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DESIGNING SERIOUS GAMES FOR A SUSTAINABLE WORLD

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Abstract

Computer games can be used to educate and persuade. In this paper we investigate the potential of “serious games” to foster values to create a sustainable world. Although the idea of using games to persuade people raises ethical concerns, we draw inspiration from the 17 UN sustainable development goals, focusing on goal 6 – Clean water and sanitation. This research project uses design science research to propose and demonstrate design artefacts via the creation of a game prototype. We believe that this approach has the potential to lay the foundation for the future design and development of serious games for sustainability.

Keywords: *Serious games, values, sustainable, decision-making, game design*

1. Introduction

Some researchers describe game designers as being in the “behaviour business” (Fabricant, 2009). This is because games can influence players’ values (Bushman, Rothstein, and Anderson 2010; Ferguson and Kilburn 2010). However, game designers often overlook the subtle values being conveyed in a game (Barab, Dodge, Thomas, Jackson, and Tuzun 2007). For example, they might not explicitly think about how the game prompts the player to make certain decisions. Some research on game design further suggests that violent games can have negative repercussions on behavior such as increased aggression, serious injuries or death (APA, 2015; Children Now, 2015; Ferguson & Kilburn, 2010; Gentile, 2014).

Recognising the need to consider both the implicit and explicit values carried in digital games (Belman et al., 2011; Schrier et al., 2010), a number of questions arise, such as: how do consumers know which values the game promotes? how do game users or game facilitators such as educators or parents know which games they can give players in their care (Belman, Nissenbaum, Flanagan, & Diamond, 2011; Flanagan, Belman, Nissenbaum, & Diamond, 2007; Gee, 2003; Haugland & Ruíz, 2002)? This requires the design of transparent games and game platforms that will allow players and educators to understand the values in the game, as well as flexibly customise the values they want to communicate in the game.

To fulfil these requirements, we need research on usable, context and user group specific (Tilvawala, Sundaram, & Myers, 2018) artefacts such as concepts, design models, frameworks, processes, principles, architectures and/or roadmaps to guide digital game designers (Belman et al., 2011). Therefore, the aim of this research is to use design science to explore, propose and demonstrate the application of design artefacts for the creation of values-based serious games for children. We focus on values for a sustainable world, hence draw from the 17 UN sustainable development goals (United Nations, 2018), specifically, Goal 6 – Clean water and sanitation. We plan to research, design and deploy these values-based games on mobile devices given their pervasive and ubiquitous nature.

The paper begins by briefly outlining the research method adopted. Next, we provide a summary of serious games related to the 17 UN sustainable development goals. We then unpack the aspects of game design in the games summarised to propose a conceptual design approach. Then we outline scenarios for a proposed game based on past research and observation of existing successful games on sustainable values. This is followed by a synthesis of the findings from this research in the discussion section. Lastly, we conclude the paper with implications for future research.

2. Research method

The Design Science approach, in particular Hevner, March, Park & Ram's (2004) design principles, will be applied to the creation of a values-based game prototype. Design science involves four major steps: observation, theory building, system design and experimentation. This paper provides a brief literature review and a review of games oriented towards fostering sustainability, theory building in the form of the conceptual models and processes proposed, and system design through the planning and creation of a prototype.

3. Serious Games for a Sustainable World

Serious games refer to digital games that are designed primarily for the purpose of learning (Crookall, 2011), unlike games that are focused on entertainment. As such there are a number of terms used interchangeably to describe games for learning but the two that resonate with this research are *Serious games* and *Persuasive games* (Bogost, 2006; Fogg, 2003). Persuasive games, as the name suggests, are designed to persuade a behavior or idea. Given the focus of this research, digital games focused on sustainability may be described as *Serious Persuasive games*.

We review some representative games related to the UN Sustainable Development Goals (UN SDGs) below (United Nations, 2018). Whereas various games have been designed for a general audience (e.g. World Rescue Game, Sai Fah! The Flood Fighter and McDonald's Video Game), Table 1 lists games that have been specifically designed for children and youth.

This review of existing games reveals the different orientations of the games. Some seem to have a merely informative motive, whereas others challenge the users to respond to scenarios in the game. The latter is more engaging as it prompts the user not only to act, but to reflect on the reasons leading up to their decisions and potential consequences. Some games go beyond this by presenting opportunities for decision-making and demonstrating the complex and interconnected nature of our decisions in real life. It has been noted that "educating for sustainability demands learning

approaches and environments that require the development of systems thinking and problem-solving, rather than solely the acquisition of factual knowledge” (Fabricatore & López, 2012).

Digital Game	Purpose	UN SDG addressed
Energy Hog	To teach children how to conserve energy.	7- Affordable and Clean Energy
Electrocity	To increase public awareness of energy use.	7-Affordable and Clean Energy
Food Import Folly	To encourage players to think from a Food and Drug Administration inspector’s point of view to protect their country from contaminated food crossing the border.	12- Responsible Consumption and Production
My Sust House Games	To teach school children about the challenges of sustainable building design.	6-Clean Water and Sanitation, 7- Affordable and Clean Energy, 8- Decent Work and Economic Growth, 10-Reduced Inequalities, 11- Sustainable Cities and Communities, 12-Responsible Consumption and Production

Table 1: Games for Sustainable Development targeting Children and Youth

4. Designing Serious Games: A decision-driven transformative approach

For the purpose of this research, our objective is to design a game and game scenarios that exemplify, assess, demonstrate and motivate sustainable value/s we wish to foster in a player. We would therefore like to go beyond educating the player to initiating transformation in the player.

4.1. Educate, Practise, Transform and Sustain Model

Based on our review of some representative games (Table 1), there are various levels of design where the objective is to influence the values of a player. These levels and possible progressions across levels are illustrated in Figure 1.

4.2. Decision-making and Target user

The progression through the transformative game design model (Figure 1) is underpinned by the decision-making processes of the players. Therefore, the audience for the game is an important consideration. Children, for example, have vastly different mental and decision-making models when compared to adults. While adults are able to make decisions that will result in long-term gains, most children under the age of 8 make decisions for instant gratification (Saxler, 2016). Further, different players may react to different scenarios in the game differently. For example, children in the developed world may be unfamiliar with life in the developing world, especially in the context of the UN SDGs. This means that they may not be able to relate to the situation presented, or even feel disturbed upon seeing the realities and life in the developing world.

5. Prototype

We have started the design of a game prototype for children guided by the transformative game design model proposed. We do this via scenarios, each representing different stages in the model (Figure 1). We have chosen to focus the game on the UN Sustainable Development goal 6 – Clean water and sanitation. The sustainable value(s) to be communicated include: educating the player

on the value of water and the difficulty of sourcing clean water, demonstrating that conserving water helps as well as ways of conserving water. The game begins with a gentle introduction on the issue of access to clean water via a video (<https://www.youtube.com/watch?v=r10YiZjTqpw>), as recommended in literature (Janík & Seidel, 2009). We have named the game Save H₂O.

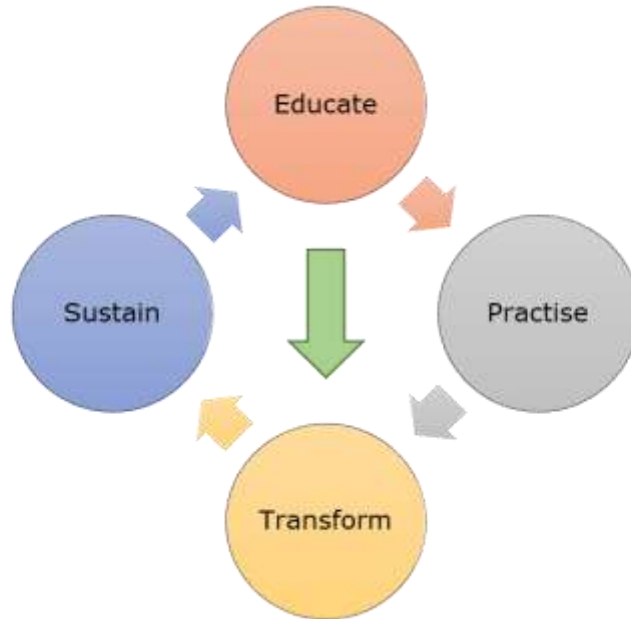


Fig 1: Transformative Game Design

5.1. Educate Scenario

The intention of this scenario is to educate the player(s) on the challenges of sourcing water. The objective of this scenario is to collect a pail of water. The analogy of the desert is used to show a watering well that the player needs to get to in order to collect water. The longer the player is able to stay at the well, the more water they will collect. However, there are several obstacles along the way. If a player gets hit by the obstacles, it slows down the player.

5.2. Practise Scenario

This scenario builds on the educate scenario. The player begins with the amount of water they collected in the first scenario. The player is then presented with different opportunities to use water more sparingly. The water level in the virtual pail will slowly drop with every use. Use will be measured in terms of time spent doing an activity. For example, if they selected showering, the challenge would be to use a minimum amount of time to shower to get clean. A screenshot from this scenario is attached (Figure 2).

5.3 Transform Scenario

The following scenario will present new opportunities for conserving water. Variations of the previous scenario will be shown to the players in a fun and relatable manner, prompting them to make decisions for the avatar in the game. The repeated decision-making by the player will demonstrate the change/improvement in the player's actions as they progress through the scenarios.



Fig 2: Practise Scenario of the Save H₂O Game

5.4. Sustain Scenario

For this level of the game design model, a log of all the repeat scenarios are presented to players. The player is then prompted to go beyond the virtual world by presenting real world challenges to the players. This involves reporting back via pictures/stories of children conserving water to demonstrate they can sustain this practice/sustainable goal.

6. Discussion

This research contributes to the emerging research area concerning values-based digital game design in three main ways: Firstly, it proposes a transformative game design approach and demonstrates its application. Secondly, it presents a scenario creation process for future designers/stakeholders involved in creating scenarios. Lastly, it suggests a design architecture to support the transformative game design model proposed. These findings are synthesised below.

The game design model proposed will be implemented in the future stages of this research, and further analysed. It is however complete as it is and provides an opportunity for future researchers to further explore and improve it.

We also foresee a scenario planning process based on our experience of creating a UN sustainable development goal related scenario for the game. This process is relevant for future game designers, as well as potential players or facilitators of games to customise specific scenarios for the targeted players. The process will be described in a future paper.

Lastly, the game design experience reveals a potential game design architecture for designing games to foster values. The initial architecture is presented in Figure 3 as a starting point. In our future research, we intend to explore the detailed components of the architecture, in particular, the components related to decision support since this is at the heart of influencing or transforming a player's values. Future iterations of the architecture will also consider variations associated with different users' (game designer, facilitators of games and players) perspectives.

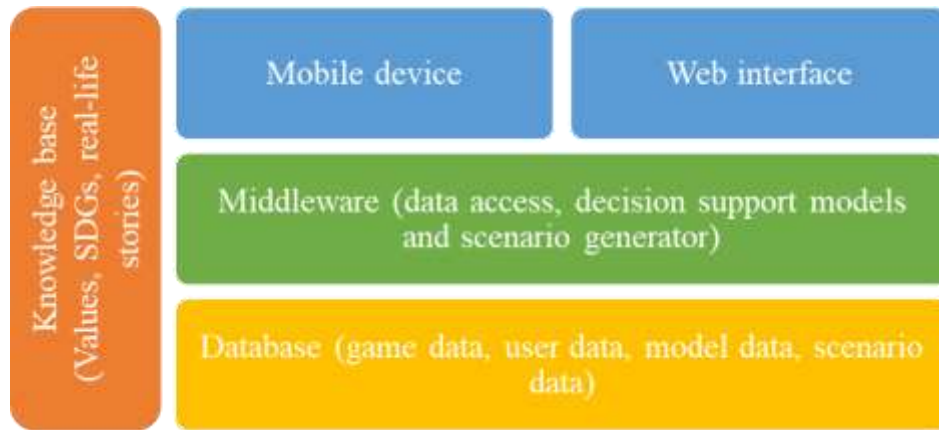


Fig 3: Values-based Games Design Architecture

7. Conclusion

Serious games are often labelled “powerful” because of their “persuasive” nature. Research on their power to educate and transform behavior has also been growing. However, research on the design of values-based digital games is still lacking.

The aim of this research was to use design science to explore, propose and demonstrate the application of design artefacts that can be used for the design of values-based serious games. In order to narrow the scope of this research, we focused on values for a sustainable world, hence explore serious games on mobile devices designed to persuade young players to practice sustainable values (from the 17 UN sustainable development goals).

The key contributions from this research are the conceptual artefacts proposed, as well as the game prototype implemented using some of the artefacts. The real value from games in terms of persuasion is exploring decision-models, and how best to design the game so players have a real-world experience without bearing consequences in the real world. Future research will explore decision-making theories to further this research agenda.

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