Development of a Mobile Game utilising Stimuli to Increase Human Reaction Time

A Project Proposal for the Individual Project

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Contents

Abstract

The human reaction is fundamental to any everyday activity, and the speed of this reaction can often change the severity of the repercussion. This project will design and implement 3 small games within a mobile application developed using Unity's game engine, and will aim to improve the human reaction time. The games will utilise visual, auditory and tactile stimuli to induce a reaction from the user, which will then be recorded. The games will be tested by users over a set period of time, and the data will be recorded to evaluate how well the games can improve the human response time.

Introduction

The human reaction time can be the differentiating factor to the severity of any everyday situation, so it is important to keep these reaction times as fast as possible. Whether you are driving or playing a sport, the outcome of every reaction will be defined by its speed and accuracy.

It has been said that playing action video games *'significantly reduces reaction times'* (Dye, Green and Bavelier, 2009). This was proven by having participants play action games like Call of Duty 2 (2005) and Unreal Tournament (1999), and then testing their response time after a period of use. These discoveries led to the motivation behind this project which is to create a series of small games that will require the player to react quickly, consequently improving the speed of their responses over time. The games will be simple versions of popular action game types (i.e. driving and shooting) that demand fast and accurate responses. Action games are the perfect game type to improve response time due to their nature of fast paced gameplay, and their requisite for quick decisions and actions by the player. Once they have been played, a response time reading will be output and then compared to any previous plays. This should show an increase in response time from the first play session of the game when compared to the last, which can then show further proof of video games' ability to improve response times and accuracy.

Reactions within games are caused by various types of stimuli. Technology has the capability of using visual, auditory and tactile stimuli to cause the user to react. Mobile phones are a great example of a device that can utilise all three (See Fig. 1 for an example of a mobile game), for example notifications on a mobile phone can be reported in

Figure 1: A simple mobile phone game (Greenbot, 2015)

the form of visual information, auditory sounds and tactile vibrations to the user. This means that this platform is great to create a response testing game upon, as the game will be able to produce the three stimuli to the user, all within one device in the same instance. A study showed that the response to *'tactile stimuli was significantly shorter'* (Ng and Chan, 2012), then followed by auditory and visual stimuli respectively. This project will test the concept of varying response times to each stimulus by utilising each stimulus at different times. The game will always need to consist of visual stimuli, but it will be enhanced by auditory and tactile stimuli and compared to one another.

Not only are mobile phones a great platform for these simple games, but they are also great for making these games very accessible to the public. There is a huge increasing number of smartphones per capita; the population of smartphone users was at a rate of 75% of males and 73% of females in the UK in 2016, which means that the population of users increased by 21% and 25% respectively since 2012. (Statista, 2018). Fig. 2 below also shows the main demographics of smartphone users and the growth of users in each age.

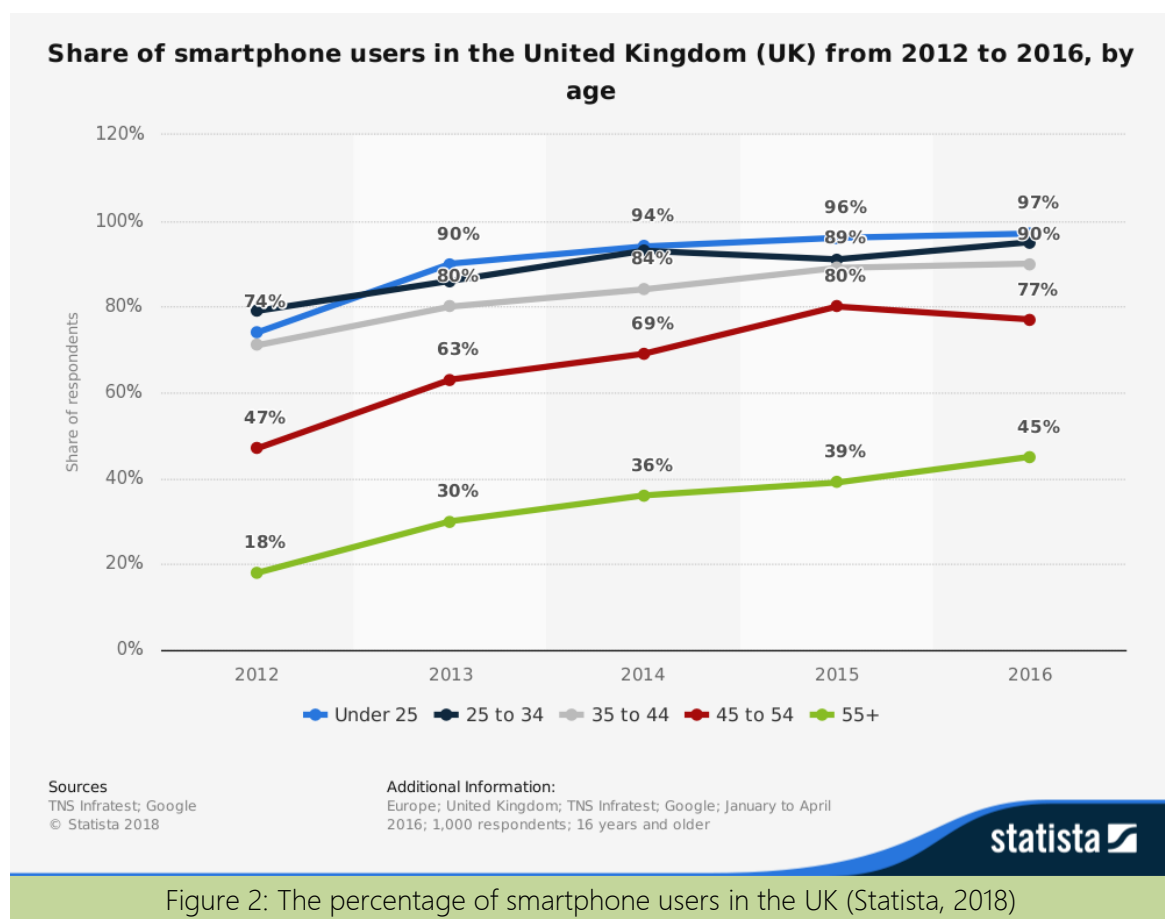Figure 2: The percentage of smartphone users in the UK (Statista, 2018)

These games will be simple and accessible, yet retaining a challenging and entertaining factor, making the improvement of one's reaction time enjoyable. This means this project will enable both gamers and non-gamers to improve their response time for any reason they deem necessary, whether it's to improve their ability in sports, driving, or video games.

Aims

- The primary aim is to create a mobile application for Android using Unity, consisting of 3 games that test response time.
- The secondary aim is to test multiple users' response times over a set period, and compare the results to show any improvement of their response time.

Objectives – What will I do? (Detailed)

Essential Objectives:

- Create a clear and easy to navigate User Interface (UI) to store the 3 games that will be made.
- Create the 3 games which are as follows:
    - A shooting game where random targets will appear on screen that the player must shoot.
    - A driving game where a random course will be created, and the player must choose the correct direction when prompted.
    - A dodging game where missiles will appear on screen that the user must dodge before being hit.
- Implement the addition of auditory and tactile stimuli to initiate reactions.
- Design two scoring algorithms:
    - A score which combines the players' reaction time and accuracy to output an integer style score.
    - A score that shows the average reaction time of the player which can be used for testing purposes.
- Test a group of users' reaction times over a set period of play-time, to then determine any improvement of reaction time through extended participation, and compare visual stimuli to reactions caused with the addition of auditory and tactile stimuli.

Surplus Objectives:

- Create a leaderboard for users to compare their reaction times against others.
- Design levels and waves for the games instead of random generation to allow users to make progression through the game.
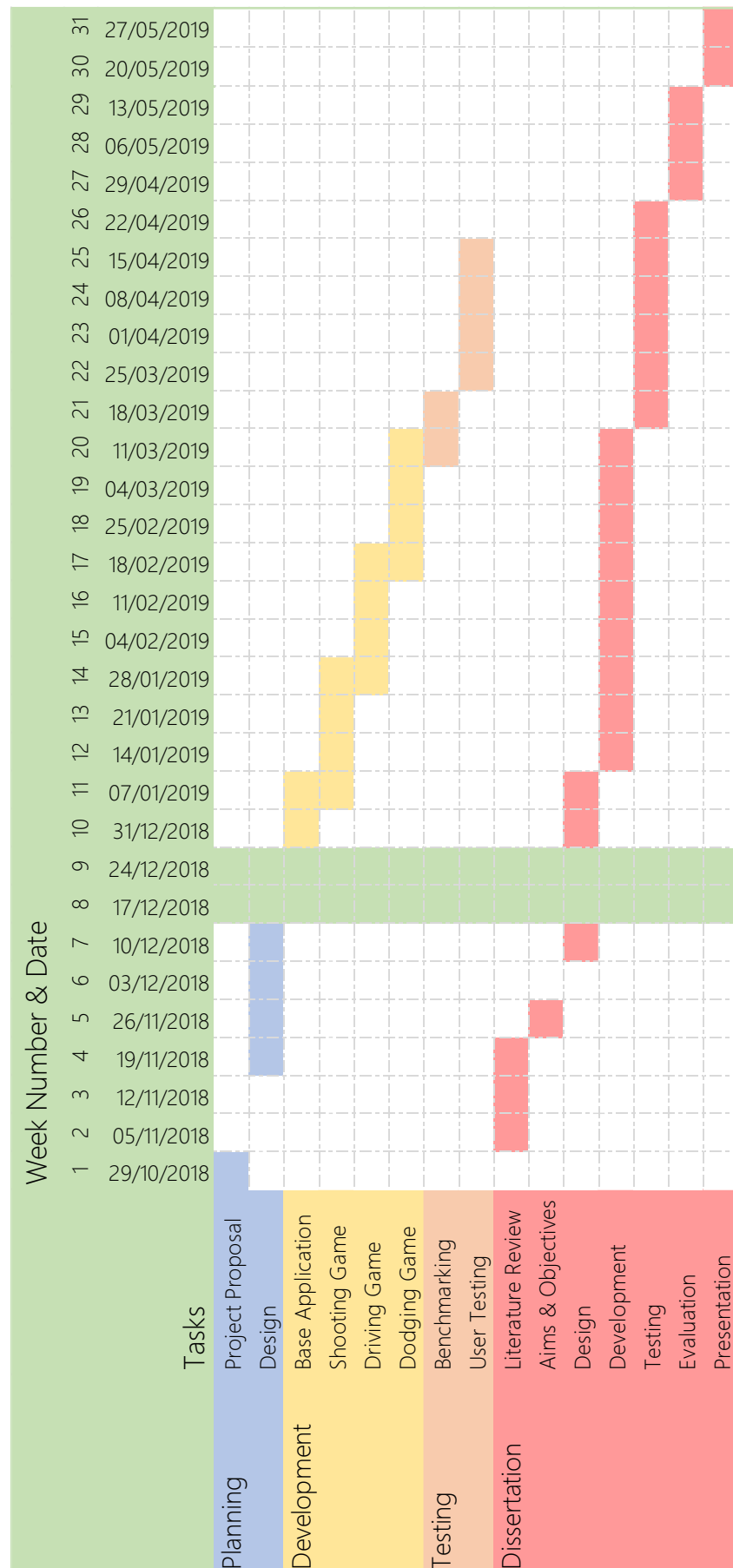- Create different environment styles for each minigame.

Methodology – How will I do it?

The project will begin with a literary review that will discuss any previous work relative to the human response time, and also video games' impact on the human reaction. The processes taken to calculate response time will be considered, as well as the procedures other studies have taken to try and improve the responses over a period of testing.

Once the literary review has taken place, the design and development of the application will begin. The goal for this project is to consider any previous work/games, and then progress and improve upon it during the design process. The design will begin with a simple overview of the application design and also the 3 games. The games will need to be designed with how the response time calculator will work in mind, and these will differ between the three games. Due to this differentiating factor, the response times will not be able to be compared to one another, and will leave the user with 3 separate response time averages when the games are played; this will be considered when it comes to testing. The games' visual design will be simple to accommodate for mobile phones' smaller screens, relative to the size of a computer monitor. The UI for the games will also be clear and basic to reduce as much confusion for the user (which will also be minimised by a user guide that will be included within the app). The assets that will be used for the game will come from a free simple asset website that are available for public use (Kenney, 2018). This means that along with Unity's free licence, there is no budget required for the production of this project. During the application's development, benchmarking will be done using multiple Android devices. This will be able to test how the application performs on lower end specifications, as well as how different resolutions will affect the application's UI.

Testing will be carried out upon completion of the application, by taking participants and getting them to use the application for a set period of time, and then taking results. Three groups of participants will be used to test the difference in response times between visual stimuli on its own, visual with auditory stimuli added, and finally with visual, auditory, and tactile stimuli combined. These results will then be compared to evaluate the application's ability to improve the user's reaction time. The intended outcome of this project is to prove that video games do have the ability to improve reaction times, and that an easily accessible and simple game can make aid that improvement.

Plan

	Week Number & Date																															
Tasks		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
		29/10/2018	05/11/2018	12/11/2018	19/11/2018	26/11/2018	03/12/2018	10/12/2018	17/12/2018	24/12/2018	31/12/2018	07/01/2019	14/01/2019	21/01/2019	28/01/2019	04/02/2019	11/02/2019	18/02/2019	25/02/2019	04/03/2019	11/03/2019	18/03/2019	25/03/2019	01/04/2019	08/04/2019	15/04/2019	22/04/2019	29/04/2019	06/05/2019	13/05/2019	20/05/2019	27/05/2019
Planning	Project Proposal	■																															
	Design			■	■	■	■	■																									
Development	Base Application										■	■																					
	Shooting Game												■	■	■																		
	Driving Game																	■	■														
	Dodging Game																				■												
Testing	Benchmarking																					■											
	User Testing																						■	■	■	■							
Dissertation	Literature Review		■	■	■																												
	Aims & Objectives					■																											
	Design							■			■																						
	Development												■	■	■	■	■	■	■	■	■	■	■	■									
	Testing																										■	■					
	Evaluation																													■	■		
	Presentation																															■	■

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