsen et al., 2017)



Figure 45: Ministry of Root Causes Moodboard (Olsen et al., 2017)



Figure 46: Health Bazaar Moodboard (Olsen et al., 2017)

	S1 The most for majority	S2 The Healthy Human	S3 MORC	S4 Healthbazar
Colours and mood	Reference moodboards			
Materials	Fibrebonded, gray linoleum, white walls	Fitness-gym/ Health-gadgets/	Built environment with greenery and parks "Controlled savannah"	Deep Colors A single, short stroboscope effect Within you without you
Sound	Abrupt sounds Traffic noise in the distant Airplane. The sound of hospitalization	Gentle disco / 60 strokes in min. (heartbeat). The scanner interrupts using data on a regular basis	Classical, smooth jazz. Slow gates close silent, rubber-damped sounds	Demonstration alarm Buddhist bells Techno sounds Classical, possibly.
Smell	hospital Odor Chopped steak	New car	Fresh perfume / soap Grass, freshly cut "Sea air in the city"	Incense (too obvious?) Burned
Feel/taste	Bitter pills	Light scanning / selftracking at the entrance and result "You are 83% optimized". Wearables - ring with light in which contains personal "medicine"	Asparagus / parsley / carrot snacks	Wet warm terry over the face
Interaction	Plaster on, hives off, hurts a little bit - a standard procedure	VR possibility	Question / Answer and smiley for your lifestyle as a sticker	Input and response questions at exit. "What science do you believe in?" "What is the meaning of life?"
Very brief pictures / text / speak with people with health / illness as a starting point.	- Stress / Mental Disorder - Emergency / Accident - Chronic - Non-patient	- Stress / Mental Disorder - Emergency / Accident - Chronic - Non-patient	- Stress / Mental Disorder - Emergency / Accident - Chronic - Non-patient	- Stress / Mental Disorder - Emergency / Accident - Chronic - Non-patient
Other effects (slogans ...	We save lives	We are developing lives	We create the basis for life	We give life meaning

Figure 47: Sensory Elements, Interactions, etc. for each Scenario (Olsen et al., 2017)

Character Personas

Scenario 1: The most for majority

Broken leg - doctor:

"A fracture like this is routine. We proceed according to the procedure. Register, clinical diagnosis, immobilize. Check in at health.dk in four weeks for control. After eight weeks of bandage. Rehabilitation. For the patient, the process can take 3-6 months before full recovery of mobility. However, in effective medical time, maximum 45 minutes in total. In general, we manage with less "

Chronic - Doctor:

"Today, we notice an increased number of complex chroniclers - people live for a very long time, fortunately. The patient here has arthritis, diabetes and COPD. Research is very important to ensure that we catch it all. He needs the right package. We have the most effective means. And "digitized compliance" ensures that he always takes the right medicine at the right time in the right dosage. It's actually one of the most important advances for the chronicles in recent years. It really helps them a lot. And it also makes our work easier ".

Mental illness - doctor:

"Depression triggered by stress - we see many of them today. Many wait too long, resulting in aggravation of the symptoms." The chances of recovery are good. The antidepressants available have a reasonable effect. But we hope that the next generations will be released by DNS, they show very promising results in China. Until then, outpatient and "target" electrochok can be a good supplement. "

Figure 48: Scenario 1 personas (Olsen et al., 2017)

Scenario 2: The healthy human

Broken leg - innovator:

"Fracture-Return is the world's leading bone fracture specialist. Our vision is that the recovery of bone fractures should be just as quickly as a cold." Simultaneously, the bone's function level must be brought to a even higher optimization level than before. " Fracture-Return " was founded by the former elite snowboarder Mark McMorris, who won the Olympic Bronze 11 months after a massive 17-jar fracture. He has dedicated his life to fracture research. We have the world's largest fracture-related database, and we have developed and trained the world's best AI intelligence. We work with skeletal, muscular, biochemical and mental components. It is our dedication, that has enabled our famous 40-day guarantee of full recovery and optimization. "

Chronic - pharmaceutical company:

"It's big data that's the key to personal health. At Alpha-Galactix we have a global comprehensive patient database with chronic patients in our area, the largest in the market. We have experts and AI capabilities to analyze in depth. Patient in our programs receives precise and personal treatment. There are daily online updates on all platforms. If you are in the elite group, you can get personal coaching and we work on what we call boost optimization. There is still a reason why it is called chronic disease. But until then, we can remedy and relieve many of the most difficult genes. "

Mental Illness - Insurance Company:

"What coverage can we as an employer, offer our employees in the event of stress and depression?". This is a natural question from many of our customers. As a wide-ranging Health Insurance Provider, in MeCare we know, that stress and depression can be debilitating for the individual and a high cost for the employer. Our most popular offer on the market is the E-level package. In this patient case, using E-level, we have been able to compile a program based on pinpoint neuropharmaka combined with digital online therapy. It provides a good recovery of functionality and life satisfaction. You can also optimize with personalized supercoaching, nano-shock and hands-on care, but then you need to upgrade to C-level. "

Figure 49: Scenario 2 personas (Olsen et al., 2017)

Scenario 3: Ministry of Root Causes

Broken leg - hospital director:

"This fracture is an example of traffic-related trauma. We see very few of these instances, do to a continuously developing of road safety, working environment and leisure time." Healthcare is not complicated. Our main task is to map the circumstances alongside with the patient, local area and MORCs security unit. We focus on Root Causes, so it does not happen again. "

Chronic - Ministry's perspective:

"Chronic diseases have many causes. We know a lot and we do a lot. We have identified a variety of Root Causes for diabetes, arthritis, back pain, cardiovascular disease, cancer, etc. With information, offers, motivation, pricing structure and healthy gaming, we create frameworks, we prevent and we nudge. The results prove far better compared to our previous and limited way of treating patients. This is also due to the broad commitment of the citizens. With this said, there are of course still needs for treatment, as in this case. "

Mental Illness - Local Communities' Voice:

"As a local president, Peter's depression affects me a lot. It's something we all need to take seriously. We know it's hard, but we all know we shouldn't let go on him, even though he can be hard to talk to when it's at it's worst. Good that he has decided to resume his participation at the near by center. His family also goes - they can not do everything alone. In his case, the most important Root Cause is often the stress / stimulus ratio at work. We are in collaboration with the workplace and a consultant from MORC. "

Figure 50: Scenario 3 personas (Olsen et al., 2017)

Scenario 4: Healthbazar

Broken leg - citizen / patient perspective:

Voice I: "A broken leg is nothing special, one can say. But sometimes, all it takes is a little push." The accident has led my life to a new lane. I'm seeing myself much more clearly now. I have a deeper energy that I have to develop much more "

Voice II: "So, all that good advice and cosmic care, let me to heal in peace. And then it's up to myself if I use the neomorphine. It's also quite harmless if you get the right one."

Voice III: "Well, I still think you should give the cholera therapy a chance – you have to heal in many ways. All your life."

Chronic - Citizen / Patient Perspective:

Voice I: "So, when I first realized that the doctors, I do not get them anymore, then I found my way. It's something entirely else that needs to be done. It's about how I live in my body's pain. How I am in harmony. I'm not a machine, I'm a living creature. The pain is a personal message that I have to understand. It makes sense in a completely different way. "

Voice II: "Doctors and that, I do not really like that anymore. I'm biohacker, so the body is digital. I'm working on finding the code and I'm hooked on to the Haccos network. There's so much intelligence, doctors can not match. I'm on your way. The singularity is already here "

Voice III: [Intended dialogue between mother (65) and daughter (30) about her daughter's children (5)]

"You have to give him the medicine they have prescribed!" (mother 65)

"No, I do not have to. He's getting sick of it, blunt" (daughter 30)

"Well, he's sick!" (mother 65)

"Yes, exactly! And so he must have his energy raised. It's the best for him, I can feel it." (daughter 30)

Mental illness - own perspective:

Voice I: "I've been so unwell for so long. But no, you're not sick, you just gotta get going." The doctor says. "But I can't." But now I'm learning mind control. It gives me something, I think. "

Voice II: "It's society that's sick. It's not you. You have to find your way, do not listen to the others."

Voice III: "Woaw!, this is some very strong stuff, this Depridelic you can get now a days- if you know the road. I'm up and fly every time. It makes me a new person as long as it lasts."

Figure 51: Scenario 4 personas (Olsen et al., 2017)

Appendix B: Danish Design Center Workshop Forms



Mostly for most people



understanding
Health is the absence of disease



global context
Cost-effectiveness assessments



Organization
Sharp prioritization of diseases



Keyword
Broad public coverage within budget

Health care is basically about of- fentlig core welfare. Changes and new conditions require adaptations and choices, and in Denmark selected wide. Improved life expectancy, treatment of folkesygdome and equity in health are important goal, and the vast

Most patients with the most common diseases are a good treatment. But the National Health Council prioritizes focus and Denmark can not be in the forefront of the latest treatments and health technologies.

CHALLENGES
in the scenario seen from my thematic role

OPPORTUNITIES
in the scenario seen from my thematic role

Figure 52: Most for Most Workshop Form

Appendix C: Workshop Feedback from Danish Design Centre with Our Own Analysis

These comments were taken directly from the feedback given to the DDC on one of their Boxing Future Health workshops. These comments were analyzed using a qualitative content analysis method that encompassed reading the comments over and finding similarities between comments. Based on these similarities, categories were created. The comments were then read through again and highlighted in different colors corresponding to the different categories. Notice that not all the comments are highlighted. This is because some comments were either related directly to the physicality of the scenarios and how the scenarios were presented, which does not directly relate to our game. The categories related to each color are as follows:

Key:

- Emotional Connection
- Educational Points
- User Engagement
- Futurism
- Developed scenarios

If you give us a good advice on the design of the scenarios, it would be ...

- More visual tools
- More "space" - more tactile - more vibrant
- Role Play
- Create greater differentiation in naming the two lower scenarios, eg "The Optimized Body" vs "Health and Wellbeing Bazaar"
- There is only focus on the mood - put some facts up. The stories do not involve you. You do not have to interact with - you only observe.
- Super with smoke and music! Strong effect with few artefacts!
- More mood in MORC - for example, chair racks.
- Most for most" lack some excel sheets. Present, for example, the opposite point of view too - you are led into the very negative track and thus the most challenges.
- Build scenarios in audio (narratives) and create images in the listener's imagination.
- Scenarios "most for most" and "health bazaar" are too one-dimensional. They were produced in a stereotype manner.

- Build elements that you can physically test. For example, create one element that crosses all scenarios and thus becomes comparable.
- They are based on well-known issues and does not become futuristic enough. Technology will have a big role - it might be good to let it have that role in the scenarios.
- A little clearer scenario - so you are completely aware of the scenery's character and frame.
- Incorporate how devices support good communication, good working environment and efficiency.
- More concrete - something for all senses (active simulation, where one is active). Less attitude / stigmatizing scenarios. The actors must be active in the scenarios.
- Place the people who speak in each podcast (speak) physically in the room - eg an actor you can ask the following questions.
 - The healthy person" must have more visual things. More roles / characters. Slightly more dynamics / pace.
 - More light - hard to see (especially in" health bazaar "). Good with props - more of them! Set the different moods well.
 - Bold sound - maybe with dialogues ?!
 - More artifacts + micro processes / process where you feel / experience the future upclose. Sharpen the reality, so that the pos / neg. appears clearly.
 - More soundproofing between the rooms. Continue playing on multiple senses: light, sound, fragrance. It provides a good experience.
 - Good with personalities - maybe a physical role-playing game? More gadgets / things you can touch, test, read and discuss and / or visual / technical / hologram / 3D.
 - More perspectives must be presented in each scenario.
 - More effects that reflect time and create atmosphere. Participants must be active, more involved.
 - The sound works well, but more body / empathy. Use artifacts to visualize the difference. Technology plays a too small role in its physical form. Maybe you also work with movies?
 - A clear storytelling with concrete issues and tangible solutions. Use the senses! 10 min audio is too long for each scenario.
 - Postcast as well as acting.
 - Create a dimension of interaction - we participated passively in the experience of the scenarios. An active dimension would create better immersion.
 - Perhaps a little more provocative questions that can create the right reflection.
 - To see it from several angles, eg the therapist, the economist, the relative, etc.

- More interactive - become part of the future scenario.
- Play on all senses - manipulate the senses to get the listener into the future.
- More role playing games - will provide better empathy in the scenarios.
- Expand scenarios to a "day-in-the-life" experience in every scenario - ie, depict the scenario from morning to night.
- More nuanced stories in each room. Simulate contradictions in society associated with the scenario.
- Meet some real people in the scenario. Share your thoughts - "What's happening here? Why do you see it like this?"

If I should give a good advice on how to work with scenarios, it would be ...

- A little more facilitation, makes it a little less abstract.
- A "prototyping" feature – we are talking about the future, why not shape them physically?
- More time for all four fields in the discussion.
- Perhaps we lack something about the economic premise for each scenario. Use the scenarios against our strategy of work on management and organization in the future.
- Part of the education, through teaching. Workshops / sprints at larger meetings / conferences (off./privat). Acts. Good general test today.
- A clearer link between task 1 (own notes) and task 2 (the small poster). We did not use 1, which I think was annoying.
- Focus on actors and their dynamics, including collaboration, motivation / driving forces, value.
- Out of business/companies, to the citizens.
- Opportunity to hear / experience scenarios again - dive into - explore.
- Set up different challenges / dilemmas that actors should work with in the scenario.
- How can we work with the present to co-create the future - must be designed and made concrete.
- Make it available in multiple formats for use in multiple situations.
- Scenarios consist of a number of prerequisites. Can you reassemble them?
- A little clearer (perhaps more caricatured) persona.
- Role seems difficult to relate to. Who can see if we exist? Can participants relate to their assigned role?

- More time for reflection - a shortcoming in today's program. Where is the technology?? More of it!
- First individual experience in the room - afterwards you do it with others.
- To perceive the state's perspective / state as an actor. The resource issue is important for what will be possible.
- Cross-country workshops. Engage the newspapers. Create debate at FB.
- Hire an actor for interviews.

What can Boxing Future Health do for your Business / work area?

- Frame + Visualize future scenarios
- Help the collections after the exercises, if they are to be made available to an employee group.
- Help us with strategy work. Learn what other professions + actors think (good with roles that are castet/given to you - others than one's daily role).
- Keep the purpose in mind when diving into 4 scenarios
- Use them for podcasts
- Breaking habit thinking. Finding new solutions
- Provide specific tools or a "standard" to operate with in terms of development, dialogue with customers, etc.
- Give us a look at where the health area moves in 2050.
- Hospitals: We are testing value-based management. It could be a project that can be brought with us.
- Inspiring! Fun day.
- The dilemmas of the scenarios could be a method - health dilemmas: if this ... then what ??
- Input to where society and citizens are heading - Platform for entrepreneurship in the private sector.
- Inspiration methodically: how can we design our future products.
- A space for cross-sectoral acknowledgments. Should contain summary and realistic (= current) next-steps for the cross-sectoral team.
- Take part in setting up the stage for future projects / initiatives. Create networks for future collaborators.
- A good" hands-on "element in teaching future scenarios, research, business development, etc.

- We can take course participants and students into the scenarios and thus practice reflection and practice-oriented education. We can use it for our own teachers - which competencies the future calls for.
- Inspiration, reflection on development, perspectives, etc.
- We can use it in education and in higher education.
- Communicate my product / services abroad. We can help to influence the future by acting now.
- Clarify a more nuanced and differentiated healthcare system, where you can make reservations or meet different scenarios.
- Invitation to a debate focusing on the future - where do the individual technologies stand?
- Create networks and dialogue with potential collaborators.

Appendix D: Learning Objectives for Scenarios

The following table contains the learning objectives that we used for the content models of the Balanced Design method while designing the game. These objectives are taken directly from the Boxing Future Health documents on the initial scenario design.

Scenario Title	Learning Objective
Most For Most	"Health is the absence of disease, illness is a fact of life and affects everyone. Society must provide treatment within a budget." (Svendsen, et al., 2017)
Healthy I	"Health is the greatest possible bodily and mental well-being. It is a personal project and it is the responsibility of every individual to keep healthy and to use the many technological opportunities in the market to strengthen themselves physically and mentally." (Svendsen, et al., 2017)
Ministry of Root Causes	"Illness and health occurs in the individual, but there is a consensus that it is to a large extent caused by social conditions. Society must conform to the needs of people, not vice versa. From food and working conditions to constructive social relations. Breakthroughs in epigenetics, big data and AI further the development." (Svendsen, et al., 2017)
Health Bazaar	"Health and illness are about more than the body, they are about life. We seek meaning, comprehension and coherence. The biomedical paradigm is challenged by many new approaches, many parallel existing responses that create fragmentation, tensions and conflicts." (Svendsen, et al., 2017)

Figure 53: Learning Objectives for Each Scenario

Appendix E: Questions for Psychology Professor

We used the following questions during an interview of a psychology professor as referenced in the methodology chapter. We developed the questions to target specific concepts of visual and auditory engagement. We used the concepts when developing the visuals and sounds for the game.

1. Have you played video games before? Educational video Games?
2. In the study you conducted was the increased encoding speed from video game playing specific to high action video games? Were other game forms tried? Any experience with educational games?
3. How long are objects stored in short term memory and how many may be stored?
4. Have you worked with sustaining attention?
5. Are you familiar with the cognitive theory of multimedia learning by Richard Mayer?
 - a. Most of the research you completed was on visual attention, did you ever work with auditory?
6. Do you have any strategies to best present information to the user? Specific words/phrases?
 - a. If not, what methods are used to to stimulate high attention rates?
7. Explain the natural theory of visual attention/attention selection of objects vs. categories. How does NTVA work, and how can we assign importance to objects and people based on the filtering process that the brain goes through?
 - a. Brain organizes in objects vs categories

Appendix F: Excerpt from Dialogue

Enter Most for Most

Conscience: Hi (insert players' chosen name here). Before you wandered away from your dad, you were faced with a difficult question evaluating what healthcare would look like in the year 2050. Well now, you are in 2050. It is your goal to understand the challenges that face the healthcare market when it is centered around the common good.

Hear a cough in the Background.

Conscience: Oh that must be your dad, I would go find him and see if he is okay!

Task box appears on your screen to go find your dad.

You must walk around the world to find your dad. As you get closer to your dad the coughing gets louder.

Dad: Oh hi son, my breathing problems is really starting to flare up! *cough cough* It hasn't been this bad in years! *cough cough*

Conscience appears

Conscience: Hmmmm your dad seems like he should go to the hospital.

Task appears to bring your dad to the hospital.

Conscience appears

Conscience: Gee your dad is sounding worse, I would get off to the hospital sooner rather than later if I were you.

The player can wander around. Once the player enters the hospital door, a nurse comes up to you.

Nurse: Hey! Haven't I seen you before? ... Oh that's right, you used to volunteer here. We are short on staff today so I need your help! Lead the patients to their doctors as quickly as you can.

Start of Mini game 1

Nurse: Thank you for helping out! We need to help as many people as possible as quickly as possible. Some patients need urgent care. Walk around the hospital to find the patients in need and bring them to the needed doctor all within your allotted time.

You wander around and come across the various patients while exploring. Given a time limit.

Appendix G: Reflection Questions

The following are three sets of questions used by both our sponsors and ourselves in reflection periods for workshop participants and game users, respectively. The first set of questions were used in a scenario workshop hosted by the DDC in order to have participants reflect on the scenarios as they walked through them. The second set of questions are the mid-game reflection questions for *Most for Most* and are used in the game to prompt the user about tasks that happened prior the questions being asked. The third set of questions are the overall reflection questions for the *Most for Most* scenario and appear at the end of the policy mini game.

Reflection Questions from Danish Design Center Workshop

1. Which opportunities does this scenario provide, in relation to your role?
2. Which challenges occurs in this scenario, in relation to your role?
3. If this is the future health in 2050, what does your organisation/company/education, etc look like? Who are you?
4. If you are to succeed in this role, what are the must win battles?

Most for Most Mid-Game Reflection Questions

1. How do you think your father feels in this situation?
2. Is a healthcare system that prioritizes quality treatment for the most common illnesses fair or should they focus on basic treatment for everyone?
3. Did you help your father and other people during the past exercise?
4. What could you have done differently?
5. Of the actions the doctor gave you, which would you chose?

Most for Most End Game Reflection Questions

1. How do you feel after playing this game?
2. What decisions did society make that lead to the future presented and what actions can we take today to achieve or improve upon the presented future?
3. What are the barriers that stop healthcare from succeeding? What are healthcare's most important priorities?
4. How would you allocate the budget in the healthcare system? Why is that?
5. After being presented the past scenario, how do you think society would react if this was how the healthcare system was structured? Would culture shift? Would social interactions change?

6. Based on the past scenario, what do you think healthcare should look like by the year 2050?

Appendix H: Commented Code

The following is a description of the logic behind the coding for the video game. The description includes the various switches and variables used in the game, when they change, and what triggers the events. Annotated pictures of the game map and event blocks are shown as well. The descriptions are divided by scene/map.

Intro to the game

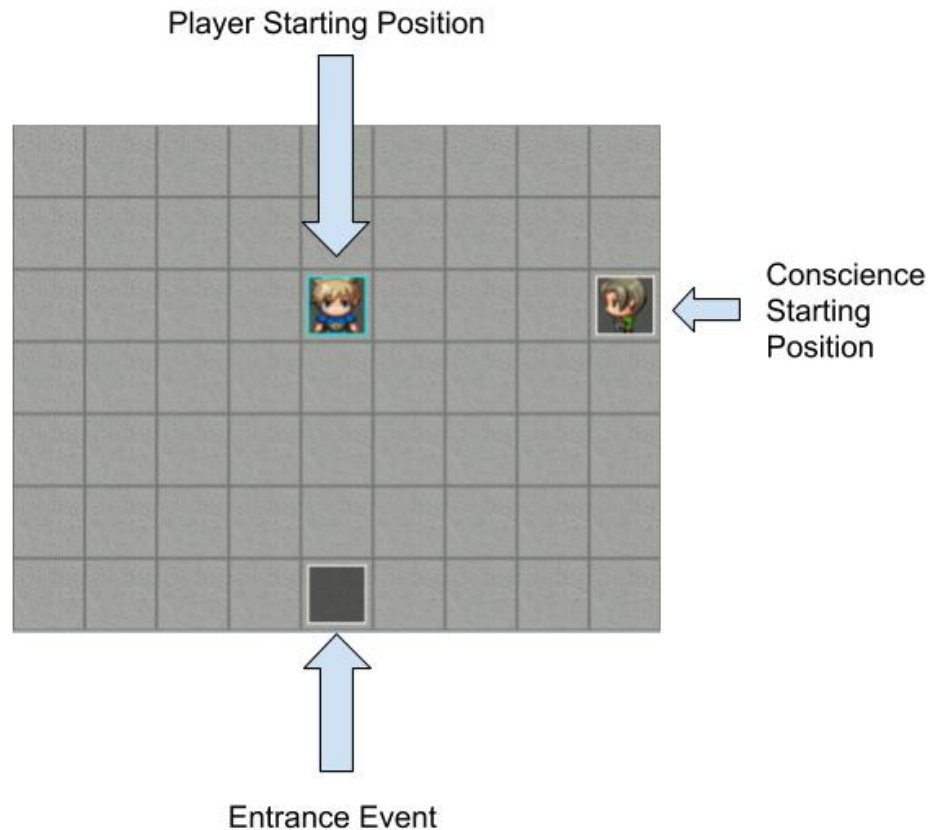


Figure 54: Introduction Scene

- Entrance Event (Autorun)
 - This event Autoruns as soon as the game opens.
 - Background Music Plays "Neutral Park Theme" by Heather Cummings
 - Conscience walks over to player
 - Text shows that introduces the game to the player and how it works
 - Player inputs their name
 - Player is transferred to the neutral park map
 - Switch
 - "#0014 First time entering a scenario = ON"

- Background music fades out
- Conscience starting position (Autorun)
 - This is where the conscience character initially appears on the screen
- Player starting position (Autorun)
 - This is where the player initially appears on screen

Neutral Park Map



Figure 55: Neutral Park

- Background Music Plays "Neutral Park Theme" by Heather Cummings
- Father: Tutorial and Prompt
 - Tutorial (Autorun)
 - When you are transferred to this map, the father has text that autoruns which provides a tutorial of the controls (arrow keys to move etc)
 - Father tells you to speak to him (prompt for next move)
 - After the autorun, the father has a new "event"
 - Father speaks to you (action button)
 - After the father gives you the tutorial he tells you to speak to him.

- Father asks questions about the future of healthcare
 - After the text finishes, the first switch turns on
 - Switch "#003 Able to enter the scenarios = ON"
 - Player can now enter the scenarios through the various gates on the map
 - Your conscience, Alex, now has autorun text that tells you how to enter the scenarios (through the "gates")
- Gatekeeper approaches player (Player touch)
 - This event occurs when the player steps on one of the two tiles above
 - The gatekeeper tells the player which scenario they are entering, and that they can either continue on that path or choose a new one
- Transfer to Most for Most Scenario (Player touch)
 - When the player steps on one of these two tiles, they are transferred into the park where the most for most scenario begins (pictures appears to indicate you are entering the future.)
 - Background music fades out, flash of light, sound effect "silence" plays
- Non playable characters (NPC's) on the map (Action button)
 - When the action button is pressed, each of these characters says a sentence regarding the scenarios or one of the personas

Most for Most World Overview

Here is an overview of the map for the most for most scenario.



Figure 56: Park Overview

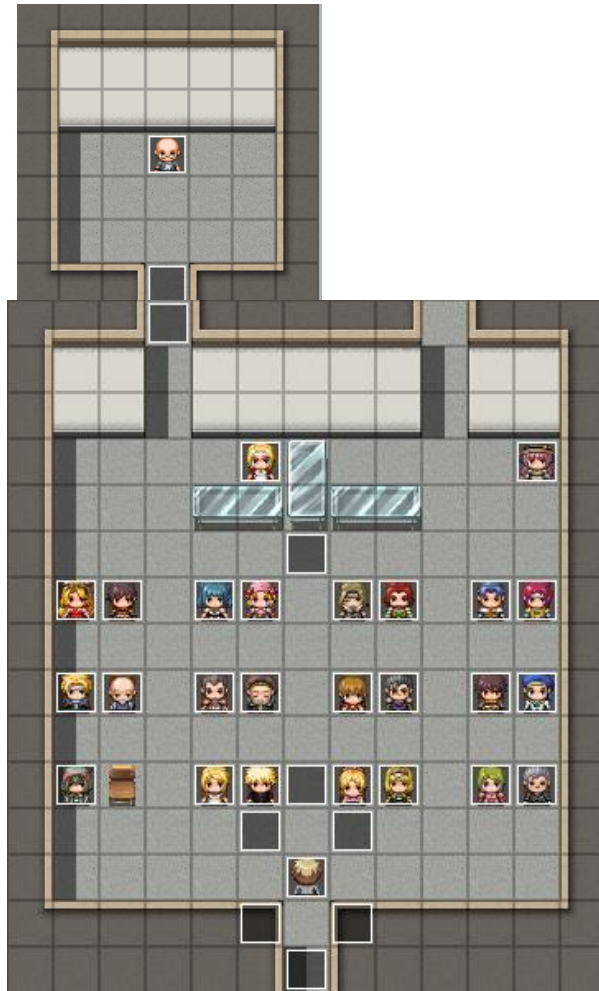


Figure 57: Hospital Overview

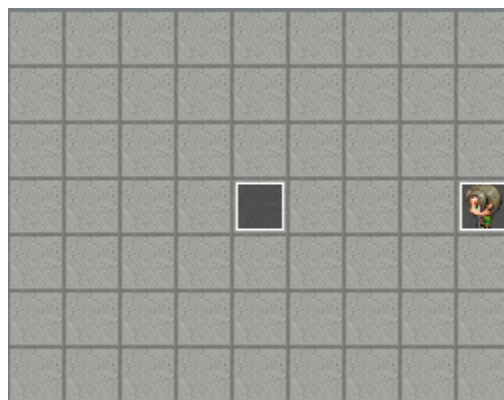


Figure 58: Reflection Room

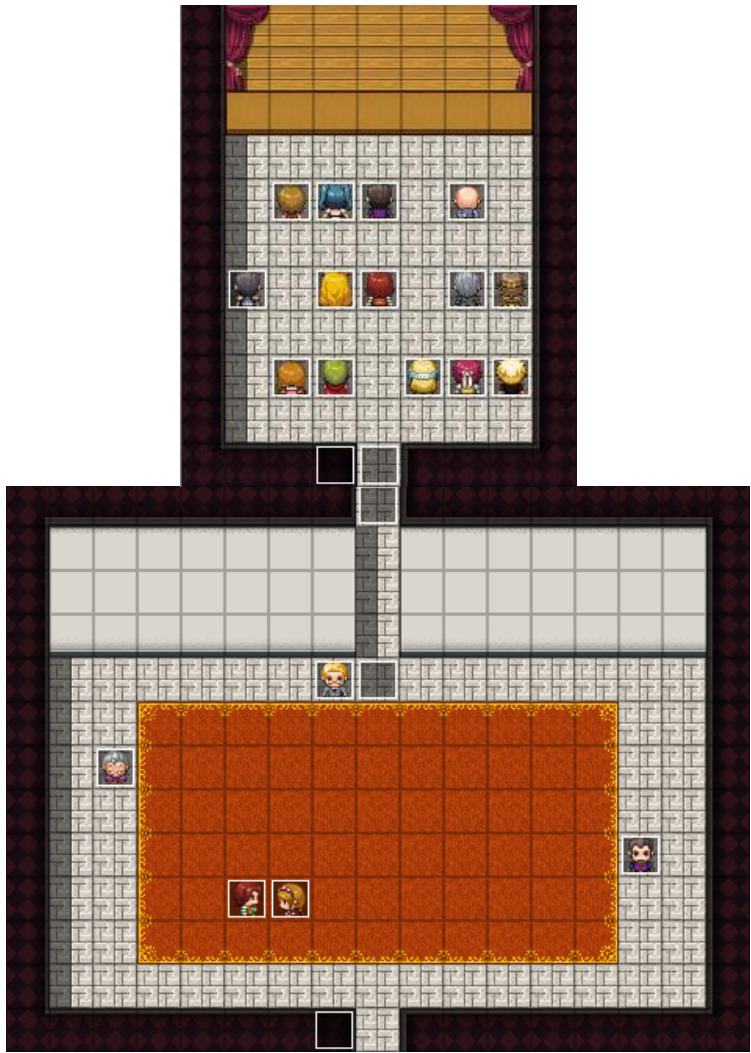


Figure 59: Capitol Building Overview

Most for Most Park

This park is where the player initially enters the most for most scenario.

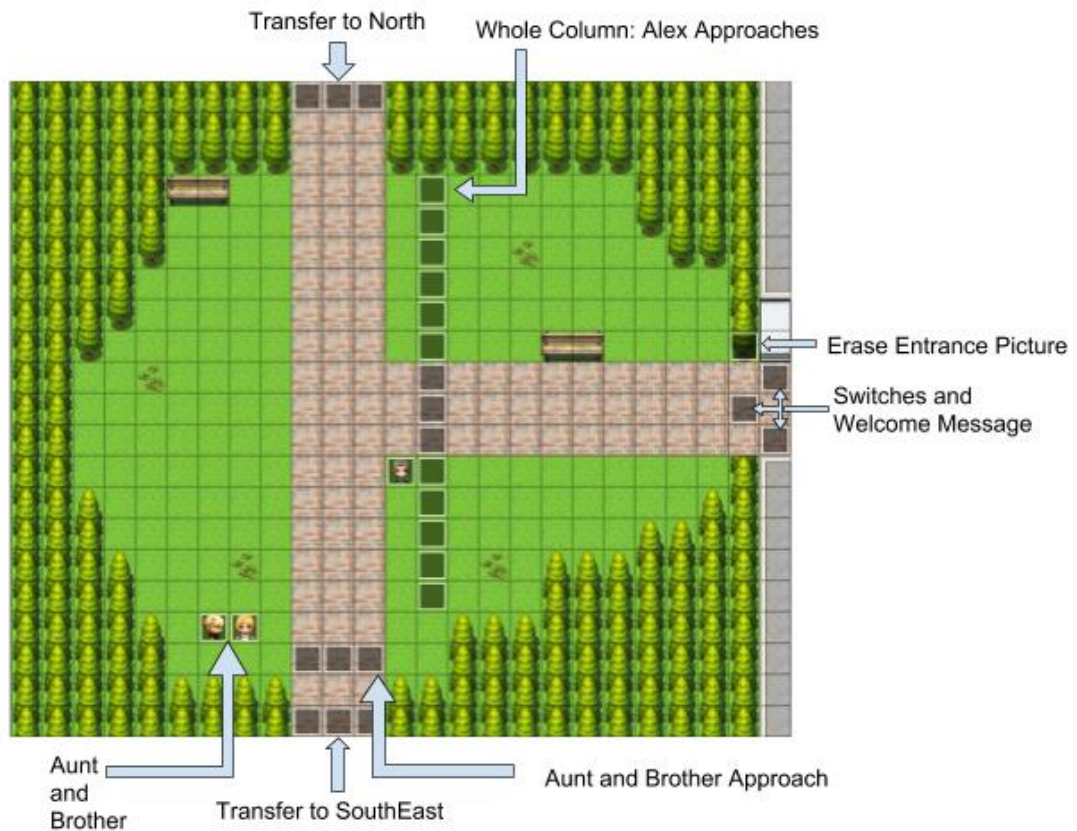


Figure 60: M4M World/Entry (Park Northeast)

- Background Music Plays "M4M Park Theme" by Heather Cummings, continues through all areas of the Most for Most Park
- Erase Entrance Picture (autorun)
 - Autoruns when player transfers to the map
- Switches and Welcome Message (player touch)
 - These events are controlled by player touch.
 - Alex welcomes you to the year 2050.
 - Switches
 - "#001 Intro M4M cough/guide = ON"
 - This makes it so alex approaches you when you reach the column of event tiles ("Alex Approaches")
 - "#002 Aunt and Brother Approach = ON"
 - This makes it so your aunt and brother approach when you reach the appropriate tiles
- Whole Column: Alex Approaches (player touch)

- If switch #001 is on, Alex will approach you when you step on any of the tiles in that column
- After you step on the tile, he walks to you and tells you to find your father
- Switch
 - "#001 Intro M4M cough/guide = OFF"
 - By having this switch the event will not happen again if you step on one of the other tiles that trigger the same event
- Aunt and Brother approach (player touch)
 - Switch #002 must be on for this to occur
 - Upon stepping on one of the three tiles in this event set, your aunt and brother walk over
 - Aunt says to find father because she is worried
 - Acts as a form of barrier to guide you to the southeast where your father is located
 - "#002 Aunt and Brother Approach = OFF"
- Aunt and Brother (action button)
 - Show text when action button is pressed
- Transfer to North (player touch)
 - Transfer player to park map labeled "Park North"
- Transfer to SouthEast (Player Touch)
 - Transfer player to park map labeled "Park SouthEast":
 - This is the location of the father



Figure 61: Park North

- Transfer to Northeast (player touch)
 - Transfers player to respective path on the park northeast map
- Transfer Northwest (player touch)
 - Transfers player to respective path on the park northwest map
- NPC's (Action Button)
 - Shows text with small dialogue

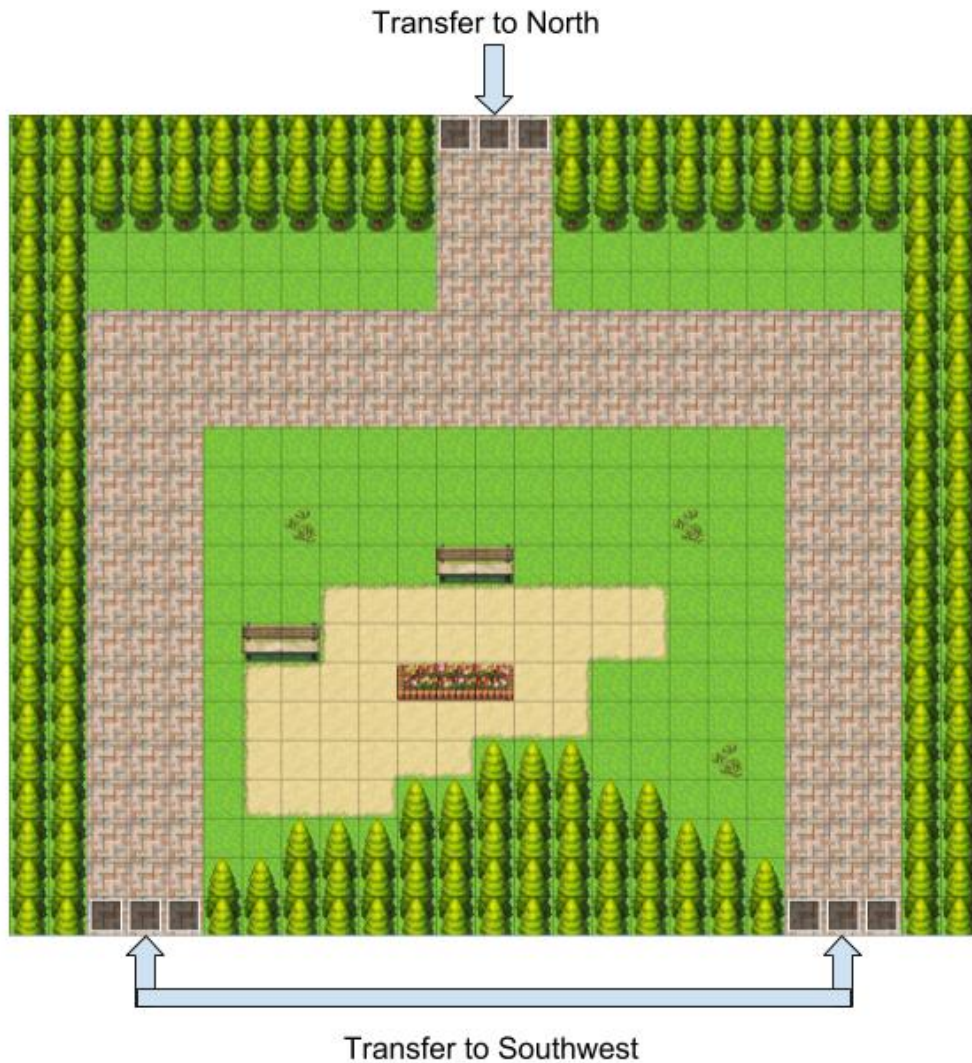


Figure 62: Park Northwest

- Transfer to North (player touch)
 - Transfers player to respective path on the park north map
- Transfer to Southwest (player touch)
 - Transfers player to respective path on the park southwest map

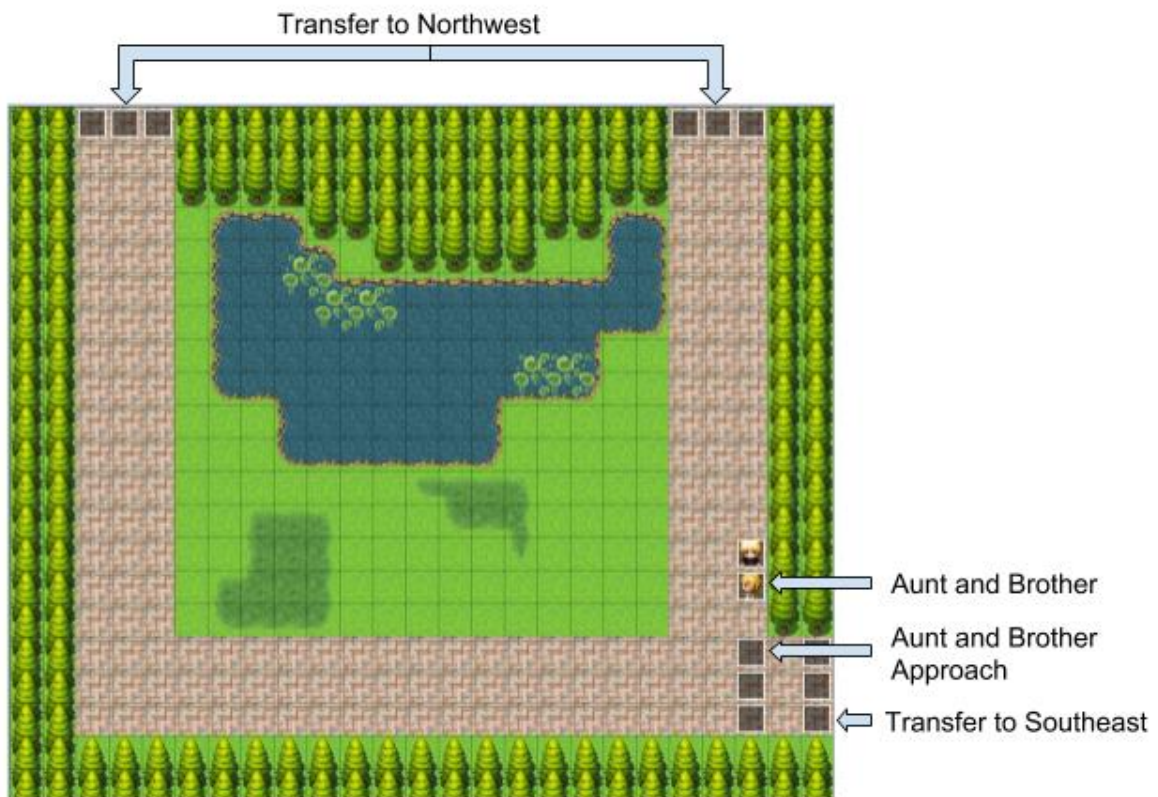


Figure 63: Park Southwest

- Transfer to Northwest (player touch)
 - Transfers player to respective path on the park northwest map
- Aunt and Brother (Action button)
 - Show text when action button is pressed
- Aunt and Brother approach (player touch)
 - Switch #002 must be on for this to occur
 - Upon stepping one of the three tiles in this event set, your aunt and brother walk over
 - Aunt says to find father because she is worried
 - Acts as a form of barrier to guide you to the southeast where your father is located
 - "#002 Aunt and Brother Approach = OFF"
- Transfer to Southeast
 - Transfers player to respective path on the park southeast map
 - This is where your father is located



Figure 64: Park Southeast

- Father Needs Help (Action Button)
 - Father asks player to bring him to hospital
 - Switch
 - "#004 Father follows player to hospital = ON"
 - With switch #004 on, the father character will approach the player's character as he/she moves, thus "following" them
- Transfer to Northeast (Player touch)
 - Transfers player to respective path on the park northeast map
 - Will not transfer if switch #004 is on
- Transfer to Southwest (Player touch)
 - Transfers player to respective path on the park southwest map
 - Will not transfer if switch #004 is on
- Exit Park to City (Player touch)
 - Transfers the player to eit park to city map
 - Background music fades out
 - Will only transfer player if switch #004 is on

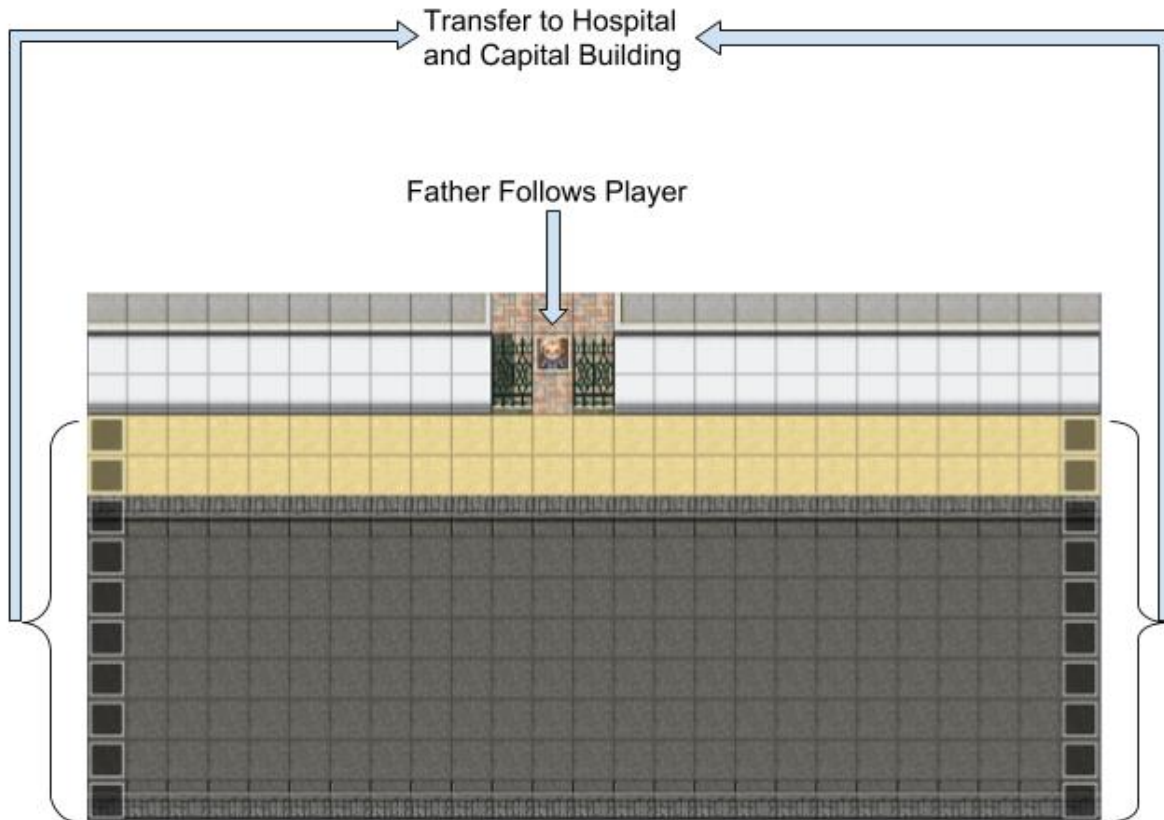


Figure 65: Exit Park to City

- Background Music Plays "Bouncing Around Town" by Eric Matyas
- Father Follows Player (Autoruns in Parallel to Player Movement)
 - If switch #004 is ON, Father follows the player's character
 - If switch #004 is OFF, Father is not following player
- Transfer to Hospital and Capital Building (Player Touch)
 - If switch #004 is ON, these transfer tiles will bring the player to the hospital mini game
 - Background music fades out
 - If switch #0010 Father leaves hospital is ON (see Hospital mini game) these transfer tiles will bring the player to the petition mini game
 - Background music fades out

Hospital Mini game

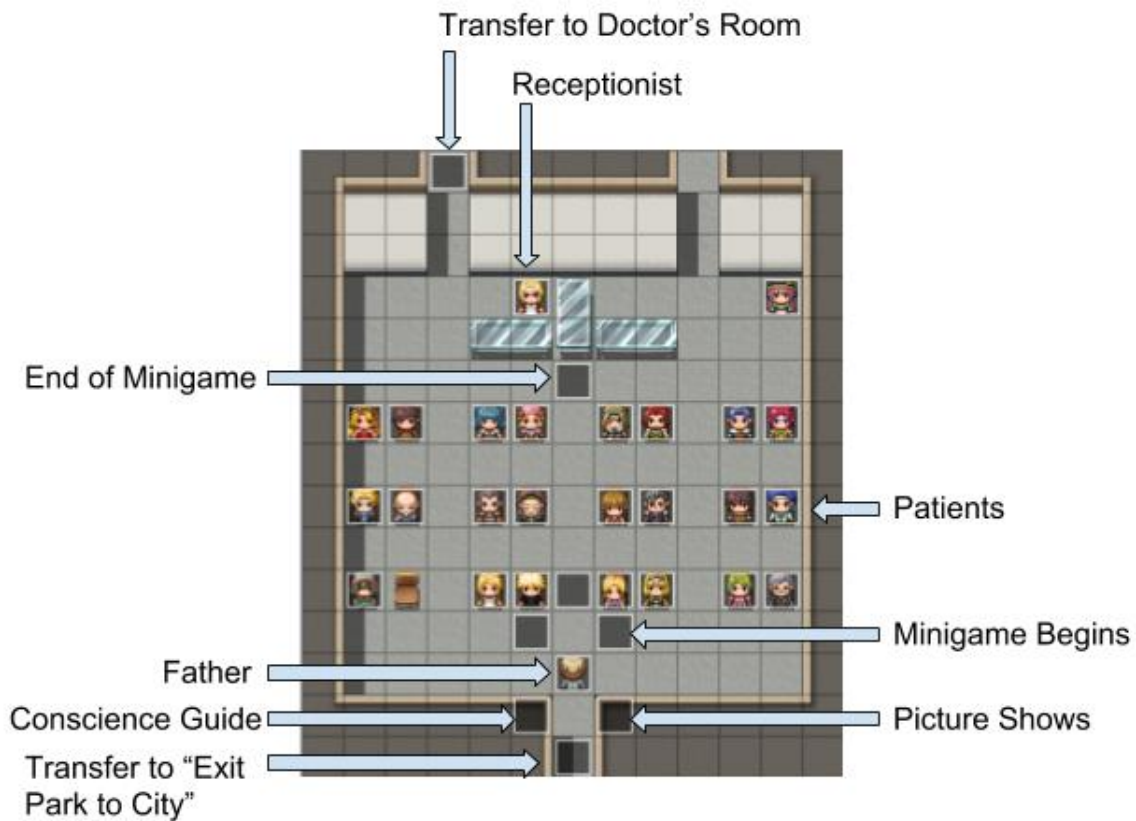


Figure 66: Hospital Waiting Room

- Picture Shows (Autorun)
 - This event occurs while you are transferring to the hospital
 - Shows a picture that indicates your travel between the maps without showing technology like cars etc
- Background Music Plays "Malte Junior" by Lobo Loco
- Mini game Begins (Player touch)
 - When entering this scene, if #004 = ON, then "#005 Nurse implores for help = ON"
 - When player steps on one of three tiles, this event begins only if #005 = ON
 - Receptionist runs over to player and shows text
 - Need help, provides directions for completing the mini game
 - Switches
 - "#004 Father following player to Hospital = OFF"
 - "#008 Doctor Mini game = ON"
 - "#005 Nurse implores for help = OFF"
 - Variables

- "#005 amount of patients healed = 0"
 - Change Gold = +100
 - Background Music Fades out
 - Background Music Plays "Puzzle Game 3 Looping" by Eric Matyas
- Father (Parallel, then Action Button)
 - When entering the scenario, father controls switch #005 automatically
 - When #005 turns off, the mini game has begun and the father becomes a patient (See "Patients")
 - At the end of the mini game after you speak to the doctor (See "Doctor's Room") the father's dialogue shifts again (Action button based) when switch #0010 turns ON
- Patients
 - When "#008 Doctor mini game = ON"
 - Patients tell you their ailment and how much they cost to heal
 - Choice to help them or not
 - If you help them
 - Subtract their cost to heal from gold
 - Variable "#005 amount of patients healed = +1"
 - Patient leaves
- End of Mingame (Autorun)
 - Background music returns to "Malte Junior" by Lobo Loco
 - This event autoruns when the player's gold amount hits 0
 - If player healed 14 or more patients
 - You win!
 - Need to speak with the doctor
 - Switches
 - "#009 Meet with doctor = ON"
 - If player healed less than 14 patients
 - Need to heal more, return to start of mini game
 - Switches (reset)
 - "#005 Doctor mini game complete = OFF"
 - "#007 Nurse implores or help = ON"
 - "#004 Father following player to hospital = ON"
 - Transferred to "Exit Park to City Map" and must begin again by entering hospital
- Transfer to Doctor's Room (Player touch)
 - Switch #009 must be ON
 - Transfers player to map "Doctor's Room"

- Conscience Guide (autorun)
 - When you return to waiting room after speaking to doctor, switch #0010 is ON
 - Need switch #0010 ON for this event to run
 - Conscience speaks to you and provides you your next task of going to the Capitol Building
- Transfer "Exit Park to City"
 - Need switch #0010 to be ON
 - Transfers player back to map "exit park to city"
 - Transfers on this map now send the player to the capitol building

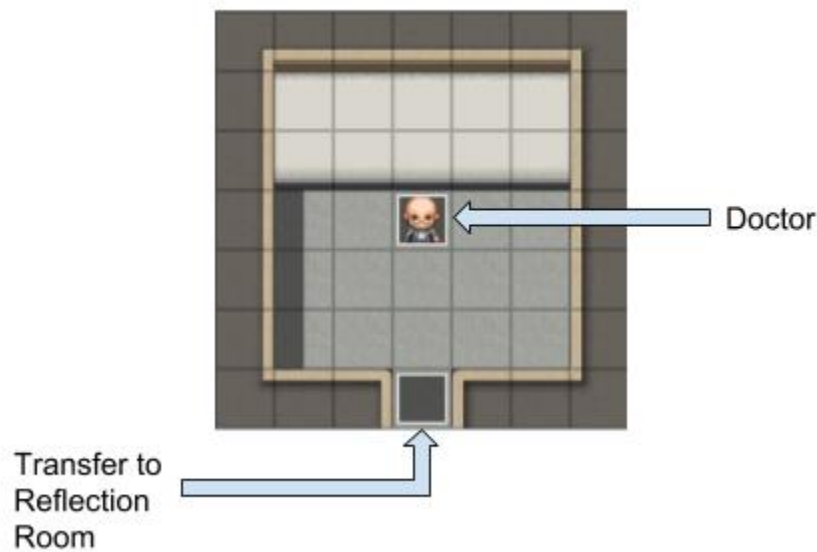


Figure 67: Doctor's Room

- No Background Music Plays
- Doctor (Action Button)
 - Shows text that talks about the scenario and storyline
 - Tells you to return to waiting room to talk to your father
 - Switch
 - "#0010 Father leaves hospital = ON"
- Transfer to Reflection Room (Player touch)
 - Requires switch #0010 to be ON

- Transfers player to map "Reflection Room"

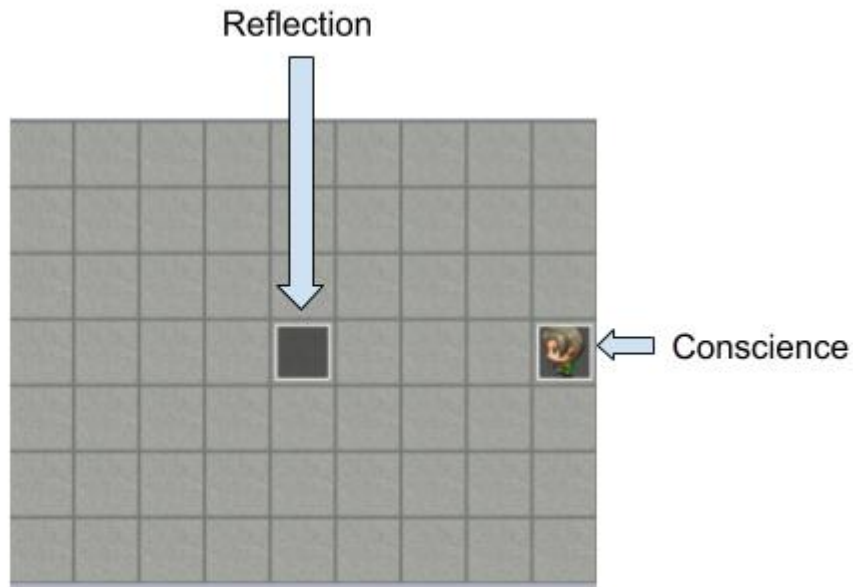


Figure 68: Reflection Room

- Reflection (Autorun)
 - When you transfer to this room, this event autoruns
 - Background Music Plays "Introspection" by Eric Matyas
 - Conscience walks over to you and exchanges dialogue
 - Reflection questions appear on the screen that the player can click through with the action button
 - When all questions have been presented, player transferred back to hospital waiting room
 - Conscience tells you to talk to father
 - Then leave hospital and continue to capitol building

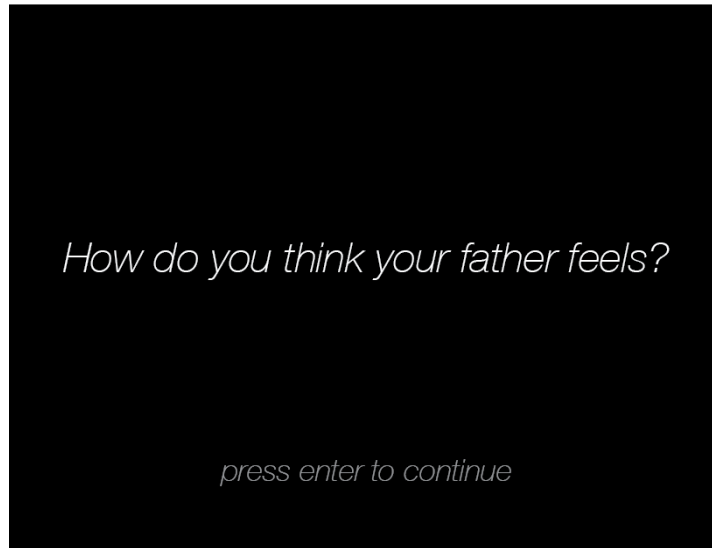


Figure 69: Question Screen 1

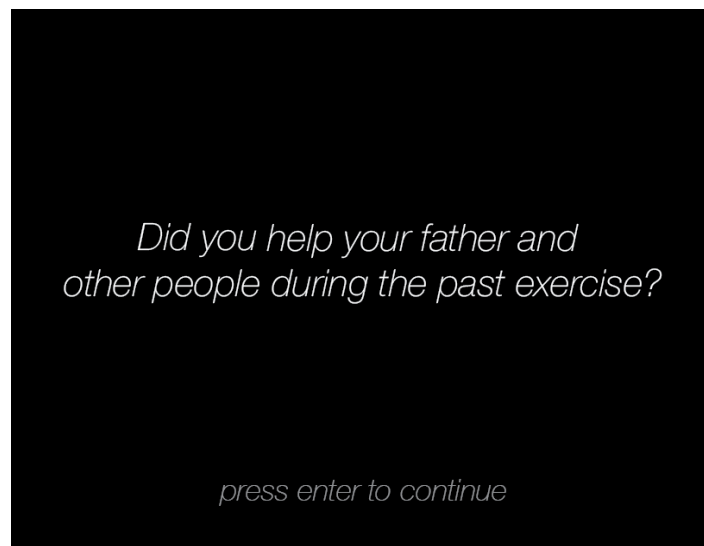


Figure 70: Question Screen 2

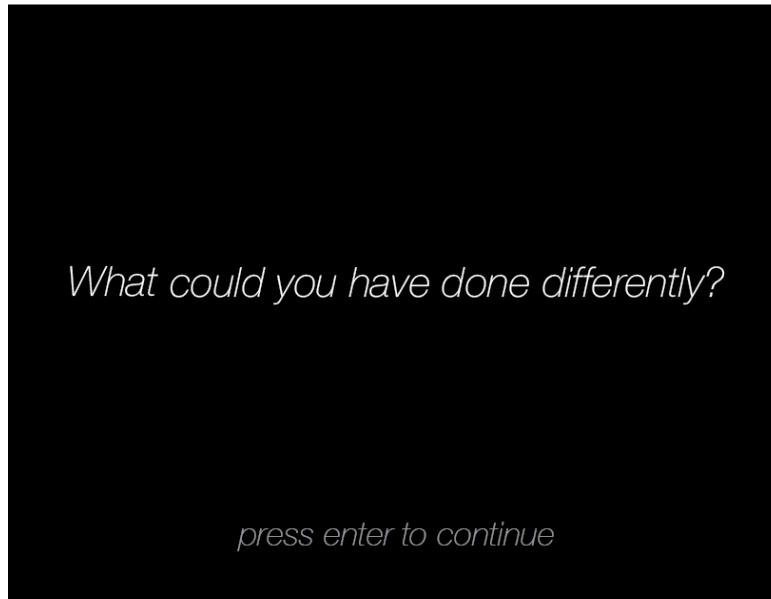


Figure 71: Question Screen 3

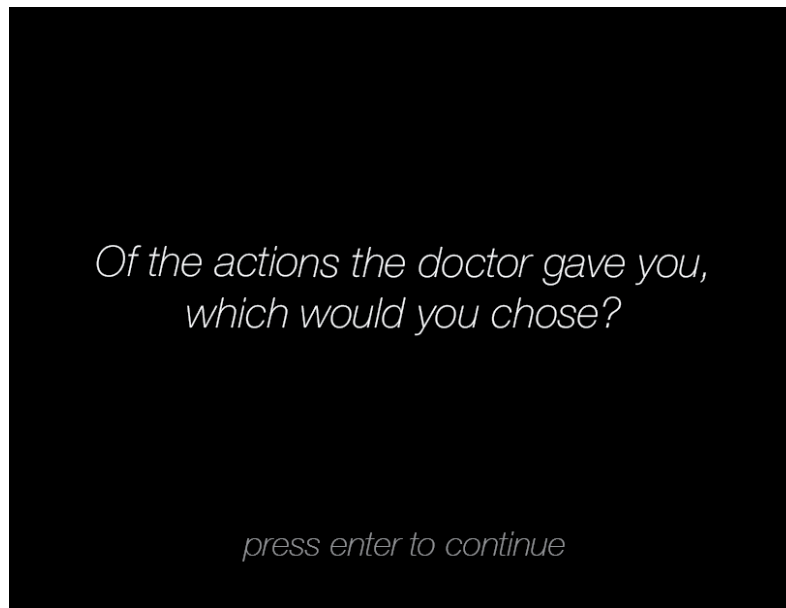


Figure 72: Question Screen 4

Petition Mini game/Capitol Building

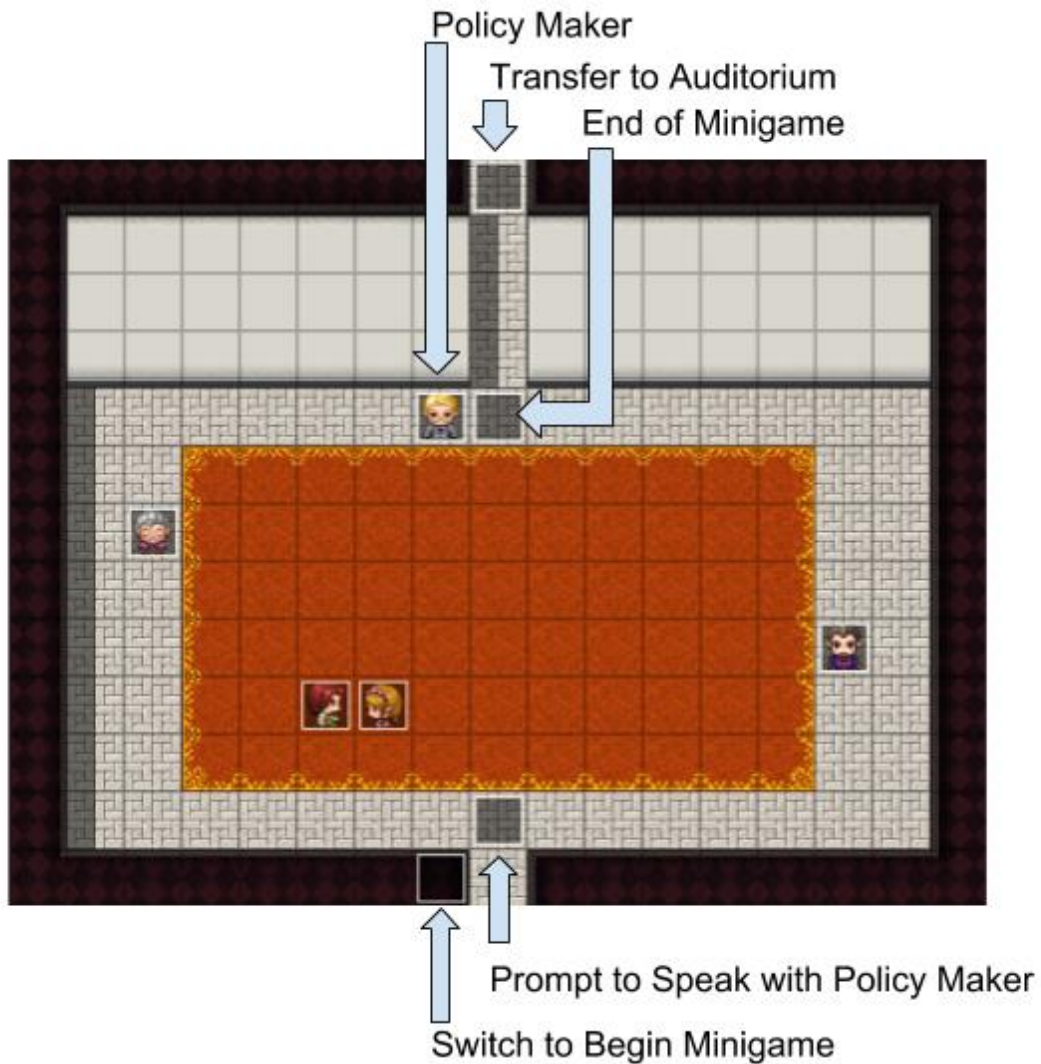


Figure 73: Capitol Building

- Background Music Plays "Happy Days" from Purple Planet Music, continues in auditorium
- Switch to begin Mini game (Autorun)
 - Switch "#0012 start of petition mini game = ON"
 - This allows you to speak to the policy maker and it decides what he says to you
- Prompt to Speak with Policy Maker (player touch)
 - Shows a question mark over policy maker character so that you know who to speak to
- Policy Maker (Action Button)
 - Presents dialogue giving the player a task to speak to people in the auditorium
 - Switch

- "#0011 transfer to auditorium in capitol building = ON"
- Transfer to auditorium (Player touch)
 - Switch #0011 must be on
 - Transfers player to map "auditorium"
- End of Mini game (Player touch)⁹
 - After completing the mini game, stepping on this tile prompts the policy maker to show dialogue to player
 - Switch #0013 must be on (see auditorium map)
 - Switch
 - "#0012 start of petition mini game = OFF"

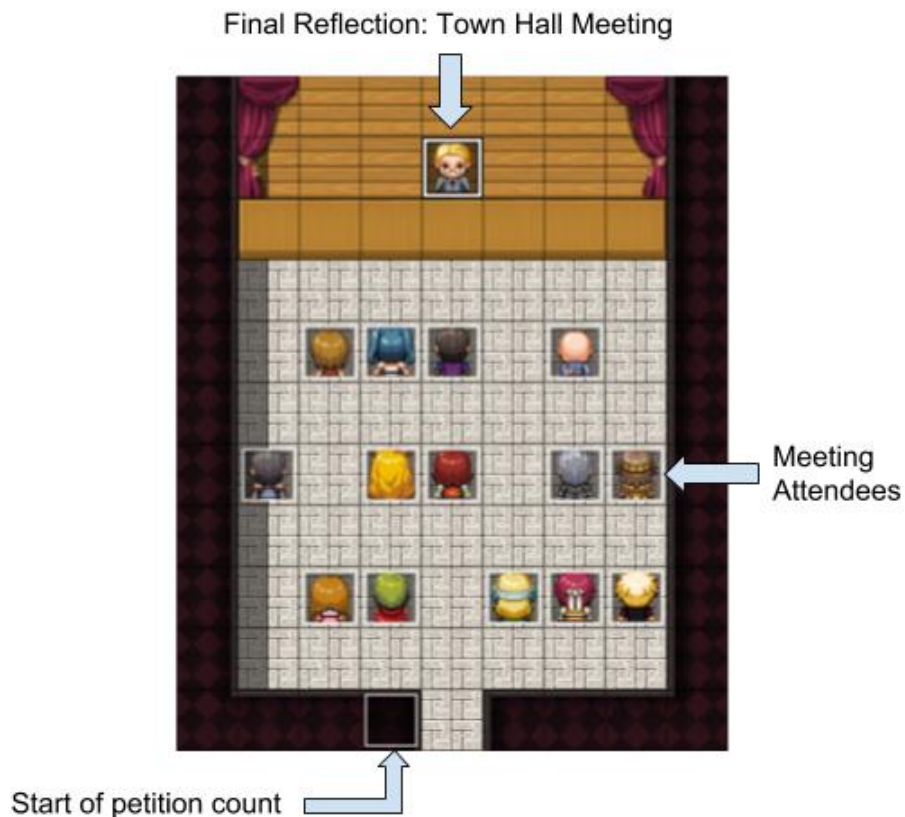


Figure 74: Auditorium

- Start of Petition Count (Autorun)
 - Switches
 - "#0011 transfer to auditorium in capitol building = OFF"
 - Variable
 - "#006 petition tallies = 0"

⁹ This event no longer runs as the player does not return to the main room of the capitol building. The tile has not been removed from the map though so the event still exists. Therefore it was not removed from the description.

- Meeting Attendees (Action Button)
 - Speaking to attendees via action button shows text and adds to count of opinions that gather
 - Variable
 - "#006 petition tallies = +1"
- Final Reflection: Town Hall Meeting (Auto Run)
 - Requires that variable #006 petition tallies ≥ 8
 - Switches
 - "#0013 petition mini game complete = ON"
 - Policy maker appears on the stage
 - Text appears that provides questions to the player about the scenario
 - After final question appears, player is transferred back to the neutral park where they can enter the next scenario

Appendix I: User Journey and Website

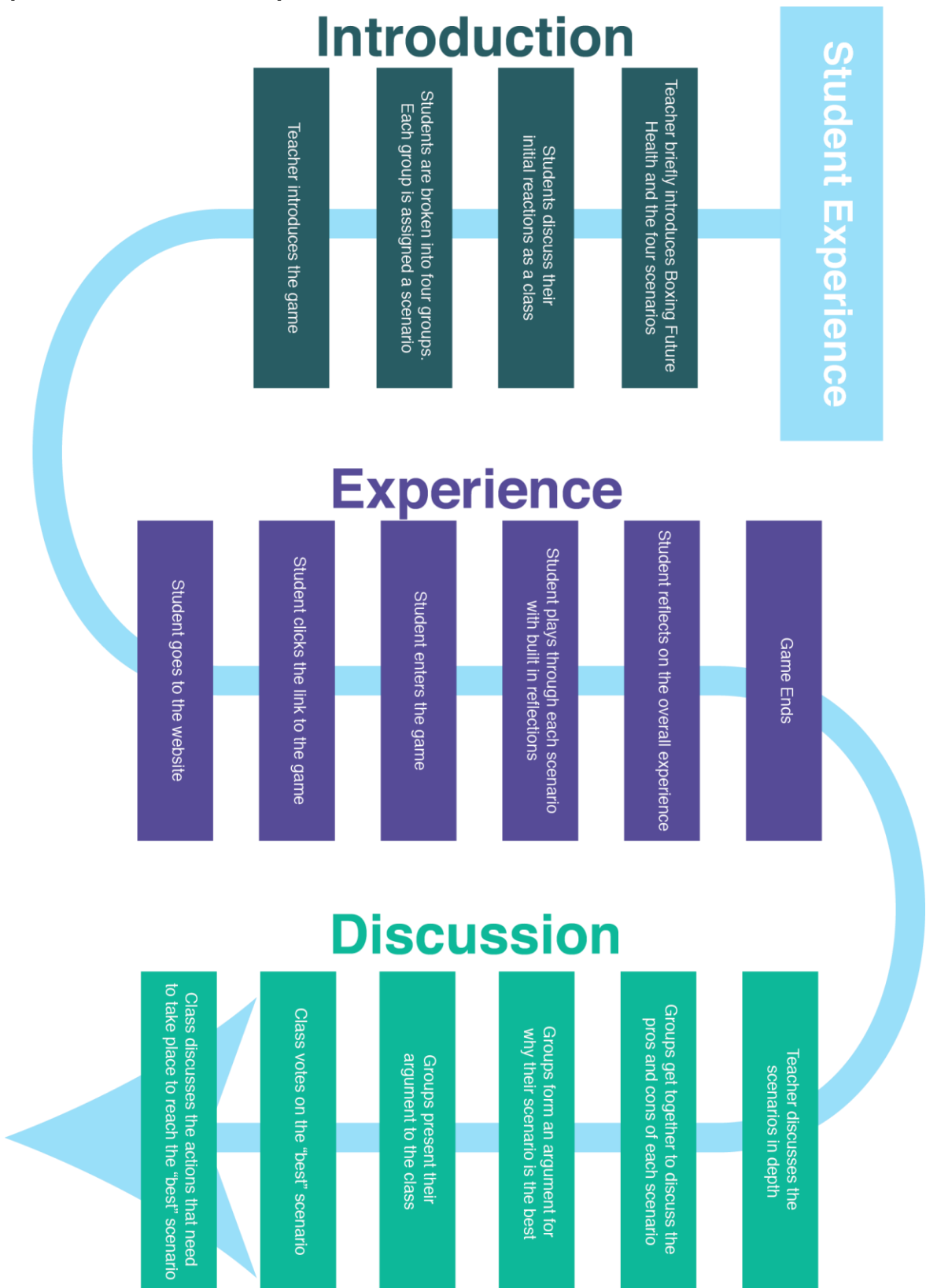


Figure 75: Student Experience

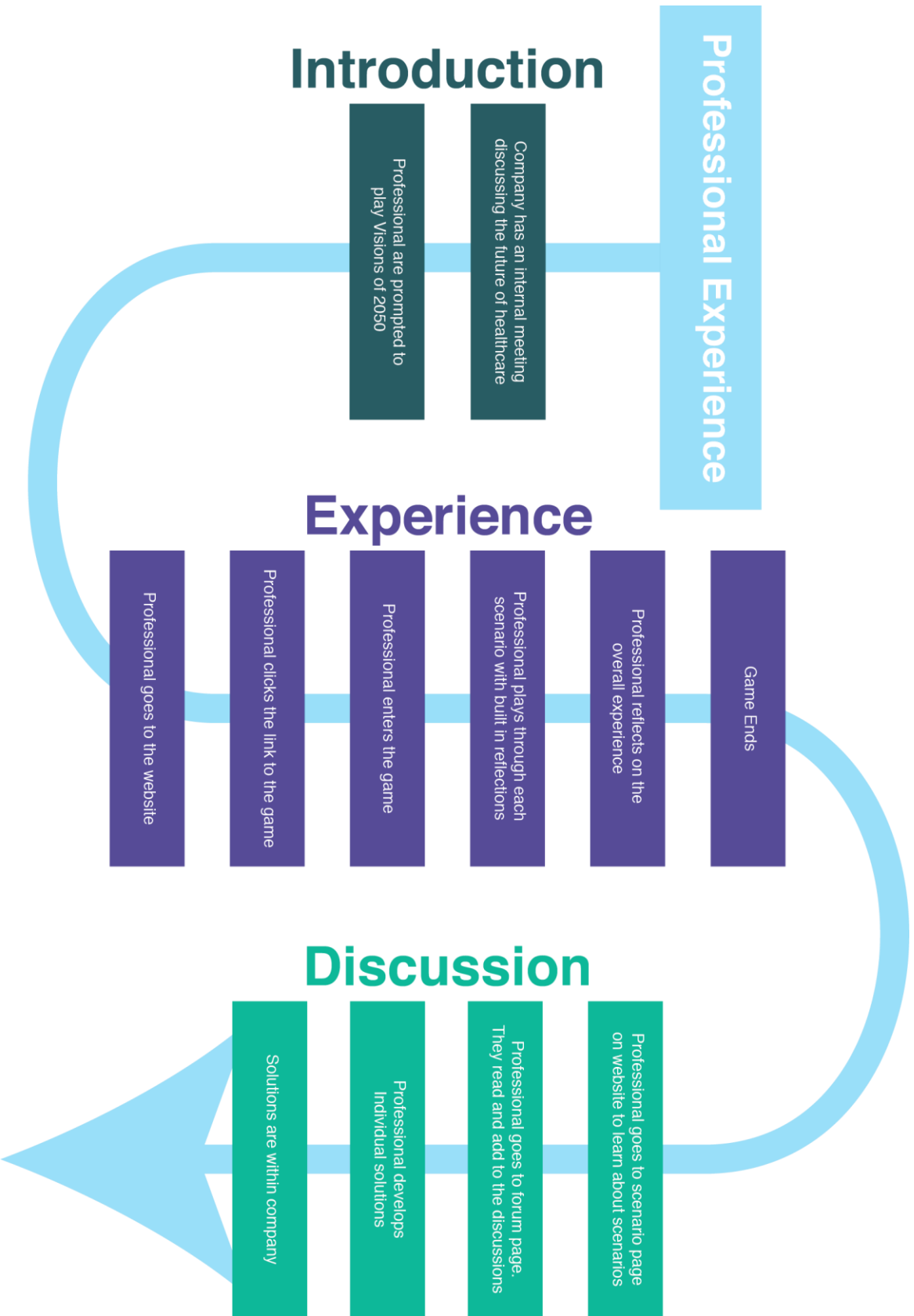


Figure 76: Professional Experience

Game Tester Survey

Section 1 of 7 ✕ ⋮

BFH Game Testing Feedback

This form is used to gather feedback from game testers of the Boxing Future Health (BFH) digital scenario tool.

What are your thoughts on the game and how you progressed through it? *

Long answer text

Were there places where you were confused on what to do? (Please give specific points in the game) *

Long answer text

How was the speed of game progression? Did the story move too fast or too slow? *

Too Slow 1 2 3 4 5 Too Fast

Figure 77: Page 1 of Tester Survey

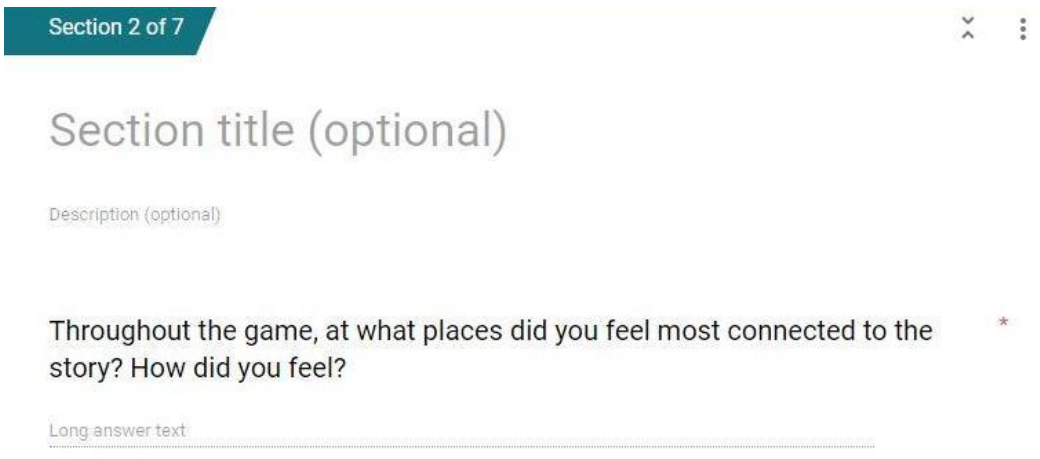


Figure 78: Page 2 of Tester Survey



Figure 79: Page 3 of Tester Survey

Section title (optional)

Description (optional)

Are the visuals in the game engaging? *

	1	2	3	4	5	
Not engaging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very engaging

What did you think about the visuals? (Be specific) *

Long answer text

Figure 80: Page 4 of Tester Survey

Section title (optional)

Description (optional)

Were your interactions with characters in the game engaging? Was there enough interaction with characters? Did you feel connected to any characters in particular? (please explain why) *

Long answer text

Figure 81: Page 5 of Tester Survey

Section title (optional)

Description (optional)

What do you think are the ideas/themes presented in the game? *

Long answer text

Were the ideas/themes of the scenario(s) in the game presented to you in a clear and cohesive way? (please elaborate on your answer) *

Long answer text

Figure 82: Page 6 of Tester Survey

Section title (optional)

Description (optional)

What else would you like to see included in the game? What suggestions would you make? *

Long answer text

Do you have any questions for us? *

Long answer text

Figure 83: Page 7 of Tester Survey



Boxing Future Health

What Will Healthcare Look Like in
2050?

Play The Game → Complete the Survey → Explore the Forum

Figure 84: Website Main Page



Boxing Future Health

Tell us your thoughts on the scenarios





 MOST for most Most For Most 18 views 1 post Health is the absence of disease, illness is a fact of life and affects everyone.	 Healthy I Healthy I 0 views 0 posts Health is the greatest possible bodily and mental well-being.
 Ministry of ROOT CAUSES Ministry Of Root Causes 0 views 0 posts Illness occurs in the individual, but there is a consensus that it is, to a large extent, caused by social conditions.	 Health BAZAAR Health Bazaar 0 views 0 posts Health and illness are about more than the body, they are about life.



Figure 85: Website Forum Page

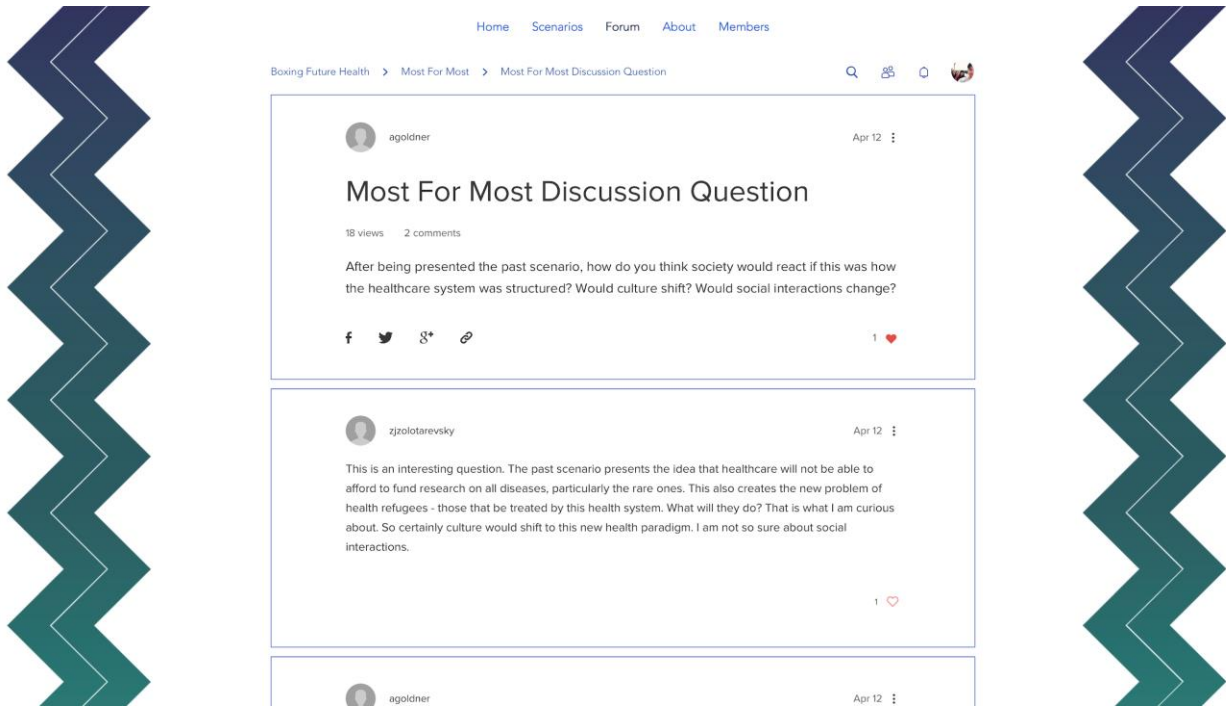


Figure 86: Forum Example Discussion



Figure 87: Website Scenario Description Page

About Boxing Future Health

Boxing Future Health is a pioneering design project, that functions in the **interplay between design thinking and foresight**. Exploring the potential in the healthcare sector, the project is experiential, concrete, and collaborative and thereby, ensuring that the healthcare sector and private businesses can understand and act upon the future. From visual future scenarios, we will increasingly be able to **detect new markets, develop new business models and jointly create tomorrow's health care solutions**.

[See More](#)

Questions? Fill out this form and we will get back to you!

Name *	Email *
Subject	

Figure 88: About Boxing Future Health Page

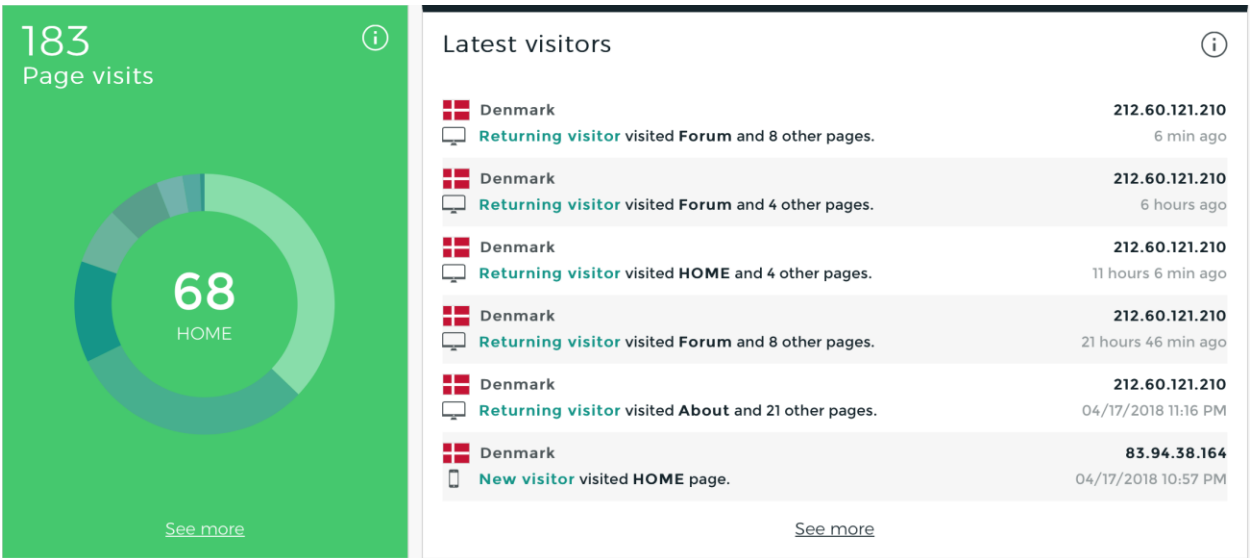


Figure 89: Visitor Analytics

Appendix J: Tester Feedback

Key:

- Game Progress
- Tasks
- Emotional Connection
- Interactivity
- Visuals
- Clarity of Themes

What are your thoughts on the game and how you progressed through it?	Were there places where you were confused on what to do? (Please give specific points in the game)	How was the speed of game progression? Did the story move too fast or too slow?	Throughout the game, at what places did you feel most connected to the story? How did you feel?	How interactive was the game?	Were there points in the game where you felt it lacked interactivity? If so, in what way could you have been more engaged?	What did you think about the visuals? (Be specific)
Punctuation could be better	Hospital part really doesn't explicitly say to get as many people as possible, kinda weird to have so many locations at the beginning (ie the park)		When I healed the blonde lady, but I was disappointed when she just left.		The survey thing at the end was kinda lame	Colorful, I like that there were a variety of different characters.
I thought it was easy to use, fun, and interactive.	When looking for Dad, I had a hard time finding my way. I also took some time to figure out that the point of the hospital room was to save as many people as possible, not people who have the scariest diseases.		When the Dad needed help but I was unable to help. I felt sad and disappointed that I couldn't help. Also, when the brother talked about his depression, it felt sad to hear.		No, I thought it was the perfect amount.	They were good! I liked that the game mocked real life and how it was clear as to which part of the game I was in.
It was a little hard to navigate and I also felt really crappy when I couldn't serve everyone	Navigating through the park was really confusing		I felt really connected to the story in the waiting room when I had to serve patients.		I think there was too much navigation without extra information	I think they were simple but they were very effective!
I think there is some unnecessary wandering involved but overall game-play makes sense. My main problem was I kept forgetting what my father looked like so perhaps making him more distinct in some way would be helpful.	I just wandered a lot and got kind of lost during the park portion		The black text screens		There were people that I thought I could talk to but I could not	I had trouble remembering what my father looked like
It was cute, reminded me a lot of pokemon games	I was confused with the street outside outside the hospital and knowing that, also after losing the minigame I didn't know that I had to try again		with the dad. sad for dad		I couldn't pick my own word answers	I liked the ponds
I enjoyed it. I liked the mix of open world and "linear progression" parts of the game. It allowed me to explore but still stay on task.	Not really, instructions were clear and visual cues were helpful in figuring out where I needed to go.		Talking to my dad or my brother or my aunt. For some reason, the simple explanation of them being related to me helped me to sympathize with the characters that much more.		No, I don't think so. It was nice during the open world parts that I could talk to anyone I wanted.	I liked that they were left ambiguous enough to apply to current or future "situations." I think it helped to communicate the futuristic aspect of the game.
The game was very straightforward. I was able to reach the end very quickly.	No		The part where I had to split my money between the different patients. I felt sad that I couldn't save everyone.		The part where you get people's opinion felt unnecessary. It needs more interactive features. Otherwise put it in a cutscene. Also, there was too much walking between places.	Father seemed very generic. There needed to be more expression in his looks and lines for me to feel attached.
It was pretty good - was always very apparent where the player had to go and what they had to do. Progress always seemed a little on the slow side, though.	Not really		I didn't really feel particularly connected to the story anywhere, to be honest		I think the amount of interaction was pretty good for the goal of the game	They were good - there was a bit of repetition here and there but that's to be expected

Figure 90: Tester Feedback Page 1

Were your interactions with characters in the game engaging? Was there enough interaction with characters? Did you feel connected to any characters in particular? (please explain why)	What do you think are the ideas/themes presented in the game?	Were the ideas/themes of the scenario(s) in the game presented to you in a clear and cohesive way? (please elaborate on your answer)	Are the visuals in the game engaging?	What else would you like to see included in the game? What suggestions would you make?	Do you have any questions for us?
As interactive as a game in RPG maker can be I think?	Healthcare stinks and interacting with people doesn't seem to do anything	The survey made it very easy to see the themes, but it was a bit lame and impersonal.	4	Make interactions with characters have consequences and fix punctuation.	Yes.
Yes. I like that the Aunt, Brother, and Dad talked and made me feel more connected to the game and how I could help.	Emotional connection, importance of healthcare, prioritizing of care.	Yes. The only part that I missed before I realized what the goal was, was the hospital scenario when I had to heal more people with small issues rather than a few with big issues. Once I understood that, it made sense.	5	None!	No :)
I think there was enough interaction! I think that there could have been something that identified the main dude, maybe a little more of a back story to him?	It's hard for healthcare to take care of everyone because some diseases are more expensive to take care of than others.	I think they were, I think it was easy to follow the story and to get the gist of what the lesson was we were trying to learn	5	I think maybe more things to explore in the park could be good so it's less just navigation.	Nope!
There was a lot of dialog for me and at times I kind of zoned out and clicked through it	The difficulty of treating rare diseases and the need to make a health care budget go as far as possible.	The themes were clear, if anything I think it could be presented slightly more subtly	3	I think the game could benefit from more interactions and having to figure things out for yourself a little more because it would make it slightly more engaging.	Nope, you guys killed it this is dope
uh i guess any family members?	help people. dont triage properly	i guess. i could tell that picking the patients was hard	4	labels of your location?	no
Yes they were engaging because text was personalized, I was able to talk to people after the initial line of text was delivered and I was provided with a secondary response. I was connected to my relatives for reasons specified earlier.	Future HealthCare, Nepotism, progressive thought, tough decision making	Yes I think the open ended questions at the end helped to get thought churning. Also the whole game is centered around healthcare so I think that was pretty clear.	4	Easter eggs. Hidden Collectibles	No
I felt there could be more human-like characteristics to the characters. I didn't feel connected enough with father to feel attached. Also, the dialogue when gathering opinions of the healthcare system felt too forced and not human enough.	Future healthcare will prioritize patients with cheaper injuries. Those with more expensive treatment requirements will get left behind.	Yes. I could understand the more for more theme after playing the gold minigame and immediately looking for the cheapest costing patients.	2	More branching story-lines. I want to see the impact of my decisions. I.e. make me go to father's funeral if I don't save him.	No
There was definitely enough interaction with the characters, but I didn't feel as if much of it was very engaging or much of a connection to the characters; I believe this might be due to the type of game (top-down RPG) rather than the writing.	Healthcare in the future, socialized healthcare, and change	Yes, they were pretty clear. While not explicitly stated, anyone who knew even a little bit about healthcare should have been able to get the concepts	4	I would like to see more content!	Nope

Figure 91: Tester Feedback Page 2