UNIVERSITY OF
BATH

DEVELOPMENT OF AN EDUCATIONAL GAME TO TEACH ITERATION AND CONDITIONAL STATEMENTS

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A final year project submitted in partial fulfilment for the degree of
Bachelor's in Computer Science and Mathematics with Honours
University of Bath

March, 2019

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Development of an Educational Game to Teach Iteration and Conditional Statements

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Declaration

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March, 2019

Abstract

To be written.

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Outline of Project

To be written.

Acknowldgements

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Chapter 1

Introduction

Chapter 2

Literature and Technology Survey

2.1 Video Games

The video games industry is growing very rapidly. The value of the video games market was predicted at \$122 billion USD in 2017, and is expected to reach \$180 billion by the end of 2021 [1].

2.1.1 History

In 1958, William A. Higinbotham conceptualised and developed one of the first video games in early video game history. The research and development division he was apart of, was expected to prepare an exhibition that showcased its current research and development projects. Anticipating that the display would not be dynamic enough to generate interest, Higinbotham created 'Tennis for Two' [2].

Prior to Tennis for Two, there were few computer-based games such as 'OXO'. However, those games did not display motion or allow multiple players to play together. OXO was also designed for academic purposes and not for simply entertainment [3].

One of the first modern generations of games is argued to have been 'Spacewar!', created in 1962 [4]. Among these is the game 'Pong' created in 1972, which has been claimed to be a success story that marked the early evolution of video games. The original game of Pong did not contain a single line of program code, it was constructed entirely from television technology, however it has commonly been thought otherwise. Pong's triumph has been credited to the simplicity of its design, whereas 'Computer Space' created around the same time, did not gain popular attraction partly due to its long winded instructions and complex game controls [5].

In the late 1980s, video games became a mainstream media industry [6].

2.1.1.1 Gaming Platforms

Computer games are defined as games that are played on Personal Computers, and video games as games played using a television and a games console [7].

In 1958, Tennis for Two was created using an analog computer and oscilloscope for a screen. Four years later, Spacewar was developed using a digital minicomputer and a cathode-ray tube as the display, making it one of the first computer games. In 1972, Computer space and Pong were among the first video games. They were played on televisions placed in upright cabinets, and this paved the look and feel for future arcade games [3, 5].

Computer games separated from video games in the early 1990s. Since then, 3D home consoles like the Sony Playstation and the Sega Saturn have been introduced. Some innovations to consoles include; touchscreen and motion control [7]. Recently, we have seen the development and the use of Virtual Reality consoles for gaming, entertainment and learning [8].

2.2 Educational Games

Educational games fall under a subset of games called serious games [9, 10]. However, a brief survey of the literature reveals that there exists many definitions for the term "Serious game" [11].

We start with an early definition of the term "Serious game", by Apt in 1970, "Games that have an explicit and carefully thought-out educational purpose, and are not intended to be played primarily for amusement", however agree that they can still be entertaining [12]. Michael and Chen simplifies this definition to "Games that do not have entertainment, enjoyment or fun as their primary objective" [9]. Moreover most agree on a core definition that serious games are (digital) games used for purposes other than mere entertainment [11], which adheres to the definitions by Apt and Michael and Chen.

On the other hand, a thorough defintion provided by Zyda is "a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives". He also suggests that the story is more important than the pedagogy and that the entertainment component should come first [10]. Thus there is a slight contradiction, between the definition by Zyda and the definition by Michael and Chen.

Susi et al. note that there can be difficulties defining the term "serious game" as its constituent terms; "serious" and "game" seem to be mutually exclusive. "Serious" is intended to reflect the

purpose of the game and has no bearing on the content of the game itself. Whereas there are difficulties to defining the term "game" [11].

Although, for the purpose of this dissertation we will use the definition provided by Apt, and work entertainment around the primary purpose of the game - to teach.

2.2.1 History

basic programming atari 2600

To be written.

2.2.2 User Motivation

To be written.

2.2.3 User Engagement

The design and production of video games involves aspects of cognitive psychology, computer science, environmental design, and storytelling, to name a few [13].

2.2.4 User Learning

To be written.

2.2.5 Examples

(Not my words) Robocode (2001) is one of the first environments developed as an open source educational game in order to support java programming

2.3 Educational Game Design

Designing educational games requires a focus that is different from general game design; otherwise, we may end up designing fun games with little or no learning value [14].

Garris et al. describes a "tacit model that is inherent in most studies of instructional games". The model is as follows. Initially, we define a set of learning outcomes and objectives that we wish to achieve. We then design an instructional program which incorporates certain characteristics of games, that delivers the desired learning objectives. Subsequently, the program triggers a cycle that includes user judgments, user behaviours and system feedback. If the pairing of the instructional content with the appropriate game features is successful and effective, the cycle

achieves recurring and self-motivated game play. Finally, this engagement in the game leads to the achievement of the learning outcomes [15]. This model is illustrated in Figure 2.3.1.
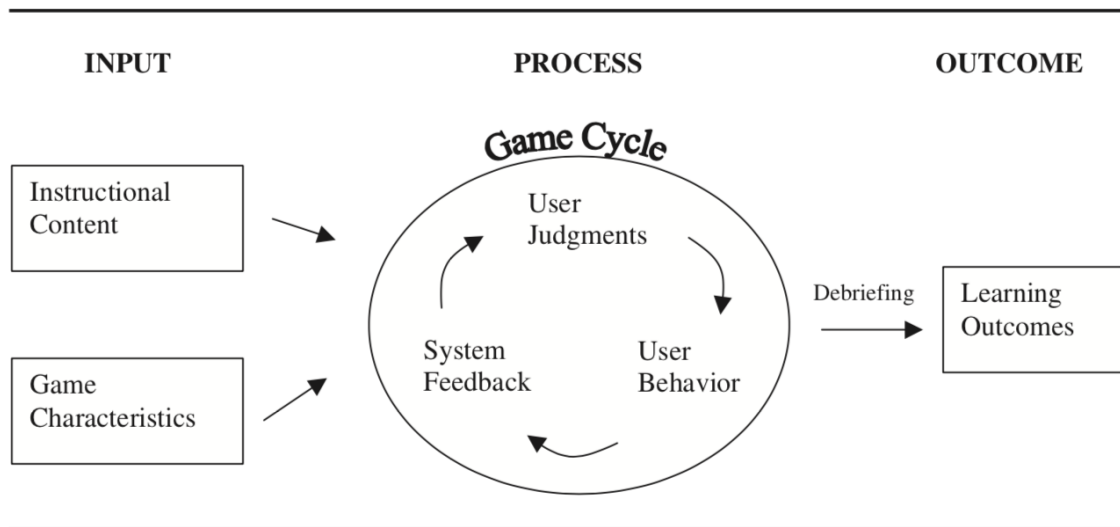

Figure 2.3.1: Input-Process-Outcome Instructional Game Model [15]

2.3.1 Frameworks

To be written.

EFM: A Model for Educational Game Design

2.3.2 Game Design Elements

(CHANGE IT UP) Barnes et al. ran a project that made University Students create games that would teach basic programming. They carried out evaluations to test participant learning from the game, and made some interesting observations as follows: Clear instructions and game goals must be provided and accessible throughout the game, Learning goals must be clearly tied to in-game feedback that motivates the player (through, e.g. experience points, health), and penalizes guessing, Humor can be a motivation for in-game interaction [14].

2.3.2.1 Genre

To be written.

2.4 Resources for Teaching Programming

To be written.

Chapter 3

Requirements Specification

Chapter 4

Design

Chapter 5

Implementation

Chapter 6

Analysis and Testing

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Appendices

Appendix A

Uncertainty Analysis

Appendix B

Screenshots

Appendix C

Ethics Checklist