On the Core Elements of the Experience of Playing Video Games

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Declaration

I, Eduardo Héctor Calvillo Gámez, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Although some of this research has been published with my supervisors as co-authors, Paul Cairns, Anna L. Cox and Ann Blandford, the work reported is my own.

Abstract

This dissertation presents a multi-method approach to study the user experience of playing video games. The motivation is to devise an objective assessment of the concept of user experience. It is proposed that user experience is better understood when it is studied as a two fold phenomenon formed by a process and an outcome. This definition allows the combination of the subjective nature of experience together with the objectivity needed to propose an objective assessment of experience. An experience is personal in the achieved outcome, during the process of forming it there are elements specific to the type of experience common to all individuals.

The thesis presents a series of studies to explore and understand the gaming experience as well as to identify the procedural elements of the experience. The outcome of the studies was the formulation of the theoretical framework that we called Core Elements of the Gaming Experience (CEGE), which focuses on the process of the experience. The metaphor of "puppetry" is used to provide a link to the outcome of the experience. Based on the theorical framework, a questionnaire and model were developed. The model was validated using Structural Equation Modelling, which provided an adequate fit suggesting that the CEGE model is an accurate abstraction of the process of the gaming experience. Lastly, the framework was used to study different gaming experiences under different conditions. The results suggest that the CEGE theoretical framework can be used to assess this type of experience.

The contributions of this dissertation are: the methodological approach used to study the user experience of playing video games, a novel approach to understand user experience as a falsifiable concept, a theoretical framework and metaphor to describe the gaming experience, a model that describes the gaming experience, and an instrument that can be used to assess and explore different gaming experiences.

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Acknowledgements

Julio Cortazar writes in *Rayuela*: *No puede ser que estemos aquí para no poder ser (It can not be that we are here so we can not be).* Without a doubt, pursuing a Ph.D. has been one of the hardest things I have done in my life. Not only because of the actual content of the thesis, which had it troubles, but because of the process that has been culminated in this document. This process has shaped, and some times tested, my personal development, my confidence and myself in almost every way that define me as a person. Pursuing this Ph.D. has helped me to be.

I was happy to endure this process because I did not do it alone. I was lucky to have the company of many capable, friendly and caring people along the way. Without the guidance, trust and friendship of **Paul Antony Cairns** this process would have derailed long time ago; I will always be proud of calling him my supervisor and, if he approves, colleague. The UCL Interaction Centre (**UCLIC**) provided a great environment to work as a research student. Every member of UCLIC contributed in one and many ways, from discussing ideas and reading drafts of my thesis and papers to going to the pub to share my frustrations or successes, to all of them a big thanks. Especially to **Dr. Sarah Faisal** for being my colleague, **Dr. Jonathan Back** for his advice, to **Dr. Simon Attfield** for his wisdom and to **Dr. Jeremy Gow**, part of UCLIC extended family, for his guidance. To **Dr. Anna L. Cox** for agreeing to be part of my supervisory team after the turmoil, all her feedback was much appreciated and insightful; and to **Prof. Ann Blandford** for being part of my supervisory team before the turmoil.

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A Paola, Valeria, Ximena y Juan Pablo

Porque para hacer un doctorado se requiere corazón y curiosidad de niño

Chapter 1

Introduction

The trouble with "research" is that by dint of searching one often discovers... what one did not seek to find (Genette, 1997, p.1).

This dissertation presents a theoretical framework, a model and a methodological approach to assess the user experience of playing video games. The concept of user experience is usually referred to as the subjectivity of the interaction between user and computer application. The argument of this thesis is that this view of user experience hinders the development of knowledge regarding user experience. The position regarding knowledge development is based on Critical Rationalism, which is described later in this chapter. This thesis does not aim to be a discussion about the epistemology of Human Computer Interaction (HCI) or philosophy of science. The thesis presents an approach by which, it is argued, it is possible to assess the user experience of playing video games with an objective perspective.

The thesis was not directly motivated by critical rationalism or by user experience, but by input devices; hence Genette's quote presented above. The role of input devices was greatly diminished in the course of this research, as the study of the concept of user experience become more dominant. The use of input devices still features in the experiments performed in chapters 4 and 8, but just as an aid to understand the study of user experience. This chapter introduces the thesis by discussing its motivation, including that of input devices and critical rationalism, to contextualise the aim of the research and the proposed research question. It also presents the main contributions and an outline of the thesis and the different chapters that form it.

1.1 Voice of the Thesis

It is common practice in Engineering, Psychology and HCI to write scientific reports in the third person or the first plural person. Writing in the third person is supposed to put the emphasis on the topic being discussed, rather than the person guiding the

discussion. Using the first plural is done, as far as I know, because it is not modest to write in the first person singular.

This document reports the scientific approach to answer a research question within certain aim; it also presents the literature review that frames the research question and the different domains for which the thesis is trying to make a contribution. All this is reported in the third person because the focus is the material being presented. Concepts, equations and data have precedence over the person in charge of doing the studies or presenting the material.

However, the research problem addressed is the result of a decision taken by a person, me. I took the decision to address this problem and I accept the responsibilities of the results obtained and presented in this document. I received the advice of my supervisory team, however, any omissions or mistakes are my sole responsibility. It is for this reason that the Introduction and Conclusions chapter are written in the first person. I want to make it explicit that I proposed the research question based on my own scientific motivations. Also, I concluded that the question was being addressed with the method followed and that the answer was satisfactory. Of course, this clarification is only needed because writing in the first person is not common.

1.2 Motivation

The development of new input devices and ubiquitous computing (UbiComp) was the first motivation of this thesis. New input devices are those that aim to take advantage of the natural abilities that humans have, such as pointing, hand waving or sight, in order to enter information to the computer; examples of these are tangible interfaces, passive interfaces, eye tracking, and gesture and face recognition. The main argument behind the development of these new input devices was that they were able to provide the user with a better user experience (Jacob et al., 2008) by providing the user a technology that weaves into the everyday life (Weiser, 1991). The question I had then was, is it possible to know whether these new input devices improve the user experience? Most of the experiments of Tangible User Interfaces, for example, were done under very controlled conditions for very specific applications (e.g. Jacob et al., 2002; Underkoffler and Ishii, 1999; Ishii and Ullmer, 1997). The first approach taken then on the thesis was to use the current concepts regarding user experience, in particular the one proposed by McCarthy and Wright (2004a), to study input devices.

McCarthy and Wright (2004a) propose that the user experience is the subjective outcome of the interaction between individual and technology. The user experience is personal to the individual as it is the result of a sense making process for which the individual provides a rich description. A description that changes every time the experience is told as the experience is ever changing as the individual shares it.

With this approach in mind, the first experiment looked at how two different input devices produced different experiences. The results showed that there were two types of experiences taking place, but it was not possible to compare the experiences. It could be concluded that any changes or differences were due to individual preferences. A more detailed review of the available literature on user experience showed that this was the common case regarding user experience; it is a subjective matter due to a personal interpretation. A series of heuristics propose that to alter the user experience elements such as aesthetics, fun, and etcetera can be taken into consideration. But there was little work on trying to formalise the study of user experience within a falsifiable theory.

Studying user experience involves studying the individual in relations with the environment, where laboratory isolation may not suffice. This difference might be due to the fact that studying user experience within a laboratory with controlled conditions can ignore situations in which the experience is influenced by something more than the technology and the user. Rogers (2004) argues that this makes it difficult to extrapolate existing theories from others fields into HCI; the results proposed by cognitive science, for example, need to be adapted to the reality of an application being used in the real world as much as engineering needs to adapt concept from physics. It might be for this reason that concepts inherent to the experience of the interaction process, such as Presence (Slater and Wilber, 1997) and Immersion (Brown and Cairns, 2004) are developing their own theories to explain the phenomenon.

Once it was determined that the subjective approach was not good enough to explain user experience, the focus of the thesis changed to understand user experience in order to formulate a theory that produces objective knowledge regarding experience. Theories abstract knowledge so that they can help us understand a wide variety of phenomenon, not just a particular instance of it. User Experience as subjective would be just a particular instance and therefore atheoretical.

1.3 Critical Rationalism

The purpose of theories is to help us understand the behaviour of nature and the environment that surround us as human beings. A theory tries to abstract reality so that it is possible to generate knowledge. It is a structure suggested by empirical laws and “tries to explain them in a scientifically rational manner” (Theory, 2009). Sometimes theory provides an accurate description of reality until the discovery of new data falsifies the assertion of the theory; this can happen by proposing more empirical laws that would challenge the existing theories. Popper (1994a) divides knowledge into objective and subjective. Objective knowledge is formed by falsifiable theories, such as conjectures, hypotheses, theories or arguments. Popper argued that knowledge grows by starting with problems and ending with problems, described in

the following formula $P_1 \rightarrow TT_i \rightarrow EE_i \rightarrow P_2$, where P_1 is the starting problem, TT_i are the provisional theories, EE_i are the processes of error elimination through critical discussions, and P_2 is the resulting problem. Subjective knowledge is subject to the phrases *s/he knows* while objective knowledge responds to *it is known*. Subjective knowledge can result from objective knowledge, but in general the same can not be said about the inverse procedure; personal experiences do not produce theories. Subjective knowledge is personal while objective knowledge is general.

To address the interaction between objective and subjective knowledge, or the study of the body-mind problem, Popper (1994a) differentiated between 3 worlds: World1 is that of physical objects, World2 is that of mental states and World3 is that of products of the mind. World2 is where subjective knowledge resides, while objective knowledge is part of World3. One of the main characteristics of the World3 is its autonomy. For example, numbers are a product of the human mind, but once numbers were "discovered", they became autonomous and started having problems in their domain, such as the properties and characteristics of the number i. In real numbers, the square root of a negative number does not exist, however, by defining $\sqrt{-1} = i$, early mathematicians were able to overcome the apparent problem of square roots of negative numbers. Eventually, i became an autonomous concept that developed into complex calculus, and then digital communications were based on these theories. In this example, the concept of i was general, it was identified as the product of human intelligence and not a mental state of a person.

Based on this approach to science, a theory is not validated but corroborated (Popper, 1959). This can be done by showing that a model, a mathematical representation of reality (Model, 2009), formulated based on a theory, is untrue. In formulating a theory, it is usually necessary to first formulate a framework, a basic conceptional structure (Framework, 2009). A theory can be falsified based on new experiments devised once there is a better understanding of the environment, these experiments provide a better understanding of the theory, and can then build upon it to provide a greater explanation. Statements made from the theory, however, can be verified. The falsification of a theory does not necessarily mean that it is erroneous, it just provides a better understanding of the boundary cases.

User experience has been defined as subjective, as part of World2. However, the need to design and evaluate experience suggests that it should be objective. User experience should be grounded on a general theory that produces falsifiable statements regarding experience.

1.4 Aim of the Thesis

Based on this, the aim of the thesis is to assess the user experience of interacting with computer based applications using, a critical rationalist approach. That is, to

understand and formulate a general concept of experience that can be used in a general way and that has the ability to produce scientific knowledge as proposed by Popper. The definitions of experience and user experience are revisited in Chapter 2 to provide a common ground on what it is meant when referring to it. In order to produce scientific knowledge, the aim is to produce a theoretical explanation that describes and predicts the user experience of interacting with computer based application, such that it would be possible to produce falsifiable statements and produce autonomous concepts. Although it might not be possible to achieve the aim completely, it is reasonable to accept that this might be a starting step towards a general theory of experience.

The specific domain of application to study experience is video games as they are conceived as an application designed to produce a positive experience. This quality of video games lends itself as an ideal test bed to study experience; as it is not necessary to motivate the use of the application.

1.5 Research Question

The aim above can be established as the following research question that this thesis tries to answer: Is it possible to objectively assess the user experience of playing video games? An objective assessment would test falsifiable statements regarding a specific phenomenon, as discussed in Section 1.3, such that it would produce a general understanding of user experience, not just a personal interpretation of the phenomenon. Based on the results discussed during the thesis, to analyse the thesis two more questions are proposed: which are the elements of the process of the experience of playing video games? And, can these elements be used to objectively assess the experience of playing video games?

The elements are defined as the core elements of the gaming experience, which are the necessary but not sufficient elements that provide a positive experience after engaging with a video game. The scope of the study of experience of playing video games is with respect to a single player engaging with a game. Although the study is centred with single players, the type of games they use might not be single player games. For example, players may be playing Starcraft, a game that can be potentially played with four different players, but only the experience of one player, and not the interaction among players, is studied. In Chapter 5 there is a broader discussion regarding this issue.

1.6 Major Results

The major results and contributions of this thesis are:

1. A proposed definition to understand user experience.

2. The Core Elements of the Gaming Experience (CEGE) theoretical framework.
3. The metaphor of "Puppetry" to describe the gaming experience.
4. A questionnaire to assess the CEGE theoretical framework.
5. A validated model based on the CEGE theoretical framework.
6. Examples of using the CEGE framework with real world examples.

1.7 Overview of the Thesis

The thesis is composed of nine chapters, including this one. In general it follows quite a linear development as one chapter usually depends on the previous one. There is, however, one chapter that it is quite not so linear; Chapter 4. This chapter is the motivation of the thesis, as described above, because it shows that the current view on experience was not strong enough to allow comparisons. The chapter would fit better as part of the literature review presented in Chapter 2. That is, the definition proposed for user experience in that chapter was inspired in the fact that Chapter 4 showed poor results under the status quo definition. It was from Chapter 4 that the research question proposed below came about.

Chapter 2 presents a literature review and proposes a new concept for "user experience". The chapter reviews the different approaches to user experience from both design and evaluation perspectives. The status quo on User Experience is to consider it as subjective. The proposed definition divides user experience as a process and an outcome. The process being common to few individuals while the outcome is personal. The thesis suggests that by studying the process, it is possible to formulate an objective understanding of experience.

Chapter 3 discusses the literature review of video games and games. The review focuses on the different methods to evaluate the user experience of playing video games. The results suggest that the experience of playing video games is usually focused on extreme experiences, such as immersion. This thesis is focused on the prosaic experience of playing video games. Prosaic experience is the everyday, ordinary experience of a user with technology.

Chapter 4 presents the first series of experiments to study and understand the experience of playing video games. The experiments focus on the outcome of the experience. The results show that the outcome is useful when the objective is to understand the personal experience, but it fails when it is used to compare among them. The results also show that the experience of playing video games is influenced by a series of factors that are not necessarily germane to playing a video game, and that there are also common elements among the different experiences. The sense of frustration was also found to be part of the experience.

In Chapter 5 a grounded theory study is conducted to identify the common elements of the gaming experience. The gaming experience is defined as the one to one relation of player with game, ignoring foreign aspects that can have an influence on the experience. The core elements are the necessary but not sufficient conditions to provide a positive experience. The result is formulated as the theoretical framework referred as the Core Elements of the Gaming experience, which is formed by a series of elements and the relationship among them.

Chapter 6 presents the development and evaluation of a questionnaire based on the ideas previously formulated. The questionnaire was developed following psychometric methods and it was deployed to almost 600 participants. The results suggest that the questionnaire was a valid tool to obtain data based on the framework.

Chapter 7 presents an abstraction of the theoretical framework in the form of a model. The model is validated using structural equation modelling and the data obtained from the questionnaire. The results suggest that the model is valid thus corroborating the framework.

Chapter 8 presents a series of experiments for which the CEGE framework is used to explain and describe the different experiences. The results suggest that the theoretical framework is a reliable tool that can be used to compare and differentiate experiences of playing video games.

Chapter 9 presents the final conclusions of the thesis, future work and the limitations and contributions of this work.

Figure 1.1 presents a graphical outline of the thesis. In this is presented the relationship of the different chapters discussed above. Finally, I wrote a short story based on the theoretical framework which is presented in Appendix A. The story is included as a way of seeing how the theoretical framework fits in the common understanding that the experience is also subjective and it is also part of every day life.

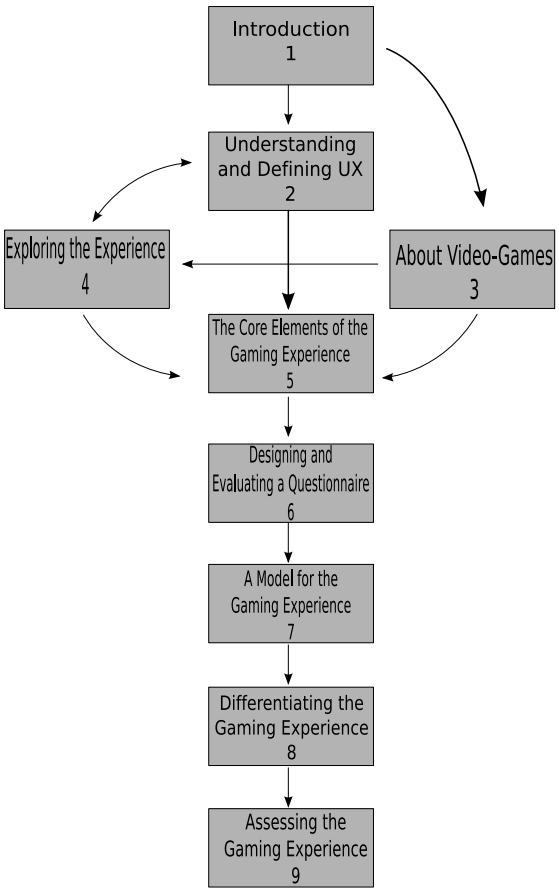


Figure 1.1: Outline of the chapters of the thesis

Chapter 2

Understanding and Defining User Experience

As was established in the previous chapter, the aim of this dissertation is to explore the possibility of assessing the "user experience" under a critical constructivism perspective. This chapter analyses the concept of user experience. The term User Experience (UX) is constantly used in the interaction-design literature (e.g. Arnowitz and Dykstra-Erickson, 2007). UX is associated to the user's subjective feeling of interacting with a usually digital application. But, what is Experience? The importance in identifying the meaning is that UX is not a term just used for philosophical discussion about the paradigmatic views on Human-Computer Interaction (HCI). UX is becoming the objective of certain areas of interaction design and HCI. There is a growing need to evaluate and design for the UX. But, if experience is subjective then, what do designing and evaluating UX mean? The objectives of this chapter are to understand the concept of user experience as used in the HCI domain and to propose an understanding that would lead to the operationalisation of the concept. The review looks at the different proposed models and understandings to design and evaluate UX. The discussion is enriched with concepts from pragmatism and phenomenology.

The chapter is divided into three sections. The first section discusses the UX within HCI by looking at the design and evaluation of experience. The second section discusses the concept of experience from a broader spectrum, looking at two different schools of philosophy. In the third section, a definition for experience is proposed; the definition is built on the philosophical review and contextualised within HCI.

2.1 HCI & User Experience

Within HCI, User Experience is usually associated when an application goes beyond usability and looks at the relation of the user and the application (e.g. Dix, 2003). Usability is how an application is implemented to let the user perform a task effectively and efficiently; the main focus is productivity, to let the user do the tasks with good quality in an optimal time. Secondary goals are user preference and satisfaction (e.g. Bevan, 1995; Frøkjær et al., 2000). Looking beyond efficiency, designers tried to

maximise user preference and satisfaction. They start looking at something beyond usability, something that could provide the user with a better experience.

It can be argued that the primary objective of HCI as a discipline is to improve the experience of the user. Usability guidelines such as those proposed by Nielsen (1993), or Norman's descriptions of how users interact with everyday things (2002) originated with the aim of providing to the individual an application that can be used without causing any distress: a system with poor usability or not designed for the human in mind is likely to provide the user with a poor experience.

User experience is a relatively new concept within HCI. Rogers et al. (2002, p.18) define it as how the interaction *feels* to the users. They address experience leaving it as a term full of subjectivity: an application taps into experience, when during the interaction process, factors such as fun, enjoyment, pleasure or aesthetics have an influence on the user. This seems a typical understanding of user experience within HCI. This use of the concept "user experience" has both problems and advantages. The problem is that it means too many things as described above. The advantage of experience is that it gives a blunt definition to a concept that is tacitly understood but that has not been properly articulated.

To address the concept of experience the discussion is divided in two: design and evaluation. Design for experience is a holistic approach to understand the user in relation to the task and the context. Evaluation looks at the state of the user while interacting with the application. Both views are presented at length below.

2.1.1 Designing for UX

The Apple (2008) guidelines for interface design divide the decision making process when designing for experience in three layers: minimum requirements; features expected by users; and differentiation (see Figure 2.1). The bottom layer on which the application lies is the one that complies with the minimum requirements; it is here where traditional usability and HCI concepts lay. The middle layer is about user and task; the user is able to interact with the application in the desired fashion and the application also has the features that the user expects to perform the task. The top layer refers to those differences that an application can have once it conforms to the minimum requirements and provides the expected features. This layer can be understood as what Apple might suggest as a commercial difference. But, the model can also be interpreted to explain the idea of designing for experience. The model reflects the idea discussed above regarding the fact that an application that is not usable would produce a poor experience; this is the bottom layer. On the other hand, the two top layers are about a closer understanding of the user, the task, and those differences that make an application more appealing than others. These two layers, middle and top, form what it is usually referred to as the user experience.

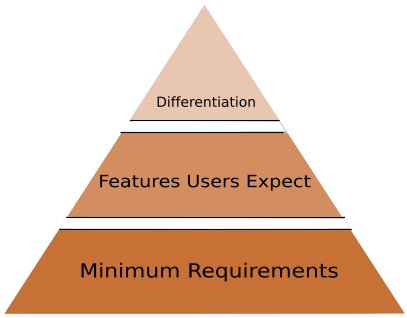


Figure 2.1: Figure adapted from Apple (2008).

The middle layer of the model provides the features the user is expecting, so it is necessary to study and learn from the user, the task and the context in which the application would be used (Buxton, 2007; Kuniavsky, 2003). Designing for UX is to understand the needs of the user, and making sure the application fulfils those needs. The designer should not only care about designing the application itself, but also to understand the different rules that surround the task and user while having a clear model of the context in which the task is being done.

The relationship between application, tasks and user is summarised in the model of the elements of the user experience for the World Wide Web (Garrett, 2002). In this model experience is defined as: "how the product behaves and is used in the real world" (Garrett, 2002, p.10). This model tries to provide a step by step relationship between the application and the user needs. These are divided in five stages, from abstract to concrete: Strategy; Scope; Structure; Skeleton and Surface. See Figure 2.2.

The relationship between user and application per stage are: Strategy, formed by the user needs and site objectives. Scope, formed by the functional requirements and content requirements. Structure, formed by Interaction design and information architecture. Skeleton, formed by information design, interface design and navigation design. Surface, the visual design, or what the user actually sees (look and feel). Within each stage, there are factors in which the Web application is considered as a software interface, or as a hypertext system. That is, in each stage the designer has to take into consideration the functionality of the system and how that functionality is portrayed into widgets or UI elements. Although this model is mainly geared for web site design, it provides a good reflection of what is considered designing for UX: A design methodology based on the user at the centre of the process in which the application is tailor-made to the user requirements. Thus, it would provide the features that the user expects.

This relationship between user, task and tool as experience is presented in Kuniavsky (2007, p.914) definition, "Understanding the user experience [...] is the process

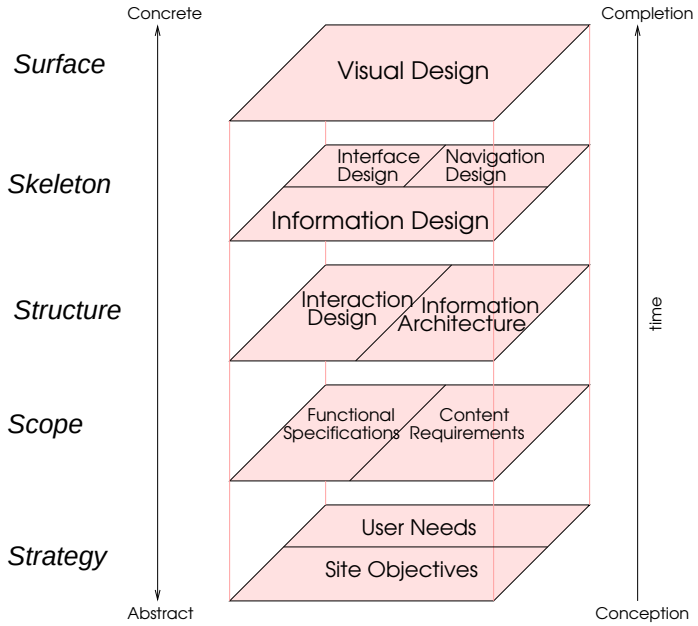


Figure 2.2: Elements of the user experience for the WWW proposed by Garrett. The elements are organised from concrete (top) to abstract (bottom). The vertical divisions in each stage separates the user interface to the left and the hypertext functionality to the right, and the horizontal division in each stage separates structural information to the front and surface information to the back. Figure adapted from Garrett (2002, p.33).

of understanding the end-user needs and the organization needs with the goal of maximizing the benefit to both". But when maximising the benefit for two different entities, both of them need to compromise. It might be that adding features might complicate the usability of the system, or the production time of the organisation. Kuniavsky's view of experience is based on the idea that software tools are produced by organisations that, they despite wanting to accommodate the user, have their own interests. And it is from the organisation interests that a difference in the application should be made to balance the shortcomings. This difference is represented in the top layer of the model.

This differentiation is to be done once the application has complied with the minimum requirements and the users' expected features. Besides the commercial differences that can be added to the application, the research community also looks at what can be added to the user-task-tool relationship to improve experience. Subjective elements can be added that aim at providing the user with a personal appeal to the application. These subjective aspects are usually associated to aspects such as value (Cockton, 2004), emotions (Norman, 2005, e.g.), hedonism (e.g. Stelmaszewska et al., 2004) or aesthetics(e.g. Hassenzahl and Tractinsky, 2006; Wright et al., 2008; Rullo, 2008). The relationship between the subjective aspects of this top layer can influence how the user feels about the other two layers, such that "pretty" interfaces

might appear to work better (Chawda et al., 2005).

The objectives drawn for each layer of the model could be enforced by relaying on different methods and theories. For the bottom layer, usability techniques can be used to assess, as close as it can be done to the majority of users (Schiller and Cairns, 2008), if the minimum requirements of the interface were met. For the middle layer, to understand the relationship between task and user, qualitative methods can be followed to gather characteristics of a type of group and then try to generalise for a wider population (e.g. Beyer and Holtzblatt, 1997; Simonsen and Kensing, 1997). The top layer is where the generalisation stops. What gives value, emotional or aesthetic appeal to the application is the user interpretation of those properties, not necessarily the aim of the designer. Subjective appreciations are, as the name implies, up to the individual in which even a thorough understanding of the user, task and context might result in very different perceptions of the application as a whole. That is, to understand if the objectives drawn at each level are met it is necessary to evaluate them. This is the point at which to consider the other side of the HCI-UX relationship, evaluation of UX.

2.1.2 Evaluating the UX

Since designing for experience is designing for the user needs, evaluating experience would be to evaluate if those needs were satisfied; this could be done with standard quantitative methods. However, it has been argued that these are not enough to really understand the experience of the user (Faisal et al., 2008), and that qualitative methodologies should be followed instead (Light, 2006). Although the interface, or the product, itself can produce a reaction on the user (Hassenzahl and Ullrich, 2007), when UX is being evaluated it is not the application that is under scrutiny, but the interaction of the user with the task (e.g. Beaudouin-Lafon, 2004).

It can be assumed that the objective of this evaluation is to assess whether the user would have a positive experience as a result of the interaction. To evaluate, and understand, the individual's state during the interaction process there are concepts such as Flow (Csikszentmihalyi, 1990). This concept looks at what can be considered as "extreme experiences", that is, states in which the user feels as separated from the real world due to a very positive experience. Assessing these states is cumbersome under traditional methods as it is not possible to ask the participant to step away from this state in order to be queried. The evaluation is usually done through a process of reflection, or by validating that the participants have reached the number of stages necessary to reach such level. In Flow, Csikszentmihalyi studied activities that produced positive experiences on people. He defined Flow as an experience so gratifying that people are willing to do it for its own sake. The essential steps to produce Flow are:

1. To set an overall goal, and as many sub-goals that are realistically feasible.
2. To find ways of measuring progress in terms of the goals chosen.
3. To keep the concentration on the activity while making distinctions of the finer details in the challenges involved.
4. To develop the necessary skills.
5. To keep raising the challenges if the activity becomes boring.

When a person is in Flow, then that person is experiencing a state in which there is a loss of self-consciousness, a distorted sense of time, and a sense of control on the activity. The person is fully concentrated on the task, able to assess any progress towards the goal because there is a clear feedback, and the challenges are matched with the abilities, not too hard and not too easy. Flow, and the positive experience, has an effect on the emotional state of the individual. After being in Flow, the person might feel happy and satisfied as it produces an experience that is intrinsically rewarding. Regardless of the personal experience induced by Flow, the steps to reach it are common among individuals.

A different approach to understand the individual's outcome of the interaction is to use physiological data (e.g. Mandryk et al., 2006). A series of physiological changes can be correlated with the idea of a positive experience. To obtain this type of data, a series of bio-sensors are strapped on the user in order to monitor the different bio-signals. There are two drawbacks in using this approach, firstly is that the use of the bio-sensors is invasive; secondly, the physiological changes have to be correlated with a mental state of the participant that would produce such reaction. That is, physiological data can produce insight for extreme experience, but it would be hard to use on everyday experiences. The prosaic experience is the common everyday experience that individuals have on a regular basis, without being extreme, it is just the norm that makes a simple interaction enjoyable.

Looking at the everyday prosaic experience, McCarthy and Wright (2004b) propose the idea of studying the concept of experience using a pragmatic approach. They argue that the experience is formed by four threads: compositional, emotional, spatio-temporal and sensual; and that the user makes sense of the experience in six different ways: connecting, interpreting, reflecting, appropriating, recounting, and anticipating. See Figure 2.3 for a graphical representation of the elements of experience and the way the user makes sense of them. Describing further the threads of experience, Compositional is how the elements relate together to form a coherent whole; Sensual is how the experience makes the individual feel from an aesthetic point of view; Emotional is how the user reacts to the experience, and which emotions are a consequence of the action; lastly, Spatio-Temporal is about the time and place where

the experience took place. The user makes sense of the experience by Anticipating, relating to the previous information that the user had before encountering technology again; Connecting, which is the judgement when the user starts experiencing; Interpreting how the experience is evolving and how the user works out what is happening; Reflecting is the evaluation of what happened, and how it changes the user; Appropriating is when the user makes the experience part of hers, and then relates it to all the previous experiences. Recounting is the socialisation of our experience by storytelling what happened. This approach formalises the idea that the experience is subjective, focusing on its internalisation and the outcome produced.

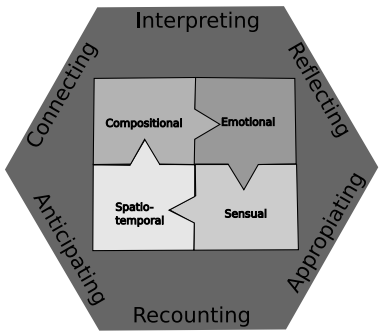


Figure 2.3: Technology as Experience, proposed by McCarthy and Wright (2004a). The model argues that experience is composed by four different threads, the square at the centre, and the user makes sense of all of them in six different ways, presented in the edges of the outside hexagon. Figure adapted from McCarthy and Wright (2004b).

In defining experience, there are the boundaries of interaction with the tool and the user's relation to their own experience (Forlizzi and Battarbee, 2004). Accordingly, fluent, cognitive and expressive are the three types of interactions with a product. Fluent experiences are those that happen almost automatically, the user does not need to perform any conscious activity to do them, such as riding a bike or turning on the television. Cognitive interactions are those that require the user to process information to make sense of them, such as using a calculator. And, expressive interactions are those that help the user form a relationship to the product, such as personalising a computer or painting a room. These three interactions are not exclusive. There are three results of the interaction between user and tool: experience, an experience and co-experience. The constant experience with the product is the experience. From the general experience, an experience can be articulated or named and it inspires emotional and behavioural changes. For example, walking in the park can be considered as a constant experience or just experience, while walking the park with a desired person can be considered as an experience. A co-experience is user experience in a social context. Figure 2.4 present a graphical representation of the model and the interactions.

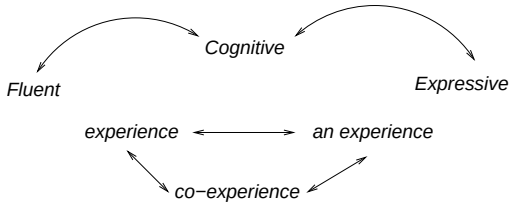


Figure 2.4: There is a constant change in the type of interactions we are having in every experience, a fluent interaction can turn into cognitive interaction which then can turn into the experience into an experience. Figure adapted from Forlizzi and Battarbee (2004).

Understanding experience is about understanding the user interacting with the environment. In the design process, this meant understanding the user, task and context; in the evaluation process it is to understand the interaction, observing the state of the user in relation to the task and context. This idea that experience is the whole of the interaction can be problematic. The experience is formed by different parts but it is the user who decides what makes a good experience once all the pieces are put together (Dix, 2003); this produces a completely different experience than the one intended by the designer (Hassenzahl, 2003). Thus, experience is personal as it is up to the user to make sense of it by connecting the different threads. At the same time, it is possible to classify when the individual has reached an extreme experience when a series of characteristics are achieved. It seems that the research community is gearing towards a subjective definition of experience (Law et al., 2009).

The problem with experience being personal is that, by definition, it is not general. As mentioned in the previous chapter, knowledge grows due to its objective nature. Personal knowledge is subjective.

So far, experience is still a concept grounded in the subjective feeling of the user. The design for experience is based on the context and needs of the user to face a task. Evaluating experience is evaluating the whole of the interaction. Both views are addressed in a case by case basis. In order to look at experience, if possible, under an objective scope, a more manageable definition is needed. A definition grounded in the everyday experience.

2.2 The Concept of Experience

In the everyday life, the concept of experience does not need further explanation. Experience is about the constant interaction with the environment as experience forms the moments of life. The Merriam-Webster's Collegiate Dictionary (Experience, 2009) defines experience as follows:

Experience:

1. (a) Direct observation of or participation in events as a basis of knowledge
   (b) The fact or state of having been affected by or gained knowledge through direct observation or participation
2. (a) Practical knowledge, skill, or practise derived from direct observation of or participation in events or in a particular activity
   (b) The length of such participation
3. (a) The conscious events that make up an individual life
   (b) The events that make up the conscious past of a community or nation or humankind generally
4. Something personally encountered, undergone, or lived through
5. The act or process of directly perceiving events or reality

Based on the definition, it can be said that experience is intrinsic to human life. Every activity that a human performs constitutes and produces an experience. Experience is time, action and inaction by an individual. But experience is also what constitutes a community, by pulling all the individual experiences together. Experience has a dual property within the human life, it is process and outcome; it is the individual and the community. Experience might be personal, but it is also shared among the same community. This dual property of experience, along with its tacit understanding, has made it a topic of interest for different branches of philosophy. Two particular schools of philosophy are reviewed next: Heidegger's Phenomenology and Dewey's Pragmatism. These two schools had been used previously within HCI in order to understand experience and the relationship between user and object.

Phenomenology considers that "the central structure of an experience is its intentionality, its being directed towards an object by virtue of its content or meaning together with appropriate enabling conditions" (Zalta, 2007). Phenomenology looks at the experience beyond the sensory qualities of it and it explains the relationship that the experience has with the person. Experience in phenomenology is the relationship between individual and object, and as such should be studied (Zalta, 2007). Among the different schools of thought within phenomenology, Heidegger (1951) discussed this relationship between individual and object. Heidegger argued against the Cartesian dualism, and defended that it is not possible to separate mind and body, as one needs the other. Individuals can indeed think and be, but this is not one as a consequence of the other, but as a relationship between both of them. In order to understand an experience, both the object and individual are joined together, and

they can not be divided, Heidegger would argue. This relationship can be seen in his concept of Thrownness which is "the condition of understanding in which our actions find some resonance or effectiveness in the world" (Winograd and Flores, 1986, p.33). That is, the object is used by the individual in order to accomplish a task of the individual, not of the object. Such as, when driving a nail with a hammer, there is no need to have a mental representation of the hammer, but to understand the concept of hammering. Furthermore, Heidegger argued that meaning is social and can not be produced by individual activities. The use of the tool comes from this understanding of the task, for which there is a relationship between individual and object.

Pragmatism, a different school of philosophy, studies the practical consequence of the actions, rather than looking at the relationship between object and individual. Among the branches of pragmatism, Dewey studied experience for education and art. Dewey stated "the quality of experience has two aspects. There is an immediate aspect of agreeableness or disagreeableness, and there is its influence upon later experiences [...] Hence the central problem of an education based upon experience is to select the kind of present experiences that live fruitfully and creatively in subsequent experiences" (Dewey, 1997, p.27). Experience produces an outcome, it is not only the process of interaction of individual and object, but there is an influence upon later experience or instant reactions. It is from this reaction that a bad experience might have the effect of mis-representing future experiences such that an experience can be "mis-educative if it has the effect of arresting or distorting the growth of further experiences" (Dewey, 1997, p.25). Dewey states that to know the meaning of empiricism we need to understand the meaning of experience, and for this end he defines that an experience is the result of the interaction of the individual with the environment at a given time.

Experience is dual; it is both a process (a phenomenological approach) and a consequence (a pragmatic approach). Whenever there is interaction, there is experience. Therefore, the HCI concept of "creating an experience" can be challlenged: experience can not be created as it always exists; however, it can be influenced by acting upon the environment and the knowledge needed to interact with the tool.

2.3 Defining User Experience within a HCI Context

Experience is the interaction and its outcome; phenomenology and pragmatism. It was argued that phenomenology looks at experience, mainly, as part of the process of interacting with the environment. Pragmatism looks at experience as the outcome of the interaction. This distinction is not clearly stated in the models discussed above. Mainly, the pragmatic view on experience, that it is the result of the interaction of user, task and context, is presented in the different approaches discussed above. However, looking at experience as a dual phenomenon might offer a different insight

into its study, an insight that might lead to some kind of objective knowledge. It is not possible to separate process from outcome as they are recursively linked; as previous experiences influence future ones. Restating Dewey's definition, experience is the result of the interaction of the individual with the environment. When designing for experience the interest is about understanding the process of interaction, when evaluating for experience, the interests is in the outcome of the individual.

When designing for experience in HCI, the process of the interaction is formed by the relationship between user and environment. The environment is formed by the goal to be achieved, the tool to be used, and the domain in which the interaction is taking place; task, tool and context. In the case of HCI, the tool is likely to be computer-based application. It can be said then that the experience is something formed by user and the environment. The user can be observed and studied, but realistically, she can not be changed. The processing levels of the human, visceral, behavioural and reflective (Norman, 2005) could be changed, but changing all of them might not the objective of HCI. On the other hand, designers have a greater influence on manipulating parts of the environment: task, tool and context. Understanding the user, the task and the context can produce a tool that can help the user divide the goal in tasks, or be used with data or references related to the working domain.

Based on the description of the tool proposed by Hassenzahl (2003), it can be said that the tool is made of three properties: functional, usable and aesthetically pleasing. The functional quality is the ability of the tool to perform the desired work. A hammer can be used to nail something to the wall, and so can a shoe, but not a tomato. Usable is the concept of usability so well studied within HCI, it relates to how effective, efficient and affordable the tool is in relation to the goal. Both a hammer and a shoe can be used to nail something to the wall, but a hammer is more usable than a shoe. The final property, aesthetics, is in lay terms, the appeal of the tool. Given enough options of identically usable hammers to the user to nail the object to the wall, the user would select the most appealing. It is aesthetics that most of the time is associated exclusively with experience. A pretty object is argued to give a better experience than an ugly one; although a pretty thing may work better, aesthetics alone is not experience. Also, the tool itself is not experience. The experience is influenced by the interaction of the user with the tool for a given a task in a particular context. Figure 2.5 shows four arrows pointing inwards towards experience, all the arrows are joined together with experience at the centre. The user has to build the experience and then stays within it based on previous experiences. Although the figure is static, the process of experience is dynamic, and the lines that join the arrow would move according to how much of each of the constituents of the experience is affecting it. User experience is in a feedback loop as, Dewey would say,

past experiences influence future experiences.

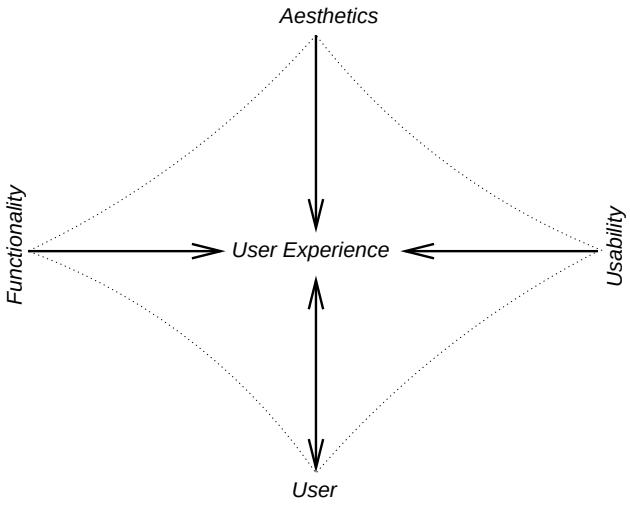


Figure 2.5: Experience as part of the interaction process is built by the user and the three properties of the tool: aesthetics, functionality and usability, in relation with a particular context with a given task. The figure shows four arrows pointing inwards towards experience, all the arrows are joined together with experience at the centre. The user has to build the experience and then stay within it based on previous experiences.

Splitting the constituents and measuring each of them does not provide a measure for experience. Keeping the user aside for a moment, the other three properties of the tool are intrinsically related. For an object to be usable there has to be a goal for which the object is usable. A hammer can not be usable if there is no goal to perform with it. The goal can be a functional one, the hammer is used to nail something to the wall, or an aesthetic one, the hammer is used as a piece of art. Within HCI it is less likely that objects or tools will be used only for their aesthetic value. The main goal is to be functional. Although there can be projects that look at interactive art from an HCI perspective (e.g. Höök et al., 2003). Unlike a mainly functional object, where the object can be partially isolated from the user to measure its usability by defining a quantifiable set of goals, an aesthetic object is intrinsically related to the individual and can not be studied without the input of the user (Maquet, 1986). Functionality and usability are neither experience nor interaction. It is possible to assess them, as HCI has been doing, and it certainly would provide variables to control. But the tool is just an artefact used by the individual to perform a task. This is the process of building an experience, and then, there is the process of understanding the outcome of such experience.

Based on this, to formalise the discussion, a slightly modified version of Dewey's definition is proposed:

Experience is both the process and outcome of the interaction of a user with the environment at a given time.

The outcome of the experience looks at experience as a whole to understand how all the elements resonate with each other to form the resulting experience. This can create changes in the mood of the person. But the objective to design for experience should not be to seek exclusively happiness or Flow, but to produce at least a sense of satisfaction. Not satisfaction in the classic usability sense of comfort with the tool, but as a holistic approach in which the user is able to integrate all the elements of experience and explain the relationship with the task mediated by the tool. The user should feel that all the elements of the experience acted in symphony during the interaction that at the end produced a sense of satisfaction, or a positive experience. In order to know the experience, it is necessary to ask the user to know what happened, and how all the elements played together to make the user feel something. The outcome is personal, it is the individual making sense of all the elements that form the experience. The outcome is what it is usually associated with UX, the properties of the tool perceived by the user (Hassenzahl, 2003), the differentiation between one particular experience out of the everyday life (Forlizzi and Battarbee, 2004), or making sense of the experience McCarthy and Wright (2004a). This is reflected in the proposed ISO definition for user experience: "A person's perceptions and responses that result from the use or anticipated use of a product, system or service"(Law et al., 2009, p.727).

The process, on the other hand, is common to different individuals. The process of the interaction is formed by different steps that eventually lead to an outcome. Regardless how different individuals might be, there are a set of common elements that let them communicate and understand each other (Popper, 1994b). As the elements of the process are common, then it should be possible to study them objectively. These common elements are not necessarily part of the tool itself, but they are intrinsic to the interaction process. As it was the case for the extreme experience of Flow, discussed previously; the steps to reach Flow are common among individuals, even if the experience induced is personal. A set of common elements should also exist for prosaic positive experiences.

It must be noted that the difference between "experience" and "user experience" is that the latter tries to reinforce the active role of the user in the experience. It is just not an experience produced exclusively by serendipity, but as a result of the user. The definition proposed above already considers the user as the fundamental factor of the experience. For this it would suffice to only use the word "experience"; however, "user experience" is a term with deep roots in the HCI literature, and the addition "user" does not limit the understanding of experience here presented. Thus, both would be

used interchangeably in this thesis.

By using the above definition, in this thesis there is an aim to understand and evaluate experience from an objective perspective. To this end, the process of the interaction is going to be studied in order to formulate objective knowledge. The application domain, or the type of task to look at, is that of games; especially computer based games or video games. This is because games have as their core objective to provide users with a positive experience. Games and video games are discussed in the next chapter.

2.4 Summary

This chapter reviewed the concept of experience commonly used in HCI. The idea of designing for and evaluating experience are reviewed in order to propose an understanding of the concept that can lead to objective knowledge. It was argued that the current view on experience as a subjective only phenomenon can limit the scientific study of the concept. To overcome this, a different conception of experience is proposed to be used through the thesis: "Experience is both process and outcome of the interaction of the user with the environment at a given time". The process of the interaction is formed by a series of steps that are common to the interaction process; while the outcome is personalisation of the experience. In the remaining chapters it is argued that the process of the experience can lead to an objective study of experience, in particular, to the experience of playing video games.

Chapter 3

About Video games

The previous chapter presented a review and a definition of the term User Experience (UX). The proposed definition identified UX as a two fold phenomena for which there is a process and an outcome. Even though the outcome of the experience is personal, the process of the experience has common elements among individuals.

In order to understand the process and outcome of UX, the selected application domain is video games. This is because the objective of video games is to provide users with a positive experience. That is, the general outcome of the user's experience of playing video games is fun or pleasurable. Eskelinen (2001) argues that it is quite easy to talk about video games because not much has been said, thus everything goes. There is actually a lot that has been said about them, however the argument is still forming.

This chapter presents a review of the concept of games and their implementation in a computer based form as video games. The objective of the chapter is to discuss the experience of video games and the different concepts that exists to understand and evaluate it. The current approaches to understand the experience focus either on extreme experience, such as flow or immersion, or in analytic models that do not provide a mechanism to evaluate and understand the development of the prosaic experience.

The review of video games is divided in three sections. The first one defines games and video games. The next section discusses the experience of playing video games; the discussion presents the experience of video games as literary media and the extreme experiences, e.g. immersion and flow. The last section contextualises the experience of playing video games with the concept of user experience presented in the previous chapter. It also sets the bar for the rest of the dissertation regarding the use of the term video game.

3.1 Understanding Games

Games are, most of the time, fun to play. Their objective is to provide participants with a positive experience; people engage with games freely and with no more motivation than having a desire to enjoy themselves. But game players do not only gain an enjoyable time; they also learn, share and build culture. Playing games is a basic and necessary, but not sufficient, condition for the generation of culture; games are inherent both to our human culture and our animal instinct (Huizinga, 1950).

The idea of game is so intrinsic to the human nature that it is actually complicated to define what a game is and what it is to play one. It is tacit knowledge that allows individuals to recognise games. But at the same time limits the formal understanding of what games are and what they achieve. Games are not only complicated in terms of their definition, but also regarding the expected outcome, to have fun. The first main scholarly study of games was considered too narrow and too broad at the same time (Ehrmann et al., 1968). It was too narrow because it did not account for all the different aspects that playing may involve; too broad because it did not delineate the limits of play (Ehrmann et al., 1968).

This entangling of play with game highlights the key property of games. Games are experience; game and play are part of each other. The only difference might be that one answers to the question "what are they playing?" a game, while the other to the question "what are they doing?" playing. Play can be understood as free-form activity, while game as a rule-based activity (Juul, 2005). However, even these definitions are more a problem of linguistics, as in other languages, Spanish for example, play and game are the same word: *juego*.

However, it is not the objective of this dissertation to define game. It should suffice to say that a scholarly definition of game is far from agreed upon. At the same time, decisions to take this dissertation forward had to be made. That is, even though an explicit proposed definition of game may not have a total agreement, it helps in moving the discussion forward; particularly the understanding of how games are studied. Observing this chapter in the context of the thesis, the tacit understanding of games might suffice to say what a game is or is not. But to understand the experience of playing video games it is necessary to understand how games are studied.

3.1.1 Defining Games

Fun, enjoyment and entertainment are used, often interchangeably, when referring to a positive experience and, as the objective of games is to produce a positive experience, almost anything that is fun can be thought of as a game. Activities such as cleaning the house, writing a document, or solving mathematical problems can produce a positive experience, but they are hardly regarded as games. Playing the lottery, betting in a casino, or yelling "the Wolf is coming!" are usually considered

games. Games are regarded as activities that might only provide fun, enjoyment or entertainment, for the sake of fun, enjoyment or entertainment. There should not be extra gain in games, if cleaning the house produces a clean house, then it can not be a game, but if playing the lottery provides the thrills, then it is a game regardless of losing or winning the jackpot. Using the computer as a gaming tool can provide a vast amount of games from official game like Solitaire or WarCraft, to searching two words in Google that produce only one result (Google Whacking), or changing the font size in Word. In spite of what is socially considered a game, every person can create games based on personal belief as to what is enjoyable since there are as many kinds of enjoyment as there are people in the world (Blythe and Hassenzahl, 2003).

In order to contextualise the idea of game into a definition that provides the general characteristics of games, Juul's (2005) definition of game is used, with some adjusted interpretations. The rationale behind this decision is that Juul formulated his definition based on the scholarly work of other researchers in the area. Also, Juul's research interests are within video games; that is, he does not study games as games *per se*, but as a way to understand video games. This provides the same framework of reference regarding the use of video games in this thesis. His definition states that:

> "A game is a rule-based system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels emotionally attached to the outcome, and the consequences of the activity are negotiable."(Juul, 2005, p.36)

The six basic characteristics of a game are then: rules; variable and quantifiable outcome; valorisation of outcome; player effort; player attached to outcome; and negotiable consequences. Rules are the regulations that define the game as such, they determine what is possible to do and not do. Variable and quantifiable outcome is the actual goal of the game, the set of rules delineates what it is supposed to be done in order to reach an outcome. Valorisation of the outcome is assigning the role of having either won or lost regarding the outcome achieved. Player effort is what an individual has to do to achieve the outcome of the game while following the rules. The attachment to the outcome is the experience of the game, and the interpretation here differs from Juul's as the value is associated to the whole experience and not only to the outcome of the game. Finally, the negotiable consequences are those that the game might or might not have real-life consequences.

Koster (2005) states that the rules of the games are covered by a story, which adjusts Juul's definition regarding rules. Games as rules are just abstract mathematical problems. The combination of rules and story provides a game for which the individual might find a problem more amusing than another one.

Now that the concept of games has been defined, this chapter turns to discuss the subset of them: games played with the aid of a computer. These games are labelled as computer games, digital games, etc. In this thesis, all these types of games are referred to as video games.

3.1.2 Defining Video Games

In the 1950s, Claude Shannon and Alan Turing theorised about using a computer like device to play games like chess (Schaeffer, 2001). Their attempt was to use the computer as an adversary that would develop into a worthy chess opponent. About six years later, with the development of electronic technology, the game of "Pong" was played using an oscilloscope (Gettler, 2009). Other games that used the computer in these early stages, were "Tic-Tac-Toe" and "Spacewars" (Kirriemuir, 2006).

A video game is a game played with the aid of the computer. As in the chess algorithm devised by Turing, the computer can take the role of a game companion, either foe or ally. In the other cases, computers were used to play games as a rule enforcer and to draw the story that covers them.

Based on the definition regarding games proposed above, in a video game the six properties of the game are affected as follows: Rules, as mentioned above, the computer is in charge of enforcing the rules and draw the story. The variable and quantifiable outcome is presented by computer; it is showing the status of the game. The valorisation of outcome is decided by the computer in some games; when the player has met the objectives the computer can issue a won value, or a lost value when the player has not achieved them or failed to survive, depending on the type of game. Player effort is the user interacting with the computer using input devices to do so. The player is attached to the experience of playing the game the same as in "normal" games. Finally, the line of negotiable consequences draws thin for computer games, as games might be played in fictional virtual worlds, but players can confuse that they are just playing a game and try to solve real world issues using the same computers (e.g. McGonigal, 2003).

On the other hand, the design of video games adheres to a different set of guidelines. The design approach resembles more a craft than an engineering discipline. The design approach is structured by a series of guidelines which transmit the expertise of seasoned designers to those who are starting in the guild. The design of current video games requires a big enterprise to pull together graphics experts, game designers, story tellers, etcetera involved in a process of pre&post-productions(McCarthy et al., 2005). But even with all the complexities that are demanded for commercial video games, they are still designed following the guidelines of the experts.

Video games, from the designer's point of view, are formed by a three tier structure: Input-Output devices (I/O), Game and Program (Crawford, 1984; Rollings and Adams,

2003). I/O Structure defines the interaction between the user and the video game; it specifies which tools will be available to the user, such as controllers and the visual and aural feedback. Game structure defines the objective and rules of the game, as well as the relations between the different elements of the game, such as the obstacles that the user has to avoid. The program structure details how the game would be implemented at the code level.

Game designers start the process with what they consider to be fun (Shelley, 2001). This gives the designer the dual role of potential player as well; yet the designer would still need to connect with what the player is looking for. The Mechanics, Dynamics and Aesthetics (MDA) model (Hunicke et al., 2004) tries to bridge what the designer is creating with what the player is expecting from the game. The mechanics describe the components of the game, such as representation and algorithm. Dynamics describes the behaviour of the mechanics as responses of the players inputs. And, Aesthetics is about the desirable emotional responses evoked in the player. For the designer, the game is built from the mechanics upwards; while for the player the game builds from the aesthetics downwards. The model explains this relationship in which dynamics are the bridge between aesthetics and mechanics; between player and designer (see Figure 3.1).

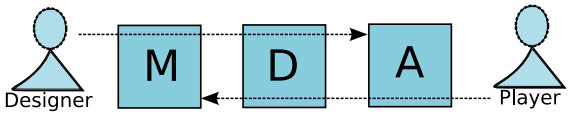


Figure 3.1: The Mechanics, Dynamics and Aesthetics (MDA) model. The model attempts to bring together the fields of game design and game research by providing a coarse-granularity model that identifies the three main components of games from the perspective of the designer and the player. Figure adapted from Hunicke et al. (2004).

The objective of the MDA model is to explain the game play of the video game. Game play is a term commonly used to explain the relationship between user and game. The definition of game proposed above already includes parts of this relationship. This discrepancy between game and game play is somehow more a problem of semiotics than of the actual activity of game playing. It is common to understand games just as a collection of rules and game play is the interaction of the player with the game. Whichever word used, game play or game, is about describing the playing of the game. It is about experiencing video games.

3.2 Experiencing Video Games

Describing the player's interaction with the game is convoluted with the description of game. As mentioned earlier, this is because the definition of game includes the role of the player. However, in video games the implementation of the game is seen as

separate from the game itself (e.g. Malone, 1982). The user plays the game through the computer, using the interface (see Figure 3.2). This is the experiencing of playing video games, or the game play experience.

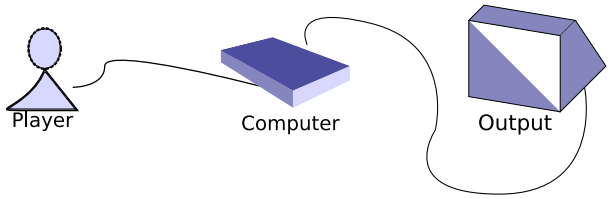


Figure 3.2: In video games, the user interacts with the game through the computer implementation. Figure adapted from Djaouti et al. (2008).

The game play experience is an attempt to describe how the game interacts together with the computer so that the player would enjoy playing the game. The vocabulary to describe it is quite diverse and informal. Besides game play, terms, such as immersion, are often used to provide a general description of what is happening, but without deeply analysing what is meant (Brown and Cairns, 2004). Immersion is often used to describe a state in which the player is really enjoying playing the game.

To represent the experience of playing video games, the Sensory, Challenge-Based and Imaginative (SCI) immersions for the game play experience model (Ermi and Mäyrä, 2005) integrates the different aspects of game play that have an effect on the experience. This model is based on what are considered the three different "immersions", sensory, challenge-based and imaginative, which occur, and interact, while playing video games. The sensory immersion is about the player recognising how the implementation of the game, the "audiovisually [sic] impressive, three-dimensional [graphics] and stereophonic worlds that surround their players in a very comprehensive manner" (p.7); this sense of immersion is about the I/O structure mentioned previously (Crawford, 1984). Challenge-based immersion is "when one is able to achieve a satisfying balance of challenges and abilities" (p. 8). This sense of immersion refers to the game structured mentioned before, and it encompasses the definition of game (p. 3.1.1). Finally, the imaginative immersion is the area when the player "use[s] her imagination, empathise with the characters, or just enjoy the fantasy of the game" (p.8). This last element is not included in the structure of video game and in Juul's definition. However, it relates to the story that covers the rules of the game, discussed above (Koster, 2005). The intersection between the three senses of immersion is what provides the player with a fully immersive game play experience. The sensory immersion is the link with the game, while challenge-based and imaginative immersions are the link of the player with the game. The player produces a "meaning" of the experience in a sense-making process through the construction of an interpretation of

the game against the personal context of the player. Figure 3.3 presents the different elements of the model.

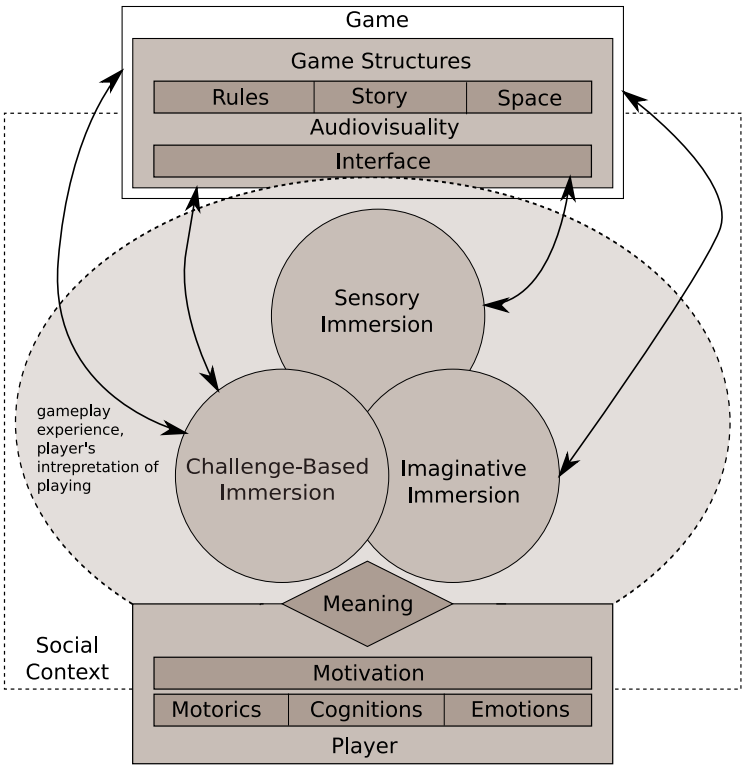


Figure 3.3: The Sensory, Challenge-Based and Imaginative (SCI) immersion model. The model presents the three fundamental dimensions of immersion as a way to explain the game play experience. Figure adapted from Ermi and Mäyrä (2005).

Both the MDA and SCI model make a clear differentiation between the game and the player. The MDA model proposes that it is the interface where the player establishes contact with the game, while the SCI argues it is through challenge and imagination. Both models are in resonance by providing a separation of the "game" with the "play"; the implementation from the interaction. These models, however, include an element in which the interface is not only a series of widgets, but a series of realistic graphics which the player manipulates. The imagery produced in the interface is the story that covers the rules of the game; these were called the "aesthetics" in the MDA model and "imagination" and "sensory" in the SCI model. These provide a direct link between the view of game-experience in both models and the definition of game.

To recapitulate, the experience of playing a video game is seen from three different angles: the story that covers the rules, the state of the player while playing and the actual playing of the game. The first two angles have received more attention while the latter is usually taken for granted. The story is usually used to classify and

taxonomise games, while the state of the player is often talked about when aiming at providing a state of immersion in the player. These three topics are discussed next.

3.2.1 Video Games as Media

The story that covers the rules of the game are used as a classification criteria. With no aim of proposing an extensive taxonomy for video games, they are usually classified in terms of their genre, point-of-view and number of players involved in the game (e.g. Taylor, 2002; Crawford, 1984; Rollings and Adams, 2003; Ye, 2004). For example, genre can differentiate between sports or war games; real time strategy and procedural games. Point-of-view can differentiate between games that are first person view, third person view or god-view. And number of players differentiate between games that are for single, multiple, or massively multi-players. Trying to classify video games in taxonomy based on their rules and stories might lead to a series of overlaps as the categories are not exclusive of each other. But besides providing classification criteria, genre also links video game with the field of media studies and literature.

Arguably, the concept of ergodic Literature (Aarseth, 1997) set the standard for the study of video games as media. Willingly or not, by using the word 'literature', it brought the experience of playing video games as being an equal to the experience of reading literature. The concept of ergodic literature reflects on the idea that readers engage with cybertexts. Cybertexts are non-linear stories for which the reader engages in an active role; a role that requires the reader something more than just "reading". The reader is expected to play an active role in the development of the story, either by selecting the path to follow in the story or by practicing what is being read, such as Yoga positions. Ergodic literature was proposed as a general description of reading the so-called cybertext, so it was not exclusively done to understand the domain of playing video games. However, most of the examples proposed in the ergodic literature are usually applied to video games. As an extension to the ergodic reading process, the Ergodic Bridge proposes that there is a difference between the player performing an action and the result of the player's action (Rush, 2005). Ergodic Bridge brings the concept of ergodic literature specifically to the domain of video games, as it divides the process between the player inputs and the development of the story of the game.

The idea that games not only have a story but that they were narrating it resulted in a discussion regarding the role of narration in video games. There are arguments (e.g. Juul, 2001) that strongly opposed this idea while others argued in favour (e.g. Schell, 2002). These arguments fuelled a debate between those that saw video games as a ludology problem and those that see it as a narrative problem (Frasca, 2003). The importance of the "Narratology vs. Ludology" story lies in the inner concepts that both schools were trying to achieve, where they were not trying to understand games

in terms of how they are implemented but in terms of how they are experienced. For some games it is about solving problems; for others it is about solving problems within the context of a story (e.g. Mallon and Webb, 2005).

The objective of this thesis is not to contribute to this debate, but just to understand the different ways in which video games are studied. Looking at video games as narratives or play elements helps to understand what it is that the player is looking for when engaging in video games. It is difficult to conceive that video games are just narratives, as players would prefer to engage with books, or that they are only problems that need to be solved. Video games are formed by a combination of play (*ludo*) and narrative, even if on a limited basis.

The narrative element of the game provides an interesting metaphor to describe what happens when players are fully engrossed with the game. The idea of the Holodeck (Murray, 1997), a virtual world in which the player takes part to become fully integrated, both physically and mentally, within the world of the game. This metaphor suggest that given enough technology, players would be fully immersed in the game up to a point that they would believe to be present in the actual virtual world. This metaphor is appropriate for discussing concepts such as presence (Slater and Wilber, 1997), but it might not reflect exactly what happens when interacting with a game (Ryan, 2002). This is because, generally, when players interact with a game they physically remain in the same place, and it is only their actions that are happening in the world of the game (Qin et al., 2009). At the same time, it would be unfair to ignore the problem solving part of the video game as a cause for this immersive state (Charlton, 2002), as the enjoyment of playing video games is produced by both elements. These states in which the player is "out of this world", and enjoying it, for the own sake of enjoyment is about the positive psychological state of the individual (Lopez et al., 2003). A state that can be reached playing video games.

3.2.2 The Positive Psychology of Video Games

Video games, and games in general, offer the possibility of understanding the different enjoyable states for an individual. The difference between pleasure and enjoyment is that the former is a result of homeostatic needs while the latter comes from those activities that stretch the human beyond the self; for example physiological needs vs. playing a game (Seligman and Csikszentmihalyi, 2000). Although it is possible that enjoyment can lead to pleasure when the activity becomes addictive (Seah and Cairns, 2008).

The vocabulary used when describing the experience of playing video games tends to be recurrent in certain words, however, it is not clear what those words mean. Immersion is a recurrent topic when discussing the experience, as it was discussed above with the SCI model; a game can be considered to be immersive or the player can

be immersed in the game. Without trying to solve a problem of semantics, scholarly study suggests that immersion is the sense of being away of the real world (Brown and Cairns, 2004; Jennett et al., 2008) and presence is the sense of being inside a virtual world (Slater and Wilber, 1997; Spagnolli and Gamberini, 2002). It can be argued that unlike presence, immersion is task dependent. The actual definitions of these two concepts might still be under discussion, but both concepts are trying to understand the experience of playing. A more established concept to understand positive experience is that of Flow (Csikszentmihalyi, 1990). There are research efforts that try to bridge Flow with video games with a GameFlow model (Sweetser and Wyeth, 2005). The GameFlow model translates the stages needed to reach flow into a series of qualities that video games offer. Flow was formulated as a model of the stages achieved by the individual, while GameFlow is being proposed as a series of characteristics that video games possess. That is, this model only suggests that video games might allow an individual to reach flow. Flow is a state of optimal experience that can be reached by an individual while performing a task, optimal because the experience is rewarding by itself. On the other hand, immersion and presence do not automatically mean that the player is having an enjoyable activity; as being in presence may also produce negative experiences (Slater et al., 2006). The focus is then to understand what was called in the previous chapter as extreme experiences.

It is the activity which determines the direction of the experience. Playing video games can produce an optimal experience, such as flow, or sub-optimal, such as immersion; a well implemented video game might help the individual to reach a state of presence. Immersion is sub-optimal as it does not imply that the experience would be positive, but it depends both on the problem at hand and the implementation of the game. That is, the experience of playing video games is influenced by the interface that presents the game. The role of the interface in the overall experience is discussed next.

3.2.3 The Video game as the Interface

One of the first approaches to the interface of the game was using classical HCI concepts such as usability. Looking at the game as a computer interface does not offer any contradictions in terms of what it is expected to provide: an interface that lets the user perform a task efficiently, effectively and with a sense of satisfaction (Federoff, 2002). Interfaces can be thought of as tools in order to do a task, so there was no reason to expect that this would differ from traditional interfaces.

Besides usability, HCI is able to offer a better understanding in the relationship between user and video game (Zaphiris and Ang, 2007). This can be done from the inclusion of newer technology into video games, such as larger screens (Sabri et al., 2007) or tactile input devices (Tse et al., 2006), to understanding the broader rela-

tionship of player with game, such as the values associated with a game (Barr et al., 2007). A user centred design approach can offer insight into creating a usable interface of the video game (Pagulayan et al., 2003); while testing the interface, the user is also testing the game. That is, evaluating the experience of the player.

3.2.4 Evaluating the Experience of Playing Video Games

Evaluation methods can provide a better understanding of the user experience of playing video games. In other words, evaluation methods that looks at the interaction process between user and application, the experience of playing. An experience that has as an ultimate goal to provide the player with fun.

However, evaluating 'fun' is problematic as it is the player who judges if the experience was fun or not. This can be influenced by the player perception of learning while playing (Gee, 2003), or because the game touches elements that challenge the player (Choi et al., 1999). The sense of fun can be different from what the player wants from what the designers are trying to provide (Choi et al., 1999). Assessing positive states, such as flow, might be cumbersome under traditional quantitative methods (e.g. Slater and Garau, 2007); this might be due to the fact that it is not possible to ask the participant to step away from this state in order to be queried. Further more, the idea of 'fun' with a video game can include from selecting the game to the actual playing of the game (Salisbury, 2004). This idea of 'fun', or the experience or the user experience of video games, might be better understood if looking at it under the definition of experience presented in the previous chapter.

3.3 Understanding the User Experience of Video Games

The experience is both process and outcome. While playing video games, the objective is for the player to have fun. In order to build that fun, a series of elements have to be amalgamated together.

The approaches discussed so far look at both parts of the experience. The MDA and SCI models try to understand the outcome of the experience by looking at the different elements that could form the process, but do not offer a mechanism to assess them. As it was discussed previously, both models provide the elements that influence the experience, but the models are not validated or provide an insight on how to use them for evaluation. Studying video games as media, or looking at elements such as flow, immersion or presence, are only concerned with the outcome that produces extreme experience of the player, ignoring the prosaic experience of playing. For example: playing for five minutes while using public transport, is overlooked in favour of the extreme experience, such as playing a game for hours and hours until the real world fades away. The models used are formulated from an analytical approach, in

which authors decide why video games are fun based on their own reckoning, such as GameFlow, SCI or MDA. That is, they take the point of view of a designer providing a game to the player, and then reflecting on the qualities of such game. So in order to understand the experience of playing video games with the current research it would be necessary to use analytic models that do not accurately provide assessing mechanisms, or it would be done through the extrapolation of extreme experiences to the prosaic experience.

The experience of playing video games is influenced by a series of factors sometimes out of the reach of the video games. The problem is vast as it includes social and cultural elements that might lie outside of the direct interaction of game and player. Following Huizinga's *Homo-Ludens*, the idea of play is embodied in the animal side of the human. Play is a relation between Human and environment that is as complex, but at the same time as basic, as falling in Love; feelings and sentiments innate to the human self. It is for this reason that the study of play and experience of play provides a rich understanding of the human nature. But it is for the same reason that the study of play has to be bound to be a manageable scholarly topic.

The approach to understand the user experience of playing video games in this thesis is to understand the prosaic experience. The basic sense of enjoyment while engaging with a video game. The efforts would be directed at identifying the elements that form the process of the experience. These elements would be used to formulate an objective theory regarding the experience. The outcome of the experience will also be studied, on a minor role, in order to showcase that both, outcome and process, lead to similar results. The difference being in that the objectivity of the elements that form the experience allows enunciating falsifiable statements regarding the experience, while the outcome only shows the personalisation of the experience.

3.4 Summary

The research that tries to understand the experience of video games is vast and growing fast in the last few years. The review proposed above is not extensive as it does not include all the possible references to the subject. It purposely omitted most of the research in computer graphics, artificial intelligence or computer architecture as these areas only provide technical detail to the implementation of the game. However, it showcases the key trends in understanding the experience. This is not discrediting the current research efforts towards understanding video games; it is just to acknowledge the fact that the scholarly study of video games is far behind from the actual impact that they have on human beings. This might be due to the fact that understanding the domain would imply understanding experience, and it seems that the research community is still struggling to open the shell of experience.

In this chapter, it was presented the definition for game and video game that would be used in this thesis. Game is defined as series of rules, covered by a story, that include the interaction of the player. That is, game is both an object and an action.

The chapter also provided a review of the different approaches to understanding video games. Video games are seen as a three part structure: the interface, the story and the actual game. Although this division may provoke a discussion between what it is seen as ludologist and narratologist, it encapsulates the trends in research for understanding video games. In understanding the experience, the focus is on those experiences that elicit extreme and enjoyable reactions, such as flow, immersion or presence. From the review it can be seen that the prosaic experience of playing video games is not fully understood to provide an evaluation mechanism.

In this thesis, the approach is to understand the prosaic experience by looking at the outcome and process with the aim of forming an objective understanding of the concept of user experience when playing video games.

Chapter 4

Exploring the Experience of Playing Video games

Chapter 2 presented a review of the concept of User Experience (UX). In the review it was argued that the main approach regarding UX is to consider it as the subjective part of the interaction between user and application. To understand it, McCarthy and Wright (2004a) suggests that the individual appropriates the experience based on self reckoning. The definition of UX proposed suggests that experience is formed by a process and an outcome. The approach suggested by McCarthy and Wright is that experience is only outcome. A different approach to using McCarthy & McCarthy's Technology as Experience framework is to use it for design (Rogers et al., 2007, Case Study 5.1). Their approach is for the design of websites. In order to design websites that provide a better user experience, the designers include each of the different categories of the framework into the design process. The approach that this chapter explores is how to use the outcome as a way of comparing different experiences, that is, using McCarthy & Wright's framework to evaluate the user experience. The results show that the outcomes provide information about the experience, but that comparisons are only possible due to the individual's interpretation.

The chapter presents a series of exploratory pilot-studies for which the individual is asked to play video games using different input devices or a different interaction style with the game. The motivation for using input devices as the control variable in the studies was discussed in Chapter 1. Besides exploring the use of outcomes to understand the experience, in the studies is also explored the methodological set-up to study the experience of playing video games.

The chapter is divided into six sections. The first section discusses in more detail the objective of the studies. The next three sections present three different studies carried out. Section five discusses the results obtained and proposes the next steps of the thesis. The final section summarises the chapter.

4.1 Setting for the Studies

To make sense of the experience, the user internalises the information of the interaction just felt in order to create a personal experience (McCarthy and Wright, 2004a). It is a process that the individual does not perform explicitly. When the user is asked to report the experience, then the individuals re-lives it. Each time the experience is told, a different experience is being told as the individual may make sense of it differently. The objective of these studies is to capture the telling of the experience right after it happened in order to understand how different input devices influence it.

Playing a video game is not the same as participating that involves playing a video game. Players engage with games on a free-will disposition, while participants for studies have to be recruited. Although participants might find the topic of the study interesting to take part in it, they are not playing video games in the way in which they would normally. There are different methodologies that can be used to explore naturalistic settings, such as ethnographic or different social methods. However, for these studies it was decided to conduct the studies within controlled conditions as the objective is to understand an artificial influence on the experience: the change of controllers and the use of narratives to assess the experience.

The setting proposed here is one of controlled conditions on a semi-naturalistic environment. Participants would be asked to play computer games in a laboratory for three different studies. The analysis of the results of the studies was exploratory, they were grounded in qualitative methods and it was mainly done looking at interesting comments that the participants made. The forms used for all studies are in Appendix B.

In the first study, participants are asked to play Tetris with two different input devices. After playing with each device, the participant would be asked about the experience. At the end of the session, the participant compares both experiences and decides which device produced a better experience. One experience would be better than another based on which one allowed the participant to enjoy playing the game more. The results suggest that the participants engaged in two different activities: playing the game and playing with the input devices. Both positive experiences, but do not particularly refer to the experience of playing video games.

The second study is similar to the previous one, but this time the video game and devices used are commercially available. Participants are asked to play GuitarHero with both the standard controller and mock-up guitar and then tell their experiences. After learning from the previous two studies, the questions posed to the participant are targeted to the actual playing of the game. The results show that participants preferred one input device over the other one, but besides personal satisfaction, it is

hard to produce a general theory as to why this might have happen.

The third study has the objective to find more information about how participants experience interacting with games, from the premise that playing video games is more enjoyable than watching the video of a game. Participants are asked to play or watch a video game, then to tell and rate the experience. The study was cut short because the results were not producing the expected results. The partial results suggest that looking only at the outcome of the whole experience can mislead the result about the experience of playing video games as both participants that played and not played found the experience positive.

4.2 Study 1: Playing Tetris with Two Input Devices

This study was carried out with three objectives: one, to explore how to assess experience; two, to understand how players communicate their experiences after playing; and three, to compare the different experiences based on the results obtained.

Participants played Tetris using two different input devices: a keyboard and a dial-type knob. The latter device was selected because it is not a common device to be used with computers and seemed like a suitable device to play Tetris. During the session, participants were told to use the think-aloud protocol to explain what they are doing and why, at the end of the session participants were asked about their experiences.

4.2.1 Method

Participants

Ten participants took part in the study, six males and four females. The level of expertise was self-assessed by the participants and it varied from none to medium; four participants considered themselves to be novice, four medium, and two have never played before. All participants were over 18 years old, two were between 18-25, five between 26-35, two between 36-45, and one was older than 46. Participants were recruited with emails to students within UCL and neighbouring colleges.

Apparatus and Materials

Tetris was run on a PC using a shareware Java implemented version. This version of Tetris does not have sound. The input devices used were the standard QWERTY keyboard and the knob like device (Figure 4.1). The mapping of the Tetris functions into the input devices are described in Table 4.1.

Procedure

Participants carried out the study individually. They started the study with a briefing of the study, verbally and written, after which they were asked to sign a consent form and complete the general survey form.

Figure 4.1: The Power-Mate by Griffin Technology was used as the knob-like device. Figure from Griffin Technologies website

Table 4.1: Exp. 4.1 Mapping of Tetris functions in two different input styles

Tetris	**Keyboard**	**Knob**
Drop	Down Arrow	Push
Move Left	Left Arrow	Rotate Counterclockwise
Move Right	Right Arrow	Rotate Clockwise
Rotate Counterclockwise	Up Arrow	Push-Rotate Counterclockwise
Rotate Clockwise	Shift-Up Arrow	Push-Rotate Clockwise

The order in which the participants used the input device was randomised. Each participant was given an explanation of how to play the game with each device. Participants would play for approximately 15 minutes with each device. They would be asked to use the think-aloud protocol to describe the actions they were doing while playing, which were audio-recorded. The score obtained with each device was written down to see if the device with the higher points would correspond to the device that provided the best experience. After playing with each device, the participant was interviewed. The interview followed a semi-structured approach in which the player was asked about the experience of playing with the input device; after playing with both devices the player was asked to compare the experience and to tell which device was better.

4.2.2 Analysis

The data from the think-aloud protocol and the interviews were analysed looking for common themes and interesting comments. The analysis was exploratory based on emergent theme analysis.

4.2.3 Results

Regarding the scores obtained with both devices, all participants had a higher score using the keyboard than using the knob. Table 4.2 summarises the obtained scores.

Table 4.2: Exp. 4.1. Scores obtained from playing Tetris, divided by those obtained playing with the knob and with the keyboard.

(a) Knob		(b) Keyboard	
Max	850	Max	960
Min	130	Min	360
Average	436	Average	640
Median	380	Median	610

The data obtained from the think-aloud protocol was discarded because it was not usable. Most of the recording during the playing time is blank as users were too engaged with the game to talk, and the few sentences that they would utter were incomplete or just onomatopoeias, such as:

(Participant 3): " Ok, that was fast, I did not intended to [blank] ups "

(Participant 2): " mmm, uh I hit the wrong, it is very difficult to talk aloud "

As part of telling their experiences, participants were asked with which device they had a better experience; which device did they like better and why. Overall, participants enjoyed both the keyboard and the knob, but this was due to different reasons. They enjoyed the keyboard because they could play better, and they enjoyed the knob because they thought it was fun:

(Participant 2): " I had more fun with the keyboard, the knob was fun to use, but the time it took time to get used to the control was too long. The keyboard seems a bit more natural. "

(Participant 4): " I think this [knob] is more intuitive than to make it left, right [...] but the keyboard was better, in this one [knob] I was not focusing on the game. "

Even when participants realised that the knob interfered with playing the game, they would still enjoy argue in favour of using it:

(Participant 7): " I like the knob better, I just need to practice more, but I feel I have better control than with the other one [keyboard]. [...] This one [keyboard] I know a little a bit, and because I work with it for a long time. But this one [knob] it is better I just need to learn. [...] I had more fun with the keyboard because I had a better score, but once I learn how to use the other one I will have more fun with it, but I felt I like more the knob, the first impression was good. "

This was considering that the knob would even produce physical pain while interacting with it for a long a time:

(Participant 3): " Actually, this thing [knob] is hurting my wrist [...] it is hard to use [the knob]. "

Overall, playing with the device allowed focusing on the game:

> **(Participant 3):** " I like better the keyboard, it was easier to me, it was kind of instinctive, I knew what to do [...] I was not thinking in using the device, while in the other one [knob] I had to be constantly thinking how to use it. "

While the knob was fun to use on its own, without focusing on the game of Tetris:

> **(Participant 10):** " I did not remember how to do stuff, I kept confusing push with push and turn [...] Actually, I liked the knob. It is just that I was not good at coordinating, I think I just need to get used to the knob [...] I had more fun with the second one [keyboard] because I was more efficient [...] I think the first one [knob] gave me better control, it was just that I was bad at using it, at least I felt it gave me more control, but in practice, I had more control with the other one [keyboard] [...] but I like the knob better. "

4.2.4 Discussion

Overall, participants preferred the keyboard to play the game because they had a better sense of control. Some who preferred the knob and mentioned that it was because it was fun to use. They felt it was natural to use a rotating device to play a game about rotating figures, so that they could rotate the hand in the same direction they would be thinking to rotate the figure would provide a better control of the game. Those who preferred the knob also explained that their low scores were due that they were not really used to the knob as they had never used it before; they claim that with more training they would score higher, so they can focus on the game and not on using the device. The keyboard was a better device to play Tetris, while the knob was fun to use.

The participants wanted to play the game and not with the controller. An input device that is visible distracts the user from the objective of the game as the user was thinking on what she had to do with the device to so that manipulated figure would perform as desired. However, almost half the group said they preferred the knob. The new input device used in this study had an appeal to it, the knob looked like novelty and it seemed that participants were willing to give it the benefit of the doubt even if it was cumbersome to use. The push and rotate function was quite hard to use, and if using it quite frequently then it can cause discomfort around the wrist. The objective of the study was to start exploring how the input devices affected the gaming experience. It is clearer now that the input device can distract the user from playing the game, not only because it has poorer usability, but because users find it entertaining to engage with the device.

Regarding the set-up, using the think-aloud protocol was not successful as participants were not able to talk and play at the same time. The use of semi-structured interviews did provide useful data about the experience of the player.

4.3 Study 2: GuitarHero with Different Input Devices

From the previous study, it can be seen that the input device can alter the experience by distracting the participant from playing with the game in lieu of playing with the device. Also, one of the devices used actually produced physical discomfort after using it for some time. This study also looks at the role of input devices in the gaming experience. Unlike the first study where one of the input devices used was new to all users and to the task, in this study two commercial input devices are used. That is, two devices that have been fully tested to work with the game in question. Also, the method used to debrief participants was changed from the previous study as participants were not required to use the think aloud protocol. The objective of this study is to learn how participants differentiate their experiences after playing GuitarHero with two different input devices.

4.3.1 Method

Participants

Fifteen participants took part in the study, 9 females and 6 males. The average age of the participants was 26.6 years, and the median was 26. Some participants had no previous experience playing the game or video games in general, while others have played the game at expert levels. Participants were recruited from UCL and neighbouring colleges. All participation was voluntary. Most participants had played the game before or at least heard about it.

Materials

A commercial copy of GuitarHero for PlayStation 2 (PS2) was used in the study. The input devices used were the PS2 Dual Shock Control Pad (CP) and the Guitar Controller (GC) (Figure 4.2). The GC is a guitar-like controller that looks like a small Gibson Guitar; the GC is smaller and lighter than a real guitar; the mapping of both controllers is shown in Table 4.3. There are two basic differences in the functionality of the GC and the CP. First, to play a note using the GC, the user has to press the coloured fret and move the strum bar, while in the CP the user only has to press the equivalent of the coloured fret. The second basic difference is the Rock Star feature, in the GC the user is asked to tilt the guitar vertically, in the CP this function is implemented by pressing the select button.

Table 4.3: Exp. 4.2 Mappings of both input devices in order to play GuitarHero.

GuitarHero	**Guitar**	**DualShock**
Red Fret	Red Fret	L2
Green Fret	Green Fret	L1
Yellow Fret	Yellow Fret	R1
Blue Fret	Blue Fret	R2
Orange Fret	Orange Fret	X
Strum Bar	Strum Bar	N/A
Whammy Bar	Whammy Bar	Left Stick
Star Power	Tilt	Select

(a) CP (b) GC

Figure 4.2: Exp. 4.2 The two input devices used for the study. a) The Sony Dual-Shock Control Pad and b) The mock guitar controller.

Procedure

The session started by asking users to play and not to worry about the outcome of the game. Each participant was asked to do the tutorial, or an equivalent, or to play 2 songs in the easy mode, unless the participant explicitly stated otherwise, on the Quick Play mode. The order in which either the GC or the CP were used was randomly determined. The participant was accompanied by me during the session in case there were any questions regarding how to use the controllers. At the end of the playing session, a semi-structured interview was conducted, which began by asking the participant to summarise what had just happened, then continuing on details of the explanation just given, pointing out moments that the participant would remember for any especial reason, and asking how that made him feel.

Analysis

All interviews were transcribed and then analysed looking for themes in common and reflections.

4.3.2 Results

The summaries of the participants dealt with two topics: Playing a game or how they felt while interacting with the game and the input device:

> **(Participant 1):** " I played a video game that was a guitar video game. "
>
> **(Participant 14):** " Ok, well, I think I enjoyed the guitar more. "

Some of the summaries were given in chronological order:

> **(Participant 2):** " Ok, so I started with the guitar input device thing, and I did two tutorials and two songs, I found it quite hard [...] and then I did it with the controller, and that was really hard at first [...] "

While others focused on how playing the game made them feel:

> **(Participant 13):** " I really felt quite foolish when I started with the game controller [...] I did not even notice the star power meter until I started playing with the guitar. I appreciated the tutorials [...] When I played with the guitar, so I felt more in control. "
>
> **(Participant 14):** " [...] I enjoyed the guitar more, because it was more life like [...]on the second one [Control Pad], playing with the string of buttons, it was easier, you felt much more in control [...] but it [the guitar] was definitely more fun. "

The overall assessment was that the controller provided a better experience:

> **(Participant 3):** " The mock guitar was far more fun to use, you could far easier make believe that you were the music player. "
>
> **(Participant 10):** " With the controller was a lot harder and not as much fun "

There were also comments that mentioned the surroundings of the game, such as the sounds and the crowd present in the game:

> **(Participant 3):** " it is really good that that the crowd cheered, cheering proportional to how well you were playing, [...] if you started playing badly then they will start booing you [...], people reacts fast to what you hear, that people are booing, you start putting more effort into playing. "

When queried about their negative experiences, participants mentioned a sense of frustration:

> **(Participant 11):** " I remember being frustrated with the hand control because I kept getting the green and red [confused] "

Even if the player was successful in finishing the song, they would like to challenge themselves even if the game did not require it:

> **(Participant 5):** " the solo of Smoke on the water that I wanted to do really well, and I did not do too well. "

The general assessment was that playing the game can be both frustrating and enjoyable:

> **(Participant 13):** " I thought it was kind of funny, but I thought it was kind of frustrating [...] I felt very dumb, I don't know why, because I can not play the guitar, but I felt very upset "

> **(Participant 15):** " I enjoyed, a lot. I felt a little bit frustrated when I did [sic] mistake [...] I want to do it again, it is a very nice game "

4.3.3 Discussion

The results showed that the experience of playing video games can be both enjoyable and frustrating. Participants expressed a sense of frustration when they were not able to perform as expected. And as sense of enjoyment when they do.

Engaging with the game can be divided in two different stages, first learning to use the controller and then focusing on the actual development of the game. Once the participants were able to focus on the game, they found that the cheering and booing from the crowds, or the music, was quite enjoyable. These elements had an overall influence on the experience. All participants preferred the GC as they felt that it provided a stronger connection with the game. They felt it was easier to use and allowed them to concentrate on the game.

The results showed that participants were able to differentiate their experiences, and even though all of them preferred one device over the other, it was not clear how the experience was influenced by the change in the device. The insight that the narrative produced was not necessarily a result of the game, but just on the on the state of the user at the end of the experience.

4.4 Study 3: Narrative in the Gaming Experience

This study explores how to use of narratives of the outcome of the experience as a comparison mechanism. The idea is to ask pairs of participants to engage with video games in two very different ways. One participant is asked to play while the other one to watch; not at the same time. Supposedly, the participant playing the video game should have a better experience than the one only watching; the produced narratives will be used to compare the experiences. It is expected that those participants playing the game would produce narratives that reflect a better experience with the game than those that only watched the game. That is, it is expected that those participants playing would enjoy the interaction with the game more than just watching, producing narratives that reflect this result. The objective of the study is to test the use of narratives to compare two very different experiences.

The study suggested further examination to be unnecessary after running it with six participants because it was not possible to determine which participant was having a better experience based exclusively on the narratives. Narratives were able to tell us that the participants were having an experience, but they were not really comparable grounds to determine which one was better. On the other hand, it was possible to observe that participants that were not playing with the video game still engaged with the video game and took some level of appropriation on the game.

4.4.1 Method

Participants

Six participants took part in the study, two women and four men. Participation was voluntary and participants were invited using the mailing lists of the students at UCLIC.

Materials

Three different computer games were used: Tetris, Donkey Kong and Starcraft. Tetris is an abstract game with no plot or storyline. Donkey Kong is a game with a basic story: Donkey Kong, a Gorilla, kidnaps a Princess and takes her to the top of the screen. Mario, the protagonist, has to rescue the princess from Donkey Kong. Starcraft is a Real Time Strategy Game, unlike the other two games which were created in the mid 80s; this one was created at the end of the 90s. The game requires the player to control an army, collect resources from the land, and defend and attack foes.

All games were recorded using a video recorder connected to the Audio/Video outputs of the computer. The recorded game was stored in a VHS tape. It is important to remark that only the game was recorded, not the player. So the participants in the watching group could only see the game and not the reactions of the player.

Procedure

The participants were split into two groups: Watching Group and Playing Group. Participants were split into two groups at random of equal size, to match a participant for each group. Each participant would play or watch a game for at least ten minutes until approximately twenty minutes. The participant was allowed to stop at any time after the minimum threshold. Once the participant finished playing, he or she was asked the question described previously. The conversation was audio recorded. The participants were asked about their experiences. They would be asked to summarise what just had happened, and to rate the overall experience from 1 to 5, 5 being the highest.

Analysis

The narratives were inspected for key words or phrases that would help in rating the experiences, such as superlatives or adjectives.

4.4.2 Results

The ratings that each participant gave to the experience are presented in Table 4.4. Both groups enjoyed their experiences quite equally. Although the group of participants scored higher than those watching, the difference in the rating was only one point.

Table 4.4: Exp. 4.3 Rating of experience by type of game and group. The results show how participants answered to the question "Please rate the experience you just had from 1 to 5, 1 being the lowest and 5 the highest".

Game	Group	Scale
Tetris	Playing	3
	Watching	2
Donkey Kong	Playing	4
	Watching	3
Starcraft	Playing	3-4
	Watching	3

The summaries of the experience were divided between those that only described the activity they were doing, and those that described the game unfolding:

(Tetris - Playing): " I played. "

(Tetris - Watching): " I was watching Tetris, it looked like the old Gameboy Tetris. Yeah. I was watching someone play Tetris. "

(Donkey Kong - Playing): " I played Donkey Kong "

(Donkey Kong - Watching): " It looked that they kept replaying the same lever over and over again [...] whoever was playing got to the top, was going to the top, going up on the ladder trying to avoid the barrels and jump over the barrels. "

(Starcraft - Playing): " Sure, mmm see I was, I went into kind of, mm a lot of time at the start was to work out the interface trying to work out what things did... I can kind of have one unit exploring the area trying to see what was going on [...] I can kind of have one kind of one unit exploring the area trying to see what was going on. In retrospective, I did not produce enough guys maybe, I should have been making more guys to gather more resources; I think I was too conservative with that. "

(Starcraft - Watching): " Yes, someone started a new game, and they were collecting the resources and started to build up the facilities [...] he scouted around a little bit, around the map. [...] I thought that guy was pretty crap. "

When asked to elaborate about their experiences and to explain the rating given to the experience, participants mentioned that they enjoyed the challenge:

(Tetris - Playing): " In the first stages it was kind of boring [...] When I reach like level 8, it started to get faster [...] it was then I would have enjoy it more. "

(Starcraft - Playing): " It was enjoyable building the stuff. "

They also enjoyed discovering the different rules of the game or challenging themselves:

(Donkey Kong - Playing): " I began to notice I was getting points for jumping, so I began to think the trick is not to avoid but to jump. [...] When it got kind of boring, I figured that I probably would like to get up there two or three times, and then I feel satisfied. "

They commented that they enjoyed the music or just remembering the old game:

(Donkey Kong - Watching): " It was kind of fun because I haven't seen it in ages, and all the retro sound and the graphics and stuff. "

Not all participants enjoyed the experience, one just found it interesting:

(Starcraft - Watching): " It was more interesting rather than fun. "

While another one found it just frustrating.

(Tetris - Watching): " I Would not say I enjoyed it. Because it is frustrating to watch someone else play. I mean, you can be empathetic [...] but you don't find it rewarding. "

4.4.3 Discussion

The results obtained from the ratings did not provide the expected insight. It was expected that the participants in the watching group would have a more negative experience. Overall, only one participant said that it was frustrating. For this reason,

further examination was unnecessary after running six participants, a pair per video game.

From the narratives obtained, it was possible to see that the participants found their experiences positive for different reasons: challenges, personal goals, enjoying the music and bringing back old memories. The participant that found it frustrating was because he did not find the activity rewarding. The experience can be positive because it involves more activities than just playing. For the individuals watching, two had a positive experience and the game was part of it. But it was for different reasons than those who played.

The results of the experiment provided insight into the different experiences of playing and of watching; two different experiences. Both of the two groups were focusing on the elements that they considered interesting. It was expected that just watching would be negative, but that was a misconception because the experience involved different aspects that eventually made it positive. Although a study that does not offer many results, it offers the insight that when measuring experiences, it is necessary to isolate the desired experience. If the experience that is being studied is that of playing, then other elements should be barred as much of possible. This also raises a warning about comparisons of experience, since it is still personal and subjective. There are no clear elements to study that should be able to inform better about the process of the experience. Although, elements such as control, rewarding, challenge and sound and graphics emerged as reasons why those who enjoyed playing did so.

4.5 General Discussion

The studies just presented were an approach to find ways to explore the gaming experience. The main way of understanding the experience is to ask the individual to elaborate about it. The results showed that the player had a sense of enjoyment or frustration as a result of interacting with the game. Looking at the outcome gives an understanding into the final state of the individual with an emphasis on the different elements that had a direct impact on this outcome. As it is suggested by McCarthy and Wright, there is a personal felt-like experience.

Regarding the specific studies, the following can be concluded. From the first study can be concluded that the input device can distract the player from interacting with the game. The input device itself can become the object of interaction, instead of just a tool-at-hand. The fact that new input device, the knob, had non adequate mappings, made the object more visible than intended. However, its novelty masked its deficiencies. As users were interacting with a video game, an activity that seeks a positive experience over all, the participants considered that having a positive experience with the device itself was sufficient enough. The participants of the study stated

that they had more fun with the keyboard because they were able to concentrate more with the game, but almost half of the users enjoyed interacting with the knob. The knob made the users lose control of the game.

The second study also compared two different input devices. The devices used in this study were commonly utilised to play the selected video game. At the end of study it emerged that frustration is the key element of experience. Frustration is an element that has to be overcome from the game, and not from using the device. The naturalness of the device depends on the user. Users who were familiar with the control-pad expressed that they considered this one to be more natural than the guitar. Participants enjoyed one controller in over the other. The argument seems to be around the sense of control, the guitar provided a better sense of control than the other one. However, it is not clear why this might have happened.

The third study explored a potential quantitative use of narratives. It can be concluded after it that it is not possible to compare two different experiences just by the narratives. It is possible to determine if the experience was positive or negative, but it is not possible to determine if an experience was better than other one just by narratives. The experiences explored in these video games are short and not necessarily reach a state of flow. A user may enjoy playing a computer game, but does not necessarily imply that the he or she would be willing to play again. Users played the video games for only ten minutes, an arguably short time to create a life time memorable experience. The experiences are personal, it is not possible to compare against other if they are based on different frames of references.

As a general discussion, the outcome of the experience is a sensible place to understand the personal interpretation of the player. However, it failed when it was to be used to compare different experiences. The comparison was due to the personal reflections of the participants, unable to generalise. An individual might have a positive experience not only because of playing with the game, but because of the different activities that might surround the game playing activity. In looking at the outcomes, also, it was possible to understand that besides the specific elements that shaped the personal experience, there were a series of common elements that suggested having a greater influence in the overall experience. These elements were common in the different studies and were common to the different settings presented. Evaluating and understanding them should provide a more general understanding overall the whole experience of playing video games. Further, it should provide insight into games and what they bring into the forming of the experience. The identification and evaluation of these elements is discussed in the remaining of the thesis.

4.6 Summary

This chapter presented an approach to use the outcomes of the experience to compare among experience. The obtained results suggested that it is indeed possible to observe an experience when looking at the outcome, however, it is not possible to compare the experiences. The results also suggest that in the outcomes the participants shared common elements that are able to shape the experience.

The next chapters of this thesis look with more formality at the different elements that form the experience of playing video games. It does so by isolating the experience and just looking at the one to one relationship of player and game. The approach is started by trying to find the different elements that form the process of the experience. Some common topics were found in these studies, but clearer understanding of all of them is presented.

Chapter 5

The Core Elements of the Gaming Experience

As was discussed in Chapter 2, the experience is a two fold emergent phenomenon: process and outcome. During the process of the experience the individual moulds the experience by using the different elements of the interaction that define the terms of the interaction, whereas the outcome is referred as the personalisation of the experience. Chapter 3 presented the current approaches to make sense of the experience of playing video games. It was argued that most of the approaches toward that end focused on the outcome of the experience, trying to understand the optimal or sub-optimal experiences, or by describing the outcome of the experience in terms of the reflections of the authors. The focus on optimal or sub-optimal experience seems to alienate the understanding of the common or the prosaic experience; while the other approach, based on personal reflections after playing a video game, can be considered as beneficial for understanding the domain; however, understanding the interaction of the individual with the game has not been properly addressed. Chapter 4 presented a series of experiments in which the outcome of the experience was analysed. The results showed that for each different experience, participants were personalising them differently. However, when comparing the experiences, looking only at the outcomes, did not allow making any falsifiable or generalisable statements besides that it was due to the individual interpretation of the experience.

So far, in this thesis it has been argued that in order to generate objective knowledge regarding experience, it is necessary to understand the process of the experience. The experiments presented in the previous chapter highlighted the difficulties of using only personal reflections to compare experiences. The motivation of this chapter is to find the elements that are the process of the experience of playing video games. It is a set of elements that ought to be common among different players, allowing them to share and understand their personal experiences.

The objective of this chapter is to identify the elements that form the process of the experience. The aim is not just to find the elements, but to formulate an understanding on how these elements interact with each other in order to form the experience.

This understanding is presented in a theoretical framework. This uses the metaphor of "puppetry" to describe the interactive part of the experience.

This chapter presents a qualitative approach to identify the core elements of the process of the gaming experience. The chapter is divided in seven sections. The first section describes the boundary drawn to understand the process of the experience; that is, it describes what it is meant by "core elements" and "gaming experience". The following section presents the methodology used to find the elements. The third section provides a high level description of the formulated framework. The formulation of the framework is presented in the fourth section. The fifth section presents an example of describing an experience using the framework. The sixth section presents a metaphor to describe the experience. The final section presents a summary of the chapter.

5.1 Core Elements and Gaming Experience

Many factors can have an influence on the experience of playing video games. From selecting which game to play (Salisbury and Fields, 2004), to the social aspect involved in playing (Lazzaro, 2004). In order to bound the problem and make it more manageable, the objective of this study is to find the core elements of the process of the experience. Core elements are those necessary but not sufficient to ensure a positive experience; they can also be understood as *hygienic factors* (Herzberg, 1968). Herzberg argues that the opposite of satisfaction is not dissatisfaction, but no-satisfaction; satisfaction and dissatisfaction are then two different concepts that are not necessarily related to each other. He argues that motivator factors are those that lead to satisfaction, and the lack of hygienic factors lead to dissatisfaction. With a similar concept in mind, this study looks for those elements that if missing they would mar the experience, but that their presence would not necessarily imply that the experience is positive. A positive everyday experience that would not necessarily result in Flow or Immersion, but it is just a sense of enjoyment. This type of approach has been suggested before when understanding human happiness, which can lead to intractable problems, this approach aims to "minimise unhappiness rather than maximise happiness" (Magee, 1973), that is, target those elements that ought to be present in the process. Many more factors can enrich the experience, but looking at only the required elements leads to a more manageable problem to understand positive experiences.

It has been identified previously that the experience of playing video games can include elements such as selecting the game to play (Salisbury and Fields, 2004). This wide definition is narrowed by looking only at the one-to-one relationship of player and game. The object of study is this interaction part, not how social aspects might influence the experience, neither why the player selected a particular game

to play. It is just the player engaging, playing, with the game; Figure 5.1 presents a graphical representation of this concept, in which the relationship of player with game is highlighted over different aspects that can influence the experience. This relationship is defined hereafter as the gaming experience. Other aspects can also lead to a positive experience while playing is in progress, but that would be a positive experience resulting, for example, from a social interaction.

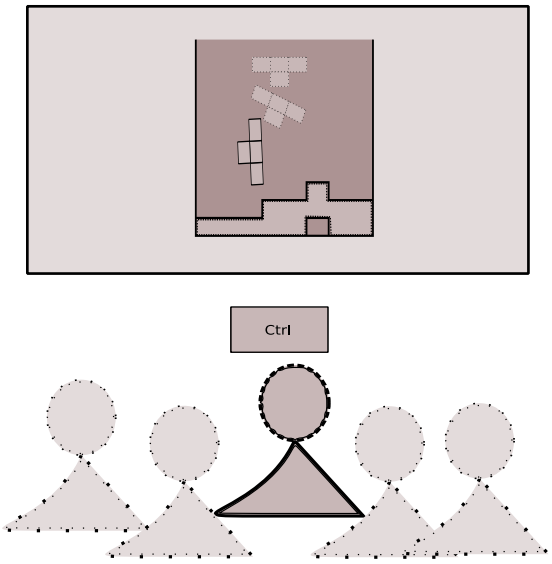


Figure 5.1: The gaming experience is the one to one relationship between player and game. It does not account for social factors or reasons to play such game.

5.2 Method: Searching for the Elements

The question driving this chapter is what are the core elements in the process of the experience of playing video games? Being more specific, what are the necessary conditions to procure a positive gaming experience? The nature of the question suggests that the route to find the answer should be bounded by qualitative methodologies (Green and Thorogood, 2004). In approaching the question, it is without a clear set of hypotheses or expected results. Grounded theory provides the type of methodology that permits to find an answer to this question. Grounded theory was originally developed by Strauss and Glaser as an inductive process from which the researcher was able to formulate a theory moving from data to empirical generalisation (Heath and Cowley, 2004). Grounded theory eventually bifurcated into two different schools: Glaser's tradition in one side and Strauss' school in the other. Glaser's view of grounded theory has remained true to the original inductive based methodology, while Strauss tradition has developed into a deductive method in which induction plays a minor role (Heath and Cowley, 2004; Strauss and Corbin, 1998).

5.2.1 About Grounded Theory

The Strauss tradition provides a better solution to the question sought after in this chapter; the objective of this study is to identify the elements that form the process of the experience. Deduction allows to iteratively selecting the common elements that form the core of the experience. The method to develop grounded theory in the Strauss tradition (Strauss and Corbin, 1998) (grounded theory hereafter) is composed of a series of coding procedures. Firstly, the data is *openly coded* in which quotes or words are selected and labelled; this process produces a set of labels, or codes, which can be related to each other producing a set of meta-codes or *axial codes*. These axial codes are the axis on which the forming theoretical understanding stands. This process is done iteratively (See Figure5.2) until no new codes emerge from the data. The codes are then *selectively coded* in which each category is fully developed in order to produce the theoretical framework.

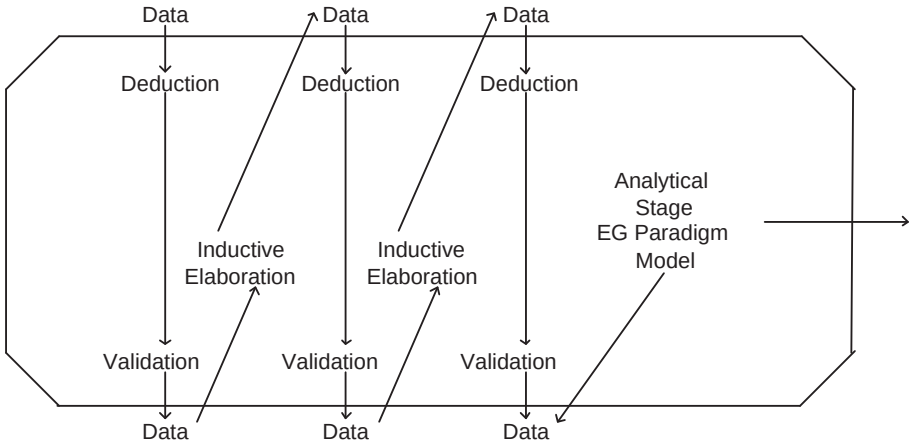


Figure 5.2: The Grounded theory process. Figure adapted from (Heath and Cowley, 2004)

One of the main challenges of using grounded theory method is that it is cumbersome to report (Strauss and Corbin, 1997, Introduction). The number of quotations used in the document can produce a document difficult to read. Just presenting the different codes might lead to controversy, as it has been argued that qualitative research is not replicable (Miles and Huberman, 1994). The approach usually suggested, which is followed in this document, is to present the theoretical framework as it is, focusing on the selective and axial codes, while providing enough data to support the claims made. In other words, the framework is formulated bottom-up, but it is presented top-down.

There are two main differences that this study has in relation to most grounded theory studies. One is the type of data used, and two is the usage of a metaphor in the selective coding part. The type of data used in this study was static. Printed

material was used, which for obvious reasons is not possible to query further. Instead of performing and transcribing interviews, the data was already printed, which required the coding mechanisms to be performed manually with the aid of "sticky notes", instead of using specialised software. The use of the metaphor is address as in the several presentations of this theoretical framework, the use of the "puppetry" usually generated a very rich discussion regarding puppets, it is for this reason that after the framework is introduced, the metaphor of "puppetry" is discussed.

5.2.2 Using Grounded Theory

In the results of the study presented in Chapter 4, the use of semi-controlled experimental settings where the player may not engage with the game in a usual way might have changed the story of the experience that the player is telling. That is, the player did not engage with the game because of a personal decision, but because it was part of an experiment. Due to the complex logistics required to perform ethnographic studies on players, or to interview them in a natural setting, game reviews were chosen as the main source of data, followed by interviews with game players, reviewers and designers. Game reviews are aimed at telling the general player the reasons that certain game should be played. They do not describe the ending of the game, but just try to describe what it is like to be playing. Game reviews, in some sense, convey the experience of playing video games. Four over-the-counter magazines from the month of August 2006 and three websites, all of them with a focus on video games were used as source data; see Table 5.1 for details of the sources. Besides game reviews, interviews and articles within the magazines were also used in a smaller scale.

The fact that the four magazines are from the same month and year, or that the magazines are written by professionals, should not hinder the results of the study for two reasons. One, the grounded theory method is robust enough to overcome the variances that are innate to commercial influences. In order to formulate a grounded theory there is an iterative process that involves looking for common concepts. It is expected that during this process the potential commercial influences would diminish as the formulated concepts have to be common with those found in the interviews and the websites. The second reason is that in order to formulate the grounded theory there has to be a driving research question; in this case the research question is to find the core elements of the gaming experience, as defined above. The experience of playing the same video game described by different magazines should still have the same common elements. Also, the use of websites added some variance to the types of games reviewed, as well as the fact that two magazines specialised in console games and two in PC games. Since it has been suggested that using only magazines could bias the results of the study, five interviews were conducted once the grounded theory study was finished. One game designer, two game reviewers and two players

took part in this process. The interviews were semi-structured, transcribed and then using selective coding with the axial coding already formulated. The interviews asked the participants to explain what they focused on while playing/designing/reviewing a video game, what made the game enjoyable, and what factors made them keep-on playing a game. As the interviews were semi-structured, the questions that followed aimed at deepening the answers that the participants gave to the previous questions. Only five interviews were conducted as it was found that the analysis had reached theoretical saturation. In other words, no new or relevant data was found to be emerging for the different categories; the category development had all the paradigmatic elements accounted for; and, the relations between categories had been established (Strauss and Corbin, 1997, p.143). The findings from this analysis are corroborated in the following chapters.

5.3 A Theoretical Framework for the Core Elements of the Gaming Experience

This section focuses on presenting the theoretical framework obtained using grounded theory. The objective of presenting the complete framework, before arguing the actual process of building it usually associated with grounded theory, is to discuss the overall elements as part of a holistic explanation. The details of the formulation of the framework are discussed later. Figure 5.3 shows all the elements to facilitate the discussion and to visualise the relation among them.

Table 5.1: Sources of Data for the Qualitative Study. The abbreviation within brackets is how that source is referred within the document. Magazines are quoted providing the page number from where the quotation was taken; Websites are quoted providing the name of the game from where the quotation was taken, as it is more manageable than providing the complete URL.

Source	**Material**
PC-Gamer. 64, August 2006 – {PCG}	24 Reviews
	2 Articles
PlayStation 2 Official Magazine, 75, August 2006 – {PSO}	11 Interviews
	1 Editorial
Edge. 165 August 2006 – {Edge}	31 Reviews
	3 Interviews
	7 Articles
PC-Zone. 171, August 2006 – {PCZ}	20 Reviews
	3 Articles
GameSpot – {GS}	3 Reviews
http://www.gamespot.com	Rating System
GameFaqs – {GF}	3 Reviews
http://www.gamefaqs.com	
ReviewsGameSpy – {GP}	3 Reviews
http://www.gamespy.com	Rating System
Designer 1 {d1}	Interview
Reviewer 1 {r1}	Interview
Reviewer 2 {r2}	Interview
Player 1 {p1}	Interview
Player 2 {p2}	Interview

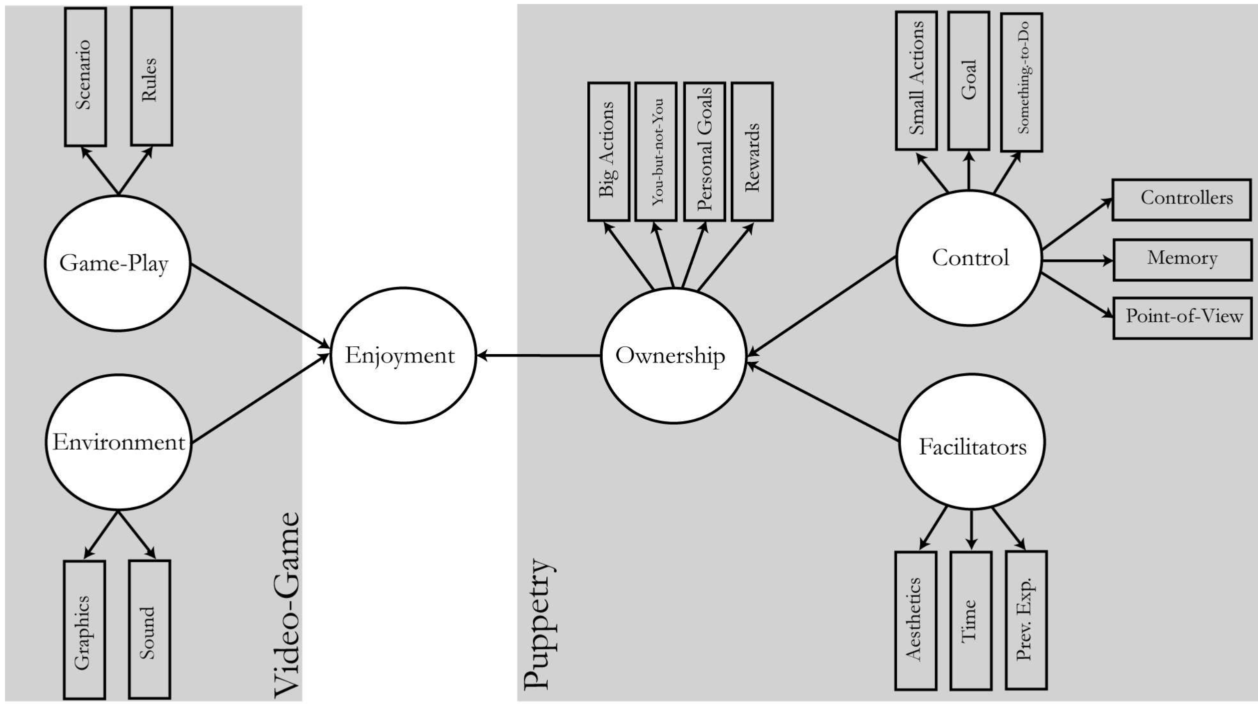


Figure 5.3: The Core Elements of the Gaming Experience. The two main elements are video game and puppetry. Video game is formed by game play and environment; Puppetry by control, facilitators, ownership.

The Core Elements of the Gaming Experience (CEGE) framework, the elements that are necessary but not sufficient to provide a positive experience. The CEGE are the video game itself and the interaction of the user with the video game, labelled "puppetry". The video game is intrinsic to the experience, without it there would not be a gaming experience. The framework does not try to describe what makes a good video game, rather, it focuses on how it is perceived in terms of the forming experience. The video game is perceived by two elements: **game play** and **environment**. The former can be thought of as the spirit of the game while the latter as the body. Game play defines what the game is about, its limitations and permisions. Environment is the way the game is presented to the player, the physical implementation into graphics and sounds.

5.3.1 Puppetry

The interaction of the player with the video game is the puppetry. Puppetry describes how the player starts approaching the video game until eventually the game being played is the outcome of the actions of the player. This process of interaction is affected by three conditions: **control**, **ownership** and **facilitators**. Control is the actions and events that the game has available to the player. Once the player takes control of the game, by using the game's resources the player makes the game respond to his actions, he makes the game his own. Ownership is when the player takes responsibility of the actions of the game, he feels them as his because they are the results of his conscious actions and the game has acknowledged these by providing rewards. There are also external factors that have impact on the interaction process. These external factors relate to the player's subjectivities, such as previous experiences with similar games or aesthetic value. Even if the player fails to rapidly grasp control, these factors can facilitate the ownership of the game by the player.

Control

It was mentioned previously that the player takes control of the game by using the game resources. Resources are understood as the tools that the video game provides to the player, they are bounded by the game's rules, environment and the implementation of the game. The process of gaining control is formed by six members: goal, small-actions, controllers, memory, something-to-do and point-of-view. Goal is the objective, the player has to understand what is the overall objective of the game, even if still is not clear on the details. Small-actions are the basic actions that the characters or objects on the game allow the player to do on them, such as moving to the left or to the right. Controllers are the way through which the player can exercise the small-actions, for example pressing a button makes the object moves to the left. Memory is the ability of the player to recall the connection between small-actions and controllers. Something-to-do refers to the concept that the player must be kept

busy, or doing something. Last, Point-of-view is the way that the player sees the environment of the game.

Ownership

Once the player starts to grasp control of the game, the player moves the game with his own intentions in order to make it his. The process of ownership is about using the elements that give the player control in his favour to enjoy the game. The elements that influence ownership are big-actions, personal-goals, rewards, and you-but-not-you. Big-actions are those actions that the player implements as strategies, by using a collection of small-actions, in order to complete the goal of the game. The player can also draw his personal-goals, and use big-actions to complete them. This process of the player achieving the game and personal-goals through his owns action is the basis of the process of ownership. The game acknowledges the ownership of the player by providing rewards. Last, you-but-not-you refers to the idea that the player is engaging in activities and that are alien to his everyday actions, which allows the player to create his personal-goals.

Facilitators

The last element to be discussed of the framework are the facilitators. Facilitators are the most subjective elements of the CEGE. It has been discussed so far that in order to have a positive experience the player should achieve ownership, and to do so the player must first get control of the game. However, it is possible to the player to achieve a level of ownership, then a positive experience, even if the player fails to get control. Also, the player may fail to achieve ownership even if getting control. This is done by the use of facilitators. Facilitators are time, aesthetic-values and previous-experiences. The amount of time that the player is willing to play, the previous experiences with similar games or other games, and the aesthetic values of the game.

5.3.2 The Theoretical Framework

The relationship between ownership and control is dynamic. Ownership is achieved when the player has a high level of control over the game; if the control is low, then the facilitators have to be high to allow the player to have a sense of ownership. The game is then used by the player to create his own story. The way the player starts making the game his own is by first applying his own actions toward playing the game. Those actions can be used to win the game, or accomplish the player's own goals. As the game progresses, the player starts to receive different types of rewards, which can be helpful toward winning the game, or just something that the player enjoys doing. It is also an opportunity so that the player can do something alien to his reality. The facilitators that influence puppetry are part of the subjective relationship of the player

with the game. A previous experience with a similar game, the amount of time willing to play, or the aesthetic value that player can perceive from the game.

From this theoretical framework, the following hypotheses can be formulated:

- Puppetry is a necessary but not sufficient condition to produce a positive experience.
- Ownership is produced by control.
- Facilitators aid control to produce ownership.

Puppetry is formed by three main categories: ownership, control and facilitators. These three categories are three latent variables or constructs. They were introduced in order to explain the process of the gaming experience. The three constructs can not be observed or measured directly. However, it is possible to learn about them by observing their members. The members of each category are indeed observable variables that can be quantified through empirical observations. Puppetry describes the relationship between the player and the video game. It does not measure the game or the player, but their relationship. It does so by proposing a series of falsifiable hypotheses and observable measures that bring the concept of user experience closer to the world of objective knowledge and operationalises the concept of experience. The details of how the framework was formulated follow.

5.4 The Formulation of the Grounded Theory

This section discusses in detail the elements of the framework, it provides quotes from the material reviewed to support the statements. Firstly, the concept of video game is discussed along with its different elements. Secondly, the interaction process, puppetry, is discussed.

5.4.1 About the Video game

It would be obvious to state that in order to have a gaming experience it is necessary to have a video game. The concept of video game discussed here is not on what makes a good one per se, rather, the discussion focuses on how the video game is perceived in terms of the experience.

The video game is understood in terms of two concepts: game play and environment. To provide an initial understanding of the difference between the two of them, it can be said that game play is the “soul” while environment is the “body”; as the former is the actual game while the latter is the physical representation of the game. The actual differences between game play and environment would be shown in the discussion in the following pages, highlithging the fact that game play is based upon the core qualities of what is a game, and environment is based upon how the game is implemented.

(Interview, r2): " People get very defensive because when you say strip away all the non essential stuff they think you are saying that things like the music are not important, which is not what you are saying, they are absolutely important but essential, you can, you should not, but you could get rid of them if you got rid of the music you still have something that is recognisable: the game. But if you took the game away and you are just left with the tape of the soundtrack and some pictures of the guys and an animation of the guy doing this, it would not be the game anymore. so if it is not that the presentation of things arent important but it is not that they are not absolutely crucial component of the overall experience, is that they are built on top of and underlying structure and that underlying structure is what makes the game a game, and everything in top of it is what makes the experience the experience. "

(PCZ, p.20): " The premise, if you're not familiar with the multiplayer modes of *Pandora Tomorrow* and *Chaos Theory*, is one of spies versus mercenaries. Three spies must hack three security terminals, controlling from a standard *Splinter Cell* third-person viewpoint and using many of the main game's acrobatic tricks. Three mercs [sic] must prevent the spies from doing this, from a first-person viewpoint, using a gun and a flashlight. Sound familiar? Well it should, because it's based on the much-played ancient Egyptian sport of hide-and-seek, albeit on a far more deadly and technological level. "

The preceding quote is the typical way in which a review refers to a video game. The game being discussed, *"Splinter Cell: Double Agent"*, is related to others with similar story lines or rules. The story of the game is about "spies versus mercenaries", the reader of the review could have a better perception of that story in case of familiarity with the two games mentioned. The rules of the game are bounded by the classic play of hide and seek, two teams are playing each with three members. Each team has a different goal in the game, and, presumable, the player can select the team of his choice. This excerpt of the review also describes the basic environment of the game, "security terminals", and a third-person view point (the character is fully visible), or first person (the player can only see what the player sees).

The description of the game is done using previous games as references, that is, instead of listing all the characteristics, the reviewers relate the game to a similar game as a way of shortening the description of rules and the type of stories. It contextualises them without getting into the details of the exact rules. In the quote presented above, the reference was made to describe the story of the game and the parts of the environment. In the next quote, the reference is made to describe the game in general:

(PCG, p.84): " The fact is, Titan Quest falls way short of its goal of being a modern, myth-based Diablo 2. "

From this quote, it can be expected that *"Titan Quest"* is similar in game play and environment to *"Diablo 2"*, but with an adapted story. It seems, that the experience of

playing video games does not start from zero, rather, it requires certain understanding of the domain in order to understand what the game is about.

> **(Interview, r2):** " Nintendo arguments that 20 years ago games were much more simpler and everybody can have a go and now games have become incredible complicated and they are full of all this hidden rules that you dont realise, if you are a gamer you dont realise you know, but the minute you sat, the minute that you try to get your mom to play something or she has no idea of what is going on you may find very hard to explain why you need to press that button to reload and you need to walk over that health pack and that other wont open until, you know stuff like doors that wont open until you kill all the enemies, which as a gamer you dont think about it, but as a sensible ordinary person is just ridiculous who is opening the door? Who is bloke who has his finger on the button and says everyone dead? OK, open. "

The rules are somehow implicit within game. This can be due to the fact that the numbers of rules in a video game are too many to be listed:

> **(Interview, p2):** " I like games that challenge your intellect: strategy, politics, and so on. "

This type of comment refers to the rules, to the "do's and don'ts" that the player can do in the game. The story is the dressing of the rules, taking the abstraction of the rules into characters and scenarios. Some times the story of the game can be inferred with the title of the game:

> **(Edge,p.46):** " Miami Vice opens with an option screen that says as much about gaming's potential as you wish fulfilment in four words as you could in 40,000. "

The story is also presented

> **(Edge,p.42):** " B-Boy. A dance-combat game that's not so much turn-based as head-stand, toprock [sic] and spin based. "

Game play is composed by the *rules* and *underlying story*, while environment is the *sound* and *graphics* of the game.

The video game is also experienced in terms of the environment it creates. This is done by providing the game with graphics and sound. In the printed data, they use pictures as aids to describe the graphics, with usually one or two lines to help in the description:

> **(Edge, p.89):** "There is a huge amount of destructible scenery [...] rocks, however, seem to be made of polystyrene. "

Revisiting one this part of the quote used previously:

> **(PCZ, p.20):** " Three spies must hack three security terminals, controlling from a standard *Splinter Cell* third-person viewpoint and using many of the main game's acrobatic

> tricks. Three mercs [sic] must prevent the spies from doing this, from a first-person viewpoint, using a gun and a flashlight. "

The environment is then bounded to the game play. It is expected that the provided graphics would correspond to the story of the video game. The player expects an environment that recreates "security terminals" where spies and mercenaries could interact with each other. But not only are the graphics responsible for creating the environment, there are also sounds:

> **(PCZ, p.12):** " Sound is hugely important for creating atmosphere and character in games - can you imagine being as tense in *Counter Strike* without hearing 'the bomb has been planted'? "

The sound seems to fade into the background of the video game, which seems to be more present when is missing or poor.

> **(PCG, p.80):** "in the wake of earsearing music and surreal audio effects"

The sound can also come from the background into the foreground by making it part of the story of the game:

> **(Edge, p.89):** "[D]ialogue boxes pop up to tell you which Nickelback song is currently playing. "

Or aiming at giving you the perfect place where the player can start engaging with the game:

> **(GS, "Barnyard for PC"):** "The audio is similarly atmospheric. Just standing still, you can hear the wind blowing through the trees, the birds chirping, and the faint sound of water coming from the direction of the river. "

Both sound and graphics make the environment of the game. The environment describes then how the game looks and sound like:

> **(GameSpy, "Flatout2"):** "Car impacts are loud and violent, and never fail to be utterly satisfying."

Once the video game has been defined in terms of the game play and the environment, it is the turn of the player to take those elements to his disposal.

5.4.2 About Puppetry

What the player is to do with the game is divided in a two stages process. Similar to a puppeteer that first has to learn how to manipulate the puppet and then has to lead the puppet into the show. First the player has to take **control** of game, and then the game has to become the player's **own**. This process is sequential, as control happens before ownership, the process is also concurrent, because as the game progresses the player can gain better *control* and *ownership* of the game. This process is called

puppetry. In case the player fails to grasp the control of the game, it is still possible to gain ownership if the game facilitates the player to overlook the lack of control for a while. Puppetry is divided in two main processes: control and ownership, but note that it is subject to the aid of **facilitators**.

Taking Control

Control is the player learning to manipulate the game. It is about the player learning how the objects in the game move, understanding the goals of the game, keeping the player occupied. It is also learning about the controllers, getting used to the objects and angles in which the objects are displayed and the ability of the player to memorise the relationship between controllers and the actions of the game.

The first two elements of control, controllers and small-actions, relate the basic actions that the characters in the game can do and the manipulation of the controller to make them do something. Without losing generality and to facilitate the discussion, the manipulable objects of the game would be called characters.

The *controllers* are the basic tool that the player needs to take control of the game. This is how the player starts to manipulate the different characters or objects on the screen.

> **(PCZ, p.53):** "Wave your mouse means wave your sword."

Controllers only refer to the player's manipulation of the physical tool, the set of actions that the character can perform are the *small-actions*. They are the other side of the controllers. Small-actions are the basic blocks that allow the player to get the character to do something on the screen. Pressing button "x" is the part of the controller, the fact that the character jumps is a small action. Consider the following quote:

> **(PSO, p.32):** "By targeting civilian and pressing L2 to shout at them"

From this quote the player has to relate the act of pressing, with the act of shouting that the character can do. In order to make the character shout, then, the player has to press L2. The player pressing a button on the controller is more of a mechanical control, whilst the player making the character shouting is more of a virtual control. If the game is ported to a different console, say from PS2 to PC, the virtual control remains the same, and it is the mechanical control that the user has to adapt. The sense of control can also be interrupted when there is a mismatch between controllers and small-actions:

> **(Edge, p.82):** "The razored neatness of its environment promises a precision that controls can't provide. "

The player then, after learning about the controller and the small-actions, has to memorise the bindings between controllers and small-actions.

> **(PCZ, p.47):** "250 skills for you to master."

> **(Interview, r2):** " ... you may find very hard to explain why you need to press that button to reload ..."

Memory is the element of control that gives the player the repertoire of actions to get into the game and that can be recalled at a given moment.

Point-of-view is how the information is displayed to the player. The player is able to see what is going in the game from different angles, depending on the game. The reviews do tell the player what to expect from the point-of-view, and it is also used as a way to classify games:

> **(PCZ, p.52):** "First person makes a combat that actually works."

Point-of-view is not Environment, POV is how the environment affects the control of the game.

The *goal* is the overall objective of the game. That is, the player learning what is to do. It is the player grasping the game play of the game:

> **(PCG, p.45):** "Village pillaging is hard work, get your posse of goblin minions to do it for you."

The goal is the top level objective of the game, as in the preceding quote, there are no details of what the player is exactly to do, but the player understand that the overall objective is to do village pillaging while directing an army of goblins. The player must be clear in what is the overall objective of the game in order to get control of the game.

The final element is *something-to-do*, that is, to keep the player busy doing something:

> **(Interview, r2):** " Say an interesting example is going to be [...] it is a driving game set in Hawaii, huge free space for you to drive around, but it is just roads like roads on an island, they are not race track roads they are not fake need for space curses they are just roads. And quite a lot of people who kind of sat with thought this just really boring just drive 40 miles and nothing happens and no one chases me and I dont have a gun and you know what is the point and it took all of us I think a while to adjust to this new experience is different kind of driven challenge, it is a different kind of experience the fun is in a different place where you are just used to looking for the game does do at all wrong it is just a genuinely new idea and it takes a while for your brain to adjust "

In the above quote, the player can identify the goal, however, the experience failed to become positive because the player got the sense that there was large spaces without things to do.

Assuming Ownership

Once the player starts to get control, the next step is the user to start building a sense of ownership of the game. This is accomplished when the user starts guiding the

player's own strategies in order to win the game and feel responsible for the actions that are taking place.

> **(Interview, d1):** " But also use tend to set their own challenges in their head, not to how much you script the challenge, or, they are actually really playing their own, you can tell them what to do, but theyll play it by themselves, they made their own mini-challenges subconsciously, they dont even know they are doing it half the time, but if you are playing a game like , you may be on a mission to do something, but in their back of their heads they are oh, last time I did this bit, I did not this street, how did I get to here? Where am I going? some people are mapping the game in their backs of their heads, other people are searching for radio stations, others are concentrating in shooting civilians, everyone plays the game in their own little way, I think is were game play comes from, as their own challenge. a lot of multiplayer games tend to take on because want that level of challenge that someone else brings, you have 30 people playing the same game at the same time but not one of them is playing quite the same game, they are all playing from their own viewpoint, from their own idea, and that is comes from. "

This quote summarises the concept of ownership quite well. The player gets hold of all the elements of the experience and starts doing his own game. To gain ownership, the player starts implementing *big-actions*. Big-actions are the set of smaller actions that the player uses in order to achieve the goal of the game.

> **(PCZ, p.53):** "Knock out a strut from a nearby shelf & barrels can tumble your foes."

Besides the objectives that the game imposes, the player also has *personal-goals* while playing.

> **(Interview, p1):** " On more recent games, sort of on the online games, I actually enjoy helping people, but to be able to help other people you usually have to achieve more than they have. So it is kind of self-fulfilling, the more you achieve the more you can help more people. "

The personal-goals can also appear while the player is engaging with the game, and decides to do something that has no influence on the outcome of the game, but rather just a personal-goal:

> **(PCZ, p.53):** "Giving you the option to ally yourself with the good or the ill without actually changing the trajectory of the story-arc."

Or it could also be to use the environment, game play and controls that the game provides to create your own game:

> **(Interview, r1):** " I'll take this as an example, is a game where you are a boy who lives just to wander around the world which is instead of cars they have this little bumpy trucks they call walking meck machines and part of the game you can indulge in is to get your own meck, customize it, play around with it but also around town is this beautiful

cartoonish kind of town, you can join a band you can start playing the harmonica in a street corner and people wouldn't listen until you get better, you can hang out with other people and you will group people to get a band and it is completely pointless and is just another way for you just to enjoy the game, you can play through the entire story with your big robot or you can become many other things as well but you can stay in the corner playing the harmonica people gather around clapping and you play a bum note and it just doesn't matter that it looks a bit rough and it sounds a bit cheap. "

The game acknowledges the ownership of the player by providing *Rewards*.

(Interview, d1): " [Question: What do you think is the thing that keeps a player playing same game?] It is bit a dough and bullet, it has to be continuously rewarding, but I am not sure, continuously challenging, there is something always that you want to do, even though, there is always rewards given to you, as completing little micro bits, and also larger sections, so there is always a feeling of you moving forward, so you always feels the potential, you can feel this you know, there are more cool things around the corner or something you havent seen before or just in the next screen, it comes down to I want to find out what is next, I want to find out if I press that button I am so engross that I cant stop now I have to keep going now, until I find a nice place to stop. is not you pushing the user to do more, is the user pushing themselves to do more, to discover what is around the corner, take the next turn, is that little intangibility of the more turn, or next door, or five more minutes. "

These rewards can be achieved sub-goals, or finishing missions:

(Interview, p1): " You fight a big boss at the end of may be 5 or 6, or several sub bosses and then a final big boss at the end with many characters over the final area, and then you share the loot and you go off and do something else. "

Or a continuum of challenges to the player.

(Edge, p83): "We were fed up with games that if someone starts to win, it becomes easier for them to win outright."

Or could also be those actions that have no direct impact on the game development, but amuse the player:

(PSO, p.36): "Also funny is princess Leia's mêlèe attack - a cheek-stinging slap."

(PCG, p.45): "It's clearly wrong to run into an inn and cut [sic] decapitate the cook, but your heart melts when one of them puts the chef's hat on."

While the player is taking big-actions and personal-goals, the player engages in actions that would not necessarily do in real life, it is a *You-but-not-You* effect:

(PCZ, p.51): "Before you offer them a quick painful smiting"

Most games would set the player in activities foreign to his everyday life

(Interview, p2): " [Question: Why do you play video games?] To have fun, to be some one else. "

Until this activities can be seen as something that the player has done himself:

(PSO, p.3): "Movies and books use real life war as rich source material, so why shouldn't games? (Although you don't get to pull the trigger yourself in a movie)"

Not only is the player able to do things otherwise illegal or alien to his own reality, but the player is also making the character grow under his control.

(PCZ, p.49): "Who you meet, how you treat them and how you solve their problems determines what recruits you can gather."

These suggest players would take responsibility for their actions as they themselves are to blame, and not the result of lack of control.

(Interview, p2): " I don't like games where you get stuck because you can't do the button combination in the precise second to jump over the pitfall. "

Ownership lets the player see the game as part of his daily life activities:

(PCZ, p.10): " Well let's see. I can leave my house and wander around the streets of east London to witness filthy roads [...] or I can ride around Cyrodiil's beautiful forests on my horse, while slashing any potential thieves. "

Facilitating Ownership

Puppetry is also formed by facilitators, which are the most subjective part of the elements, as they feed directly from the outcome of the experience. Facilitators allow the player to reach ownership even if there is poor control. With facilitators the players are willing to endure poor control because "there is something" about the game that they like.

The *aesthetic values* of the game are important in facilitating ownership. If the game looks well to the player, then he may be willing to try longer:

(PSO, p.3): "How the increased graphical fidelity changes the way you feel about your action?"

Or if the music attracts the player:

(Edge, p.82): "Locoroco is a nursery rhyme you can play."

Or because they see something about the game that is just amusing to observe.

(PCZ, p.59): "There are also Indian naked female archers that'll have your men furiously polishing their spears"

The fact that the player has engaged before with similar types of games is a constant during the reviews, as when used when describing the rules through similes with other games. The *previous experiences* of the player push the player to stay longer playing, as well assuming the consequences, or benefits, of his own actions even while playing:

> **(PCZ,p.2):** " I don't know about everyone else out there, but I'm really pining for a *Max Payne*. Fans are still churning out mods for the stylish fall of our hero. I'd love nothing more than to see a beautiful new incarnation to empty my clips at. Payne didn't look like he was going anywhere fun after the last game. Well, I say whatever it takes, we want him back. For all I care he can wake up from a cheesy *Dallas*-like dream and start all over again. "

Previous experience could not only be about similar video game, but just relating to a similar goal:

> **(PCG, p.86):** "I've never lost the heady sense of excitement when I first read about Alexander, and I've been waiting for a game to bring his story to life ever since. Rome: Total war let me live out my fantasies of conquest."

The *time* facilitator is about the time the user is willing to dedicate to play. The time can be intrinsic to the type of game:

> **(PCG, p.87):** "30 cities in 100 turns is an alarming tight schedule, and it radically changes the way you play. You can't sit back, develop your economy, and gradually build up your mega-army: there isn't time. "

Or just the time for the experience in that moment:

> **(Interview, d1):** " [It] is that little intangibility of the more turn, or next door, or five more minutes. "

The lack of those extra five minutes could make the player not want to play again, as there is an acknowledgment that without it, the game would not be enjoyed fully.

All these are the Core Elements of the Gaming Experience. The necessary, but not sufficient, conditions to procure a positive experience. Elements that if missing, then the experience would not be positive. Table 5.2 presents all the elements just discussed. All these elements and categories were formulated using a grounded theory approach (Strauss and Corbin, 1997), as discussed previously. This was done using an iterative method for which a set of codes was formulated. These codes were then refined forming a resulting set of axial codes. These axial codes were selected as the constructs, while the remaining codes are the observable elements. The next sections present an example of an experience using this framework, and the following one discusses the use of the metaphor of puppetry.

Table 5.2: The Core Elements of the Gaming Experience. There are two major elements: Video game and Puppetry. Video game describes the player perception of the game, while puppetry describes the interactive role.

Puppetry			**Video-Game**	
Control	*Ownership*	*Facilitators*	*Game-play*	*Environment*
Small Actions	Big Actions	Time	Rules	Graphics
Controllers	Personal Goal	Aesthetic Value	Scenario	Sound
Memory	You but not You	Prev. Experiences		
Point of View	Rewards			
Goal				
Something to do				

5.5 An Example of the Core Elements

To illustrate the use of the CEGE framework with a video game, an example using the game of Tetris is presented. The example is just presented to showcase the different elements of the framework as it has been suggested that this activity may ease the understanding of it. The example is based on my experience.

- Video game
  - Game play

    Scenario Cubic figures of different shapes and colours.

    Rules Figures drop from the top of the screen and have to be placed at the bottom of the screen. When a vertical line is completed using this figures, it disappears. The speed of the falling figures increases. One the top screen is blocked and no more figures can be dropped, the player has lost.
  - Environment

    Sound Russian-type music that increases its pulse as the speed of the game increases.

    Graphics Figures of different colours, formed by squares.
- Puppetry
  - Control - See Figure 5.4.

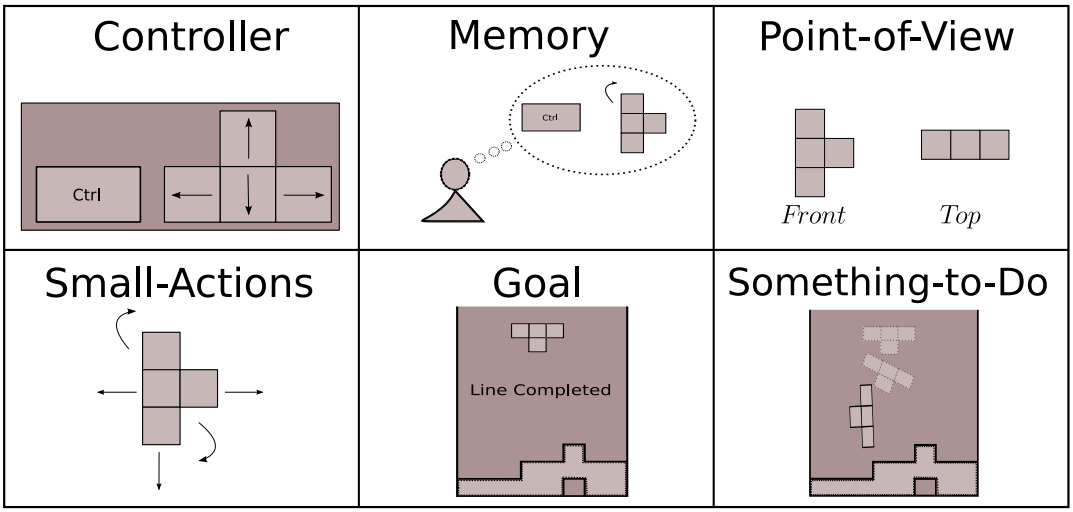


Figure 5.4: The elements of control while playing Tetris. Small-Actions are the movements that the figures can perform, such as moving right, left or rotating. Controllers are the physical implementation of how those actions can be executed by the player; in the computer version, this is done using the directional arrows and the control key. Memory is me remembering the small-actions and how they relate to controllers; some-times I forget that I can rotate the figure in two different directions. Goal is the overall objective of the game, in this case, making lines and not losing. Point-of-view is the how I see the game, in this case the figures are seen from the front, but some implementations show the figures from top. Something-to-do in this case is moving the figures around before they are placed in their location; when the speed is slow, I just moved them from side to the other to keep my self busy.

- Ownership

  Big-Actions The different small-actions used to make a line.

  Rewards The points received after making a line.

  Personal-Goals Trying to do four lines at once, or waiting until the screen is almost full and then start making lines.

  You-but-not-You Engaging in a fast paced activity that requires my full concentration.

- Facilitators

  Time I can play Tetris for a couple of minutes and for hours and hours. I don't really have a time constraint when engaging with the game.

  Prev.-Experiences Experiences with simple games make them a good time killer. Also, having played Tetris before makes me look for different implementations of the same.

  Aesthetic-Value The Tetris music is quite enjoyable, the graphics are simple, but elegant.

5.6 Puppetry and Video games

Blackwell (2006, p.524) proposes the idea that *"[a]s researchers, we must also be metaphor users, in order to invigorate the professional designs and user experiences of the future"*. With this spirit in mind, during the coding procedures of the study the label "puppetry" was attached to the categories of control and ownership. This was due because it reflected on the idea that playing a video game was similar to puppetry, in which first a puppet has to be manipulated and then used as part of a play.

Looking deeper into the concept of puppetry in theatre provides a good metaphor for the gaming experience. The discussion that follows is done with two objectives. One is to justify the use of the label puppetry to describe the core elements of the experience. The second is to provide a pragmatic view of the experience. The concept of puppetry, as a semantic tool, does not help in the original aim of the study to operationalise the experience; rather, it provides a great vehicle to relate the experience to another domain. It also completes the phenomenon of experience described previously. The process is understood in terms of its core elements and the outcome can be understood as a metaphor that allows reflecting and internalising the prosaic experience. The objective of the framework is then to provide an explanation of the *"phenomena of our experience in terms of an underlying reality which we do not experience directly."* (Deutsch, 1997, p.3).

Puppets are shadows, hands, dolls, figures and figurines. The physical representation of the puppet is eclectic, but when faced with one it is possible to recognise it.

They are not puppets because of their physical characteristics, although they share a common semiotic, but because of the experience they convey to the artist and the audience (Tillis, 1992). Upon the artist, the puppet is understood as a medium under control that frees the artist of any responsibility. It gives the freedom to act in a world unbounded by reality as the consequences of the actions of the artist through the puppet are only valid in that world. Although the artist manipulates the object, it is not the artist who makes the object a puppet. The puppet becomes a puppet once the audience gives life to it. The audience recognises that it is indeed an object performing in front of them. Still, they agree to suspend their disbelief and bring life to the object so that it becomes a puppet. Tillis (1992) calls this a "double-vision" effect, seeing the object both as an object and as alive. The puppet is then defined as a *"theatrical figure perceived by an audience to be an object, that is, given design, movement and frequently, speech, so that it fulfils the audience's desire to imagine it as having life, by creating a double vision of perception and imagination, the puppet pleasurably challenges the audience's understanding of the relationship between object and life"* (Tillis, 1992, p.65).

In video games the player performs both the functions of the artist and the audience, while the video game has the role of the puppet. The player has control over the medium, a medium unbounded by reality, while at the same time has a double-vision allowing the game to be "real". It is in this process of control and ownership that the core of the gaming experience is defined. And more importantly, that is it permits that a game can be defined in terms of its experience but letting the user define it. The common semiotic of the video game is in the implementation of the game. They are the rules and story, or game play, and the graphics and sounds, or environment.

Having introduced the theoretical framework and the metaphor, it is possible to explore the further the metaphor. Game play and environment are two elements of the gaming experience that are intrinsic to the game, but puppetry is what builds it. Puppetry is the basic part of the experience. The lack of puppetry would produce a bad experience, but its presence does not necessarily guarantee a good experience. Unlike an actor, who becomes a character in the flesh and mind, a puppeteer is responsible for manipulating the character through a set of strings. Puppetry represents drama without actually impersonating the human (Lanyon, 1993). A puppeteer is responsible for creating and manipulating the puppet, and creating it does not mean the physical representation of the figure, but the character creation. The puppet is not only characterised by its physical form, and it does not need to be anthropomorphic. Rather, once the audience imagines that the object has a life of its own, an animated object becomes a puppet but not when the persona manipulating it takes control over it (Tillis, 1992). Puppetry then is divided into a two fold process, controlling it and

giving it life. The strings of a puppet are equivalent to the controllers, or input devices, used while playing video games. However, the gaming experience occurs when the player has a lively presence within the game.

The hypothesis proposed from the theoretical framework is that in the game, puppetry is a result of the player having control and ownership over the game. A puppet comes to life when the audience sees it as a live object. In a game, the player in his role as audience, makes the game his by implementing his own actions into it. By taking the role of the artist while achieving control, and the role of the audience while owning the game. Ownership is achieved when the player has a high level of control of the game, or if the control is low, then combination of control and facilitators lead to ownership. The game becomes the clay which the player can use to create his own experience. The way the player starts making the game his own is by first applying his own actions toward playing the game. Those actions can be used to win the game, or accomplish the player's own goals. As the game progresses, the player starts to receive different types of rewards, which can be helpful toward winning the game, or just something that the player enjoys doing. It is also an opportunity so that the player can do something alien to his reality. In order to have ownership, the player has to grasp the control of the game. There is a mechanical control that is related to how the game is implemented in the specific console, and the virtual control. The facilitators that influence puppetry are part of the subjective relationship of the player with the game. A previous experience with a similar game, the amount of time willing to play, or the aesthetic value that player can perceive from the game. The aesthetic value is the player's perception of the graphical and aural elements of the game. From a representational perspective by triggering those emotions that go beyond the pure representation, but the subjective meaning that can trigger the player's desires. Figure 5.5 tries to represent this idea of the metaphor of the experience of playing video games as puppetry.

5.7 Summary

This chapter introduced a theoretical framework to explain the gaming experience. The core elements of the interactive part of process of the experience were identified as control, ownership and facilitators. The categories were encapsulated in the metaphor of puppetry, as it shares several characteristics with theatrical puppetry. Puppetry is defined in terms of the experience produced, and not in terms of the physicality of the puppets. The roles of artist and audience in the theatrical puppetry have parallels with the game player. The player is responsible for bringing the game to life, while giving the player the control over a medium unbounded by reality. The qualitative study conducted explored the basic elements that form the prosaic experience. Exploration of the process of the gaming experience allowed identification of the

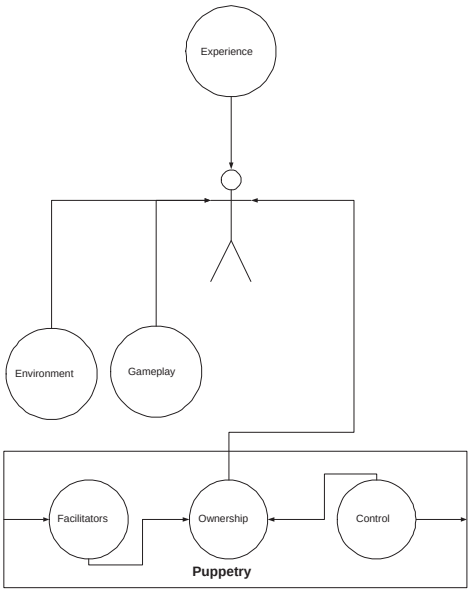


Figure 5.5: Puppetry as metaphor for the experience. The player interacts with the game by interacting with the game play and environment, and with the elements of puppetry to form the core of the experience. With the right hand the player takes note of the game, and with the left hand the player interacts with it.

elements that build the experience: video game and puppetry. The former is the players interpretation of the game, whilst the latter one is the player taking control and ownership over the game. The elements were just not listed, but it was also showed how they interacted with each other in order to form the experience.

The next step is to corroborate this framework in a wider context. The following chapters discuss the formulation of a questionnaire using this framework, and then the validation of a model based on the theoretical framework using structural equation modelling.

Chapter 6

Designing and Evaluating a Questionnaire

The CEGE framework, introduced in Chapter 5, presented a series of elements that were necessary, but not sufficient, to have a positive experience while playing video games. The framework described how the elements related to each other and how they provided an overall contribution to the experience.

The thesis of this dissertation is that it is possible to assess user experience from an objective approach. In this chapter, an instrument is designed in order to assess the CEGE; this is done via a questionnaire that asks participants to rate items according to a specific experience of playing a video game.

This chapter presents the process followed to design and evaluate the questionnaire. The evaluation presents the reliability and scores of the constructs. The analysis of the relationship among the constructs is presented in Chapter 7. The questionnaire was developed using an iterative process following the usual psychometric guidance (i.e. Kaplan and Saccuzzo, 2005; Nunnally and Bernstein, 1994; Kline, 1993; Cronbach, 1990; Loewenthal, 2001). However, the main reference used was Nunnally and Bernstein (1994) as they provided the most complete reference, and it is widely used elsewhere. Loewenthal (2001) was mainly referenced in points of style or practical considerations. The results obtained suggest that the instrument is reliable for assessing the CEGE. All but two of the constructs showed a strong reliability. The reasons that these two constructs, ownership and game play, did not have high reliability is discussed. They also show that CEGE correlate with enjoyment and that frustration is not a composite of enjoyment.

The chapter is divided in eleven sections. The first section outlines the objectives of the questionnaire. Sections two and three present the constructs to be evaluated and the development of the items of the questionnaire. Section four discusses the drafting of the questionnaire while section five discusses the deployment of the questionnaire. Sections six, seven and eight present the results obtained from the questionnaire; section six deals with information regarding the participants, section seven with item analysis and section eight with the internal reliability. Section nine presents a dis-

cussion of the results and section ten suggests how to use the results as norms. A summary of the chapter is presented in section eleven.

6.1 Objectives of the Questionnaire

The questionnaire is designed with two objectives: First, it has to be a valid and reliable instrument to assess the constructs of the CEGE; Second, to provide norms for other possible users of the questionnaire. In order to have a reliable and valid questionnaire, a construct must be "homogeneous with respect to its content, but heterogeneous from the standpoint of the methods used to infer this content." (Nunnally and Bernstein, 1994, p. 311). In other words, the questionnaire must have a high internal consistency, which should be achieved with a diverse set of items with low correlation between them. The constructs to be evaluated are divided into three categories:

1. The main construct that reflects the concept of the Core Elements of the Gaming Experience (CEGE) as the driving force behind a positive gaming experience.
2. The two sub-constructs that form them, Puppetry and Video game.
3. Those constructs that constitute each of the previous two constructs: control, facilitators and ownership for Puppetry, and environment and game play for Video game.

The validation is done qualitatively and the reliability quantitatively. Validity refers to construct and face validity, that is, that its items do address the concept that is supposed to be assessed in the eyes of experts and questionnaire takers. Reliability refers to the level of consistency of the construct. In other words, this chapter presents how well structured each of the constructs is and their basic correlations with each other. The next chapter looks more closely at the relationship among the constructs using Structural Equation Modelling (SEM) and Confirmatory Factor Analysis (CFA).

The second objective of the questionnaire aims to take advantage of the large pool of participants that completed the questionnaire. The scores obtained for the different scales are divided across experiences, such as the platform used to play the game, or the amount of time played.

The strategy to design the questionnaire was divided into six steps. The steps, presented below, are fully discussed in the subsequent sections.

1. Identify the constructs to be evaluated.
2. Propose a set of items per constructs.
3. Validate the items and constructs via pilots and interviews.

4. Deploy the questionnaire.

5. Assess the reliability of the questionnaire.

6. The questionnaire as an instrument to assess the gaming experience.

6.2 Identifying the Constructs

The Core Elements of the Gaming Experience (CEGE) are clustered in the user's perception of the video game and the user's interaction with the video game, namely the constructs of Video game and Puppetry respectively. The former is formed by the constructs of game play and environment; while the latter by control, ownership and facilitators.

Experience is both a process and outcome, as discussed in Chapter 2. CEGE addresses the process of the experience, but it is expected that it will relate to its outcome. The outcome of the prosaic experience, is the general sense of enjoyment after engaging with a video game. Also, as discussed in Chapter 4, enjoyment of playing video games may include a sense of frustration. In order to address the relationship between the process and the outcome of the experience, a construct that tests enjoyment and frustration is also included in the questionnaire. The inclusion of this construct is to keep a coherence within our theoretical stand point regarding experience; the relation between process and outcome. This is also done to establish the predictive validity of the CEGE. Nunnally and Bernstein (1994, p.83) define predictive validity as "establishing a statistical relationship with a particular criterion". In this case, it is expected that the CEGE constructs would correlate highly with the Enjoyment and Frustration construct, providing a validation of the framework with the sense of enjoyment after engaging with a video game.

6.3 Developing the Items

In order to ease the discussion, when talking about the constituents of the constructs obtained by the framework, they will be referred as "elements"; see Table 6.1. The statements to be used in the instrument will be referred as "items". An item is the representation of an element in the questionnaire. A pool of items was developed for each of the elements. The item creation consisted of a brain storming session using examples of the data which produced the constructs. The items were phrased in a general way, trying to describe the element that it was addressing in a simple way. A total of 121 items were created (See Appendix C). The pool of items was validated by external reviewers, that is, they were not part of the item creation process. They checked for coherence and simplicity in the statements, as well as for a valid relation to the elements they represented.

Table 6.1: Constructs and Elements of the CEGE framework.

Puppetry			**Video-game**	
Control	*Ownership*	*Facilitators*	*Game-play*	*Environment*
Small Actions	Big Actions	Time	Rules	Graphics
Controllers	Personal Goal	Aesthetic Value	Scenario	Sound
Memory	You but not You	Prev. Experiences		
Point of View	Rewards			
Goal				
Something to do				

6.3.1 General Items

The questionnaire asked the participants to complete a series of general items aimed at identifying the type of experience that the questionnaire would be assessing. These items, all with the possibility of open ended results, were:

- Sex
- Age
- Game Played
- Approximately Time Played
- Date of Completion

6.3.2 Items Regarding Enjoyment

The construct of Enjoyment and Frustration was added to the questionnaire to correlate the CEGE score with a measure of the prosaic experience. For this end, a set of eight items were created. The items asked the participant to rate how much they enjoyed the game and if they would play again the same again. Items were phrased both in positive and negative terms.

6.3.3 Items Regarding Puppetry

Puppetry is formed by three constructs: facilitators, control and ownership. The guideline was to formulate at least five items per construct, thus puppetry would have at least a total of fifteen items. Each of these constructs is constituted by a number of elements, three for facilitators, six for control and five for ownership. A pool of thirty items was devised to address each element of the constructs.

There were also three more items for the constructs, each of them aimed at assessing the general feeling of control, ownership and puppetry. This was done because

these three constructs address directly the interactive part of the experience. A pool of sixteen items was devised to address these general issues.

6.3.4 Items Regarding Video game

Video game is formed by the constructs of environment and game play. Each of them is constituted by two elements. The minimum number of items sought was five per construct, so at least ten items would address the concept of video game. A pool of ten items was created for environment and twelve for game play.

6.4 Drafting the Questionnaire

From the pool of items, the first draft of the questionnaire was developed by selecting around five items per construct (Kline, 1994). Using an iterative process, the item selection for each construct was done using the guidelines specified above. It was sought to include one item per element. If more than one item was included, it was done because it felt that only one was not enough to address the element; or, because the construct had less than five elements.

The items regarding enjoyment asked the participant to rate the enjoyment of the playing the game, the frustration at the end of the game, the liking of the game and the likelihood of playing the game again. These items addressed the prosaic experience of playing video games. They were diverse in the sense that they differentiated between playing the game and the game itself, they involved the sense of frustration that was perceived as important in previous experiments, and they also included the possibility of the player engaging with a similar experience in the future.

For control, there was one item per element, except for small-actions and point-of-view, as there were two items for each of these elements. The extra items were included because it was felt that one item was not enough to address the concept. There was also an item that attempted to represent the general sense of the construct. There were six items for facilitators; this was due to the fact that there are three elements. Two items per element were included to meet the requirement of at least 5 items per construct. Finally, there were six items regarding ownership, one item per element except for 'personal-goals' and 'you-but-not-you'. There was also an item that addressed the general concept of ownership and one that addressed the general concept of puppetry. The draft of the questionnaire was validated by an internal and an external reviewer. The internal reviewer was involved in the review process of the pool of items discussed previously, while the external had no previous contact with the questionnaire.

The instructions given to the participants to complete the questionnaire were: "Please rate the following expressions according to the experience that you just had". A seven point Likert scale was used to rate each of the items (Cox III, 1980).

The general items were changed due to the comments provided by the external reviewer. As these general items are not part of the construct validity study, the results are discussed now. Except for the item "Game Played", all items provided a group of answers that the participants had to select; "Game Played" was kept as an open ended item. The item "Sex" was renamed "Gender". Item "Game Played" was made the only mandatory item to complete in the whole questionnaire. Item "Age" had seven options to describe the age group. Item "Type of Console" was added with the possibility of selecting six options. "Time played" provided six options, with the possibility of writing-in the time if it lasted more than three hours. The draft of the questionnaire had 38 items, and it is presented in Appendix D. This draft was used to pilot the questionnaire with potential participants.

6.4.1 Pilot

The pilot was designed to check the face validity of the questionnaire. The questionnaire was piloted by posting it on-line. Participants were recruited by sending emails to the graduate students of UCLIC and CS-UCL. All participation was anonymous and voluntary. Participants were allowed to leave comments about the questionnaires. The questionnaire was implemented in LimeSurvey, a PHP/MySQL based program.

The results obtained from the pilot are as follows. Fourteen participants, twelve males and 2 females, took the questionnaire. Only six participants left comments. The comments argued that there was a difference regarding different gaming experiences, and that one questionnaire could not be used to address all of them.

The item "I lost on purpose to stop playing" was criticized as it is a dichotomised item, for which no scale was needed. Items with references to "characters" were also commented on because it was felt that some games do not have them.

Tentative reliability analysis showed encouraging results regarding the main constructs. The coefficient Cronbach's alpha (Cronbach, 1951) was used to assess the reliability of the different scales of the questionnaire. The alpha coefficient for CEGE was 0.780, 0.754 for Puppetry and 0.698 for Video game. The coefficients for the other constructs were, 0.801 for control, 0.488 for facilitators and a negative alpha for ownership, 0.513 for game play and 0.363 for environment. The low numbers, and the negative one for ownership, can be explained as result of the low sample size. A broader discussion on the coefficients obtained for the Cronbach's alpha is presented later in Section 6.9.1. However, the high results obtained for the main scales provided confidence in the questionnaire. In order to address the comments obtained, a series of interviews were conducted.

6.4.2 Interviews

Ten structured interviews were conducted to validate the questionnaire. The interviews followed the questionnaire in the order of the questions queried and it was used

as guideline. Participants were recruited by email, and they were not involved in any of the previous validations. The only requirement was that they would play video games on a regular basis. Participants were asked to rate each of the statements taking into consideration the game they last played, or the game they played more often. As well as rating, for each item they were asked to explain what they understood and if they could elaborate in their answer.

The range of games the participants described was wide, some of them refer to their last experience playing with a mobile device, or playing with a console. Some described playing a game that they just bought, and others their favourite game. They were free to select to the game they wanted to discuss.

Overall, the questionnaire was well received, but suggestion were made in relation to some of the language used. Based on the comments made by the participants, the following changes were made:

1. The item regarding losing on purpose was changed to "I got bored playing this time". Participants felt that rather than start losing, they would just close the application or turn off the console, so even though they stopped playing, they never lost on purpose.

2. The word 'story' was changed to 'scenario'. Players would not like the use of the word "story" to describe abstract games and they preferred the word scenario to convey the meaning of "disguising the rules".

3. Items were rephrased whenever the word "character" appeared, usually by the word "game".

4. Finally, question 39 was added as it was concluded that the element 'small actions' was not properly addressed.

Based on these results, a final draft of the questionnaire was created. The final version of the questionnaire can be consulted in Appendix E.

6.5 Deploying the Questionnaire

The questionnaire was deployed on-line with opportunistically selected participants. The questions order was randomised on each presentation. Announcements regarding the questionnaire were posted in video games forums, social networking sites, as well as emails to mailing list of different universities. The address of the questionnaire was distributed in social networking sites, such as Facebook, forums regarding computer games, and the mailing list of postgrad of undergrad students of UCL. It is important to notice that even though the questionnaire was completed anonymously, the number of respondents increased dramatically once it was distributed on the UCL mailing lists. A total of 598 questionnaires were completed.

Participants were asked to complete the questionnaire after they had finished playing the video game of their preference. As the objective of the study is to find the characteristics of video games that do not produce negative experiences, it is expected that the participants that complete the questionnaire would be those that are having a positive experience. Thus, it would be possible to assess are the proposed elements that are necessary to have a positive experience. The software does not allow the same computer to take the questionnaire more than once, however, this can be altered by using a different browser or by deleting the cookie that the questionnaire left on the computer. It is assumed that only one person per experience per questionnaire was completed, but there is no way to verify this. However, as long as one questionnaire was completed per experience, there is only a minimal fear of inappropriate data.

6.6 General Items Results

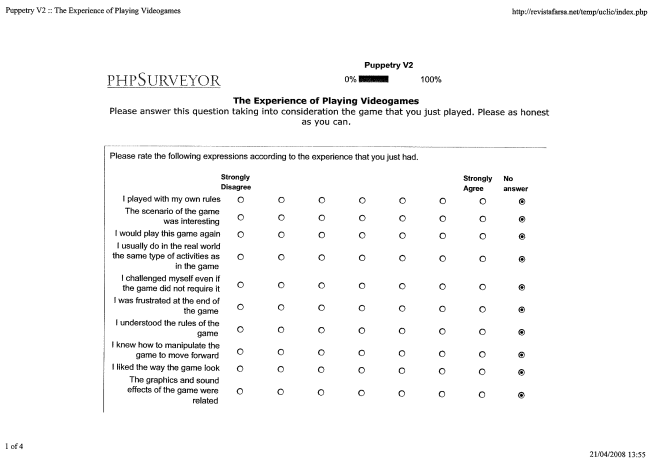
The results obtained from the general items are as follows. Of the 598 participants, 467 were male and 131 female. Most participants, 214, were between 18 and 21 years old, followed by those, 182, aged between 21 and 25. In terms of the experience being described by the questionnaire, 235 were produced by console based video games and 208 by PC. The majority of the experiences, 166, lasted between 1hr and 2hr; a very close second was those that lasted between 30mins and 1hour with a total of 163. The complete results obtained from the general items are presented in Table 6.2.

6.7 Item Analysis

6.7.1 Missing Value Analysis

Not all items were completed by all participants, so missing-data analysis was done to identify if the data was missing completely at random (Little, 1988) or if it was due to any characteristic of the questionnaire. The analysis was complemented by utilising dichotomised correlations (Hair Jr. et al., 1998, p.50). There three possible types missing data, one missing completely at random, missing at random, and not missing at random. The results show that the data is not completely missing at random. Analysing the patterns of missing data in relation to other variables using t-tests, shows that some variables have significant differences for a $p < 0.05$, suggesting that the data is missing at random. This means that the missing data does not depend on the data itself; i.e. a question is not answered because of another question.

The number of missing data is relatively low compare to the sample. Missing data is remedied with the following strategies: list-wise and pair-wise elimination and EM imputation. List-wise elimination still provides a valid sample of 359 to perform multivariate analysis. Using the EM imputation method provides correlations of the items similar to those with pairwise deletion; the means and standard deviations are


Puppetry V2 :: The Experience of Playing Videogames http://revistafarsa.net/temp/uclic/index.php

PHPSURVEYOR

Puppetry V2

0% 100%

The Experience of Playing Videogames

Please answer this question taking into consideration the game that you just played. Please as honest as you can.

Please rate the following expressions according to the experience that you just had.

	Strongly Disagree						Strongly Agree	No answer
I played with my own rules	○	○	○	○	○	○	○	◉
The scenario of the game was interesting	○	○	○	○	○	○	○	◉
I would play this game again	○	○	○	○	○	○	○	◉
I usually do in the real world the same type of activities as in the game	○	○	○	○	○	○	○	◉
I challenged myself even if the game did not require it	○	○	○	○	○	○	○	◉
I was frustrated at the end of the game	○	○	○	○	○	○	○	◉
I understood the rules of the game	○	○	○	○	○	○	○	◉
I knew how to manipulate the game to move forward	○	○	○	○	○	○	○	◉
I liked the way the game look	○	○	○	○	○	○	○	◉
The graphics and sound effects of the game were related	○	○	○	○	○	○	○	◉

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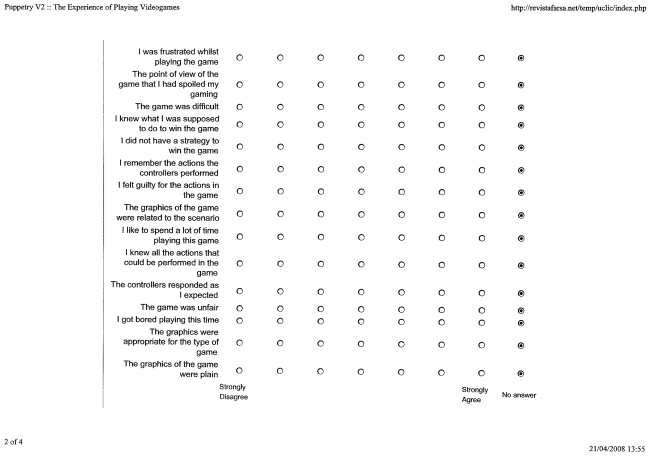
(a)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I was frustrated whilst playing the game	○	○	○	○	○	○	○	◉
The point of view of the game that I had spoiled my gaming	○	○	○	○	○	○	○	◉
The game was difficult	○	○	○	○	○	○	○	◉
I knew what I was supposed to do to win the game	○	○	○	○	○	○	○	◉
I did not have a strategy to win the game	○	○	○	○	○	○	○	◉
I remember the actions the controllers performed	○	○	○	○	○	○	○	◉
I felt guilty for the actions in the game	○	○	○	○	○	○	○	◉
The graphics of the game were related to the scenario	○	○	○	○	○	○	○	◉
I like to spend a lot of time playing this game	○	○	○	○	○	○	○	◉
I knew all the actions that could be performed in the game	○	○	○	○	○	○	○	◉
The controllers responded as I expected	○	○	○	○	○	○	○	◉
The game was unfair	○	○	○	○	○	○	○	◉
I got bored playing this time	○	○	○	○	○	○	○	◉
The graphics were appropriate for the type of game	○	○	○	○	○	○	○	◉
The graphics of the game were plain	○	○	○	○	○	○	○	◉
	Strongly Disagree						Strongly Agree	No answer

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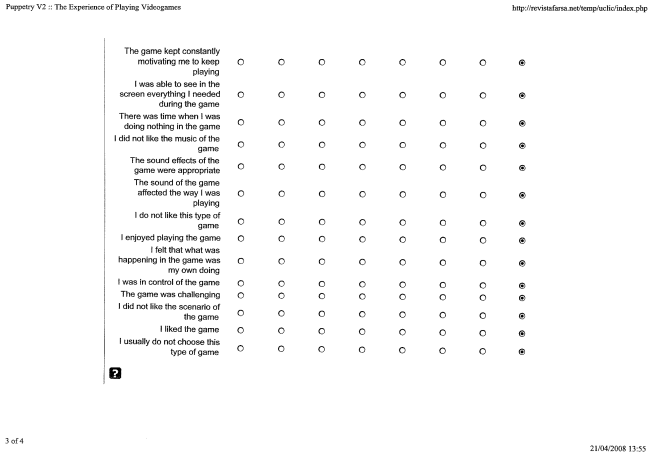
(b)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The game kept constantly motivating me to keep playing	○	○	○	○	○	○	○	◉
I was able to see in the screen everything I needed during the game	○	○	○	○	○	○	○	◉
There was time when I was doing nothing in the game	○	○	○	○	○	○	○	◉
I did not like the music of the game	○	○	○	○	○	○	○	◉
The sound effects of the game were appropriate	○	○	○	○	○	○	○	◉
The sound of the game affected the way I was playing	○	○	○	○	○	○	○	◉
I do not like this type of game	○	○	○	○	○	○	○	◉
I enjoyed playing the game	○	○	○	○	○	○	○	◉
I felt that what was happening in the game was my own doing	○	○	○	○	○	○	○	◉
I was in control of the game	○	○	○	○	○	○	○	◉
The game was challenging	○	○	○	○	○	○	○	◉
I did not like the scenario of the game	○	○	○	○	○	○	○	◉
I liked the game	○	○	○	○	○	○	○	◉
I usually do not choose this type of game	○	○	○	○	○	○	○	◉

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(c)

Figure 6.1: Screenshots from the questionnaire: The screenshots are included to illustrate what were participants seeing when completing the questionnaire. The screenshots were produced by first printing the questionnaire and then scanning it, as the original source of the questionnaire was no longer available when producing this report. The screenshots at higher resolution, and including the items for general items, are included in Appendix H.

Table 6.2: Responses to the general items. The only mandatory item to answer was Gender.

Item	N	Percentage
Gender		
Male	467	78.1
Female	131	21.9
Type of Console Used		
Console (Except Wii)	235	39.30
PC with mouse and keyboard	208	34.78
Nintendo Wii	73	12.21
Mobile Console	46	7.69
PC with special devices	17	2.84
Mobile Phone	14	2.34
No Answer	5	0.84
Time Played		
Less than 15mins	34	5.69
15-30mins	80	13.38
30mins-1hr	163	27.26
1hr-2hr	166	27.76
2hr-3hr	91	15.22
More than 3hr	62	10.37
No Answer	2	0.33
Age		
Under 18	8	1.34
18-21	214	35.79
21-25	182	30.43
26-31	120	20.07
32-36	45	7.53
37-41	20	3.34
42-51	4	0.67
52-	3	0.50
No Answer	2	0.33
Completed Questionnaires	*598*	*100*

also quite stable in comparison. The missing data in the analysis is then left as it is,

using pairwise deletion when performing calculations.

6.7.2 Analysis of Normality

The Kolmogorov-Smirnov method was used to analyse the normality of the responses. The results suggest non-normality. Most of the variables are negatively skew (Table 6.3); except for items 2 & 3. This can be explained due to the fact that most experiences are positive. That is, it was not normally distributed that some participants had a good, normal and bad experiences, but that most of them had good experiences. A more complete discussion is presented below, when discussing the issues of frustration and the scores obtained.

Table 6.3: Results per item for the questionnaire. Means obtained using only the available data (N), as non-answered items were ignored. The means of the negative worded items were obtained using the coded result.

No.	Item	Scale	N		Mean	Std. Dev.	Skewness
1	I enjoyed playing the game	Enjoyment	569	95%	6.381	0.918	-2.076
2	I was frustrated at the end of the game	Frustration	547	91%	2.693	1.654	0.894
3	I was frustrated whilst playing the game	Frustration	574	96%	3.479	1.788	0.137
4	I liked the game	Enjoyment	569	95%	6.408	0.954	-2.515
5	I would play this game again	Enjoyment	562	94%	6.528	1.001	-2.963
6	I was in control of the game	Puppetry - Control	563	94%	5.739	1.214	-1.033
7	The controllers responded as I expected	Puppetry - Control	559	93%	6.063	1.198	-1.765
8	I remember the actions the controllers performed	Puppetry - Control	545	91%	5.998	1.350	-1.663
9	I was able to see in the screen everything I needed during the game	Puppetry - Control	566	95%	5.714	1.500	-1.290
10	The point of view of the game that I had spoiled my gaming	Puppetry - Control	521	87%	6.180	1.126	-1.675
11	I knew what I was supposed to do to win the game	Puppetry - Control	564	94%	6.252	1.188	-2.009
12	There was time when I was doing nothing in the game	Puppetry - Control	571	95%	4.993	2.008	-0.627
13	I liked the way the game look	Puppetry - Facilitators	565	94%	6.088	1.093	-1.526
14	The graphics of the game were plain	Puppetry - Facilitators	572	96%	5.191	1.839	-0.820
15	I do not like this type of game	Puppetry - Facilitators	571	95%	6.445	1.040	-2.901
16	I like to spend a lot of time playing this game	Puppetry - Facilitators	563	94%	5.128	1.713	-0.679
17	I got bored playing this time	Puppetry - Facilitators	571	95%	5.541	1.517	-1.048
18	I usually do not choose this type of game	Puppetry - Facilitators	568	95%	5.667	1.670	-1.332
19	I did not have a strategy to win the game	Puppetry - Ownership	564	94%	4.745	1.936	-0.515
20	The game kept constantly motivating me to keep playing	Puppetry - Ownership	569	95%	5.464	1.423	-0.847
21	I felt what was happening in the game was my own doing	Puppetry - Ownership	569	95%	5.185	1.632	-0.901
22	I challenged myself even if the game did not require it	Puppetry - Ownership	554	93%	4.736	1.815	-0.482
23	I played with my own rules	Puppetry - Ownership	548	92%	3.347	1.978	0.418
24	I felt guilty for the actions in the game	Puppetry - Ownership	565	94%	6.227	1.375	-1.997
25	I usually do in the real world the same type of activities as in the game	Puppetry - Ownership	569	95%	6.158	1.556	-2.022
26	I knew how to manipulate the game to move forward	Puppetry	557	93%	5.688	1.493	-1.297
27	The graphics were appropriate for the type of game	Video-game - Environment	568	95%	6.363	0.921	-2.097
28	The sound effects of the game were appropriate	Video-game - Environment	547	91%	6.097	1.119	-1.718
29	I did not like the music of the game	Video-game - Environment	536	90%	5.493	1.664	-1.113
30	The graphics of the game were related to the scenario	Video-game - Environment	549	92%	6.158	1.044	-1.509
31	The graphics and sound effects of the game were related	Video-game - Environment	549	92%	6.115	1.226	-1.895
32	The sound of the game affected the way I was playing	Video-game - Environment	546	91%	4.449	1.951	-0.375
33	The game was unfair	Video-game - Game-play	568	95%	5.623	1.520	-1.098
34	I understood the rules of the game	Video-game - Game-play	562	94%	6.536	0.846	-2.582
35	The game was challenging	Video-game - Game-play	571	95%	5.518	1.335	-0.991
36	The game was difficult	Video-game - Game-play	570	95%	4.500	1.586	-0.388
37	The scenario of the game was interesting	Video-game - Game-play	558	93%	5.717	1.404	-1.313
38	I did not like the scenario of the game	Video-game - Game-play	561	94%	6.109	1.191	-1.796
39	I knew all the actions that could be performed in the game	Puppetry - Control	571	95%	5.373	1.656	-0.860

6.8 Internal Reliability of the Questionnaire

The obtained data was prepared in *Excel 2003*. Data preparation involved coding the items worded negatively (10, 12, 15, 18, 19, 24, 25, 29, 33, 38) by subtracting the obtained value from 8. All statistical results were obtained using *SPSS 14.0 for Windows, release 14.0.1 (18 November 2005)*. Non-answered items were left blank. The range of answered items was from 1 to 7. No item was completed by all the 598 participants. The results for each item are presented in Table 6.3.

The obtained alpha for Enjoyment and Frustration was 0.397, 0.797 for CEGE, 0.706 for Puppetry, and 0.671 for Video game. The alpha for the whole questionnaire was 0.789. The suggested minimum value for alpha is 0.60 according to Loewenthal (2001) and 0.70 according to Nunnally and Bernstein (1994); although some conditions have to be met to accept a 0.60 alpha, which would be discussed in Section 6.9.1.

The value obtained for Enjoyment and Frustration is very low. If instead of considering both elements as part of one scale but as two separate scales, the reliability of each factor increases significantly. Enjoyment has an alpha value of 0.780 and Frustration of 0.725. These results indicate that both factors should be considered as different scales. Furthermore, the alpha of the questionnaire without the Frustration items rises to 0.824. The obtained results show a consistent questionnaire. This suggests that Enjoyment and CEGE are related scales.

It is common practice to increase the value of alpha by dropping items that may lower its value (Loewenthal, 2001, p.63). The items to be dropped are those that have low item-total correlations and that do not affect the theoretical construct of the scale. The alpha of puppetry can be increased by removing item 25; as this item addresses the same element as Item 24 the theoretical frame would not be altered. The deleting of any of the other duplicated items did not increase the alpha. The removal of item 25 increases the alpha of the questionnaire to 0.794, the one of puppetry to 0.724 and to 0.803 for CEGE. Thus, for the rest of the analysis item 25 is not considered.

Once it was observed that the main scales of the questionnaire were reliable, a set of sub-scales were calculated. These are: Control, Facilitators and Ownership for Puppetry, and Game play and Environment for Video game. The coefficients can be consulted in Table 6.4. The obtained alphas for ownership and game play are lower than the proposed 0.6 boundary. This may be due to two reasons: the number of items to address the construct was lower than required, or the scale is not theoretically sound.

The reliability of a scale depends on the number of items. In order to achieve a value of 0.70, a number of items would have to be added to increase the consistency of the scale. The relationship between scale and number of additional items is given

Table 6.4: Reliability of the different scales obtained in the questionnaire. The different scales presented show all constructs included in the theoretical framework. They are included as a reference and to present the reliability of each of the individual constructs, even if they are included in another construct.

Scale	**Items**	**N**	Alpha
All Questionnaire minus item 25	1–39	360	0.794
Frustration	2–3	543	0.725
Enjoyment	1,4,5	554	0.780
CEGE	6-24,26–39	377	0.803
Puppetry	6–24,26,39	416	0.724
Control	6–12,39	464	0.605
Facilitator	13-18	530	0.645
Ownership	19–24	505	0.272
Video-game	27–38	481	0.671
Environment	27–32	497	0.622
Game-play	33–38	526	0.468

by the following equation (Nunnally and Bernstein, 1994, p.264):

$$k = \frac{r_{kk}(1 - r_{11})}{r_{11}(1 - r_{kk})} \tag{6.1}$$

Where r_{kk} is the desired alpha, r_{11} is the current alpha and k is the additional number of items. The number of items to be added per scale is presented in Table 6.5.

For video game, one more item should be included to reach a reliability of 0.70 and two for a reliability of 0.80.

The results obtained suggest that the higher level constructs are indeed reliable as measures to understand the gaming experience. CEGE, Puppetry and Video game are scales with valid values of reliability above 0.80, 0.70 and 0.65 respectively. CEGE and Puppetry are two reliable scales, according to the above statement. Video game, on the other hand, is the scale with the lowest reliability value, although not far from the 0.70 minimum suggested by Nunnally and Bernstein, and with the possibility to increase its consistency by adding only one more item. This result indicates that video game can also be considered as a reliable scale.

6.9 Discussion of the Obtained Results

6.9.1 On the Homogeneity of the Constructs

Nunnally and Bernstein (1994, p.264-265) argue that reliability in the "early stages of predictive or construct validation research, time and energy can be saved using

Table 6.5: Additional number of items that need to be included per scale to increase its reliability

Scale	Alpha	Items for 0.70	Items for 0.80
All Questionnaire	0.794	-	1
Frustration	0.725	-	2
Enjoyment	0.780	-	1
CEGE	0.803	-	-
Puppetry	0.724	-	2
Control	0.605	2	3
Facilitator	0.645	1	2
Ownership	0.272	6	11
Video-game	0.671	1	2
Environment	0.622	1	2
Game-play	0.468	3	5

instruments that have only modest reliability, e.g. 0.70. If significant correlations are found, corrections for attenuation will estimate how much the correlations will increase when reliabilities of measures are increased. [...] It can be argued that increasing reliabilities much beyond 0.80 in basic research is often wasteful of time and money."

The fact that CEGE, puppetry and video game are reliable scales, suggests that the questionnaire was well designed to address its intended homogeneity at the higher level of the hierarchy of the constructs. The lower level constructs of control, facilitators, ownership, environment and game play have a lower reliability. A lower alpha value can still be considered as valid provided the following three conditions hold true: evidence for validity, theoretical and/or practical considerations for the scale, and the scale is short (Loewenthal, 2001, p.60). The last condition, size of the scales, might help explain their low reliability in the CEGE. The study of validity of the constructs is presented in the next chapter, and the theoretical considerations are discussed next.

Ownership and game play are below 0.60; Nunnally and Bernstein (1994, p.252) suggest reconsidering the items when a scale is as low as 0.30, as is the case of ownership. Loewenthal (2001) also suggests analyzing those scales with Principal Component Analysis (PCA) to look for any confound variable. Instead of using PCA, a CFA based technique is used in the next chapter. This is because the questionnaire and the scales were designed as part of a construct, so rather than exploring how the items group on their own, it is looked if the items belong to the specified construct. The low reliability of ownership might have two reasons. One, it needed more items.

Two, it is not theoretically sound. The suggested number of items that have to be added to reach a reliable scale suggests that the problem is more theoretical. Ownership is the part of the experience that links the process with the outcome. It transforms the players control into what eventually leads to a positive experience. This property of the construct might have blurred the line between process and outcome, suggesting that the elements that form the constructs are not really elements, but more constructs. The high number of items to be added, also suggests that perhaps ownership is not one coherent construct, but may be a series of constructs forming ownership. The low reliability of game play might have the same explanations. Game play represents the soul of the game as the player sees it. It might be then, besides the elements of rules and scenario, there are more elements that form this construct that get encapsulated into these elements. However, based on the analysis that will be presented in the next chapter, for now it can be assumed that both constructs are valid.

The results obtained with the higher constructs suggest that the questionnaire is reliable to assess CEGE, Puppetry and Video game. The lower scales can still be used to gain insight on the experience as the correlations among the constructs, discussed next, suggests that the scales are still valid as they are heterogeneous. But, ownership and game play will be used with caution as separate constructs until the validity of the items is better understood.

6.9.2 On the Heterogeneity of the Method

To discuss the level of heterogeneity of the method we look at the relationships among the constructs. First, the main construct of our study, CEGE, correlates highly with enjoyment. These two scales account for the two key issues that the constructs represent, the role of CEGE on creating the conditions for a positive experience. This correlation indicates that CEGE is related to the experience of enjoyment. Furthermore, the scale that accounts for Frustration does not correlate with any of them. This suggests two things: one, frustration is not the opposite of enjoyment; two, when frustration is low and enjoyment is high, CEGE does not correlate with frustration. The relationship of frustration with the gaming experience is discussed below, but for now it should suffice to say that frustration has no relationship with CEGE or enjoyment.

The relationship among the main constructs of CEGE also provided relevant results in terms of the heterogeneity of the results. Both Puppetry and Video game correlate highly with CEGE, but the correlation between them is not very strong. This suggests that Puppetry and Video game are addressing different elements of the gaming experience, but that they are still related. One is the user's perception of the game, while the other one is how the user interacts with the game. They have to be two sep-

arate scales, that also relate to each other. Puppetry presents the same behaviour. It correlates highly with control, facilitators and ownership, but they correlate poorly with each other. Video game presents a similar behaviour. All the correlations can be consulted on Table 6.6.

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Table 6.6: Correlations among the different scales, ** denotes that the correlation is significant at the 0.01 level (2-tailed) and * denotes that the correlation is significant at the 0.05 level (2-tailed).

		Frustration	Enjoyment	Control	Facilitator	Ownership	Game-play	Enviroment
Frustration	Pearson Correlation	1	-.166(**)	-.229(**)	-.229(**)	-.084(*)	-.112(**)	-.155(**)
	N	578	572	578	577	577	577	577
Enjoyment	Pearson Correlation	-.166(**)	1	.509(**)	.646(**)	.356(**)	.556(**)	.449(**)
	N	572	577	577	576	576	575	576
	N	578	577	585	583	582	582	583
Control	Pearson Correlation	-.229(**)	.509(**)	1	.435(**)	.321(**)	.387(**)	.347(**)
	N	578	577	585	583	582	582	583
Facilitator	Pearson Correlation	-.229(**)	.646(**)	.435(**)	1	.354(**)	.498(**)	.479(**)
	N	577	576	583	583	582	582	582
Ownership	Pearson Correlation	-.084(*)	.356(**)	.321(**)	.354(**)	1	.309(**)	.197(**)
	N	577	576	582	582	582	581	581
Game-play	Pearson Correlation	-.112(**)	.556(**)	.387(**)	.498(**)	.309(**)	1	.422(**)
	N	577	575	582	582	581	582	581
Environment	Pearson Correlation	-.115(**)	.449(**)	.347(**)	.479(**)	.197(**)	.422(**)	1
	N	577	576	583	582	581	581	583

This suggests that the homogeneity of the main scale was achieved by using a heterogeneous method. For example, it is possible to see that control, facilitator and ownership do not measure the same concept as they do not correlate, but all together form a coherent construct that relates to the enjoyment of the experience.

About the poor reliability of ownership and game play, it might be still valid to use this scales; even though they may have confounded variables that need to be further analyzed. But the scales are theoretically sound as they relate as expected with each other. Further analysis regarding these two constructs is presented in the next chapter.

6.9.3 On the Implications for the Gaming Experience

The previous chapter introduced the idea that CEGE were the hygienic factors of the gaming experience. They are necessary, but not sufficient to provide a positive experience. At the same time, their presence indicates that the experience won't be negative. In this case, the opposite of enjoyment is not frustration, but not-enjoyment. The first step to have a positive experience is not to have a negative experience. Due to previous results, it was suggested that frustration was a complement to the experience of playing video games. However, the results suggest that in order to achieve enjoyment, there should not be frustration.

The questionnaire can be used to assess the experience using the CEGE, Puppetry and Video game scales due to their acceptable homogeneity. Schmitt (1996) claims that sometimes it is possible to accept a scale with low reliability, provided that inter-correlations and construct validity give arguments to keep the scale. So far, the inter-correlation of the constructs has provided arguments to keep the scale.

6.10 The Scores as Norms

One of the objectives of this chapter was to provide norms regarding the scores for each of the scales of the questionnaire; taking advantage of the large sample population that completed the questionnaire. For each participant, a score per scale was calculated by averaging the responses for each item and then dividing by seven. By using averages, only answered items were considered. For example, if one of the items for Facilitators was non-answered, then the score for facilitator would be calculated only using the remaining 5 items.

The results for each scale are presented in Table 6.7. The high score obtained for enjoyment should be due to the fact that the participants completed their questionnaire at their own motivation. It is expected then they would be more likely to do it when they had a positive experience, as the results show.

Table 6.7: Mean, standard deviation and standard mean error of the scores obtained per scale.

Scale	Mean	N	Std. Dev.	Skewness
Frustration	0.444	578	0.219	0.416
Enjoyment	0.917	577	0.12	-2.644
CEGE	0.796	585	0.085	-1.072
Puppetry	0.723	583	0.116	-0.945
Control	0.825	585	0.11	-0.787
Facilitator	0.809	583	0.135	-0.227
Ownership	0.708	582	0.119	-1.293
VG	0.815	584	0.097	-0.909
Environment	0.823	583	0.122	-0.782
Game-play	0.807	582	0.107	-0.896

The general items allow to group the experience by gender, age, time played and type of console used to play. The complete scores presented by age, gender, platform and time played can be found in Appendix F.

6.11 Summary

This chapter presented the development and analysis of reliability of a questionnaire to address the core elements of the gaming experience. The results show that a questionnaire is homogeneous in content and heterogeneous in method to assess correctly the core elements of the gaming experience.

The results work in favour of the working hypothesis that the CEGE produce an enjoyable experience, as both constructs correlated highly. The results also suggest that frustration is not part of a positive experience. Although puppetry and game play were two scales with low alpha coefficient, it was argued that due to the theoretical stand and their inter-correlations, the scales could still be considered as usable. The validity of the items to form each construct is analysed in the following chapter using confirmatory factor analysis.

The questionnaire was deployed with 598 participants that engaged with the video game of their choosing in their own conditions. As expected, the general enjoyment of the participants was high. The different scores obtained for the scales on different experiences were presented. They showed that across different platforms and time played, CEGE correlate appropriately with enjoyment. The next chapter discusses the relations among the different constructs present in CEGE, as well as validating the constructs presented in the questionnaire using SEM.

Chapter 7

A Model for the Gaming Experience: The CEGE Model

In the previous chapters, it was argued that there is a need to study the user experience under an objective-knowledge perspective. To start this discussion, a novel definition of user experience was proposed. With this vision of user experience in mind, the experience of playing video games was analysed and, using a grounded theory method, the core elements of the gaming experience (CEGE) were identified. These elements were then used to develop the CEGE Questionnaire (CEGEQ). The questionnaire was developed as a tool for construct validation; the statistical analysis of the questionnaire was also presented showing an overall reliable questionnaire.

Although the results presented in Chapter 6 suggest some coherence of the CEGE constructs, the theoretical framework developed in Chapter 5 has not been corroborated. The CEGE presents not only a series of constructs with their respective observable variables, but also casual-effect relationships between the constructs. Validating the model would allow the formalisation of these two types of relationships: those between constructs and observable variables and those amongst constructs.

In this chapter, the theoretical framework emerging from the qualitative study is presented as a model in order to validate the model and corroborate it. The modelling is done using Structural Equation Modelling. This technique identifies both the relationships among constructs and of observable variable with constructs; the former being a hypotheses testing property, while the latter verifies the pertinence of the observable variables to describe the behaviour of the constructs. This last property would shed light on the construct "ownership", which showed poor reliability in the statistical analysis of the questionnaire.

The chapter is divided into six sections. The next section describes the process of abstracting the theoretical ideas into a model. Then, the following section turns the model just presented into one that uses structural equations; this section uses the

questionnaire and the data obtained in the previous chapter. The next two sections implement and solve the model using LISREL. The last sections provide the discussion and summary of the chapter.

7.1 From the CEGE Theoretical Framework to the CEGE Model

The qualitative analysis presented in Chapter 5 produced as output the CEGE. The CEGE describes the experience in terms of two elements: puppetry and video game. These two elements are formed by a series of other elements that define their behaviour. Those elements that cannot be directly measured are latent variables or constructs. Those that are not and can be directly measured are observable variables. In the case of the CEGE, elements such as puppetry and control and latent, while small-actions and graphics are observable. The complete classification of variables is shown in Table 7.1.

Table 7.1: Latent and observable variables. The upper two rows are the latent variables. For each of the latent variables that belong to puppetry and video game, the column underneath shows their respectively observable variables.

	Puppetry		**Video-game**	
Control	*Ownership*	*Facilitators*	*Game-play*	*Environment*
Small Actions	Big Actions	Time	Rules	Graphics
Controllers	Personal Goal	Aesthetic Value	Scenario	Sound
Memory	You but not You	Prev. Experiences		
Point of View	Rewards			
Goal				
Something to do				

Also, the latent variables influence each other in their behaviour. For the CEGE, the relationships among the constructs are: a positive experience (enjoyment) while playing games is achieved by the player's perception of the video game and the interaction with it. These are the Core Elements of the Gaming Experience: video game & puppetry. Puppetry, the player's interaction with the game is formed by the player's sense of control and ownership. Control produces ownership, which in turns produces enjoyment. Ownership is also produced by facilitators to compensate the sense of control. The player's perception of the video game is formed by the environment and the game play, which also produces enjoyment. See Figure 7.1 for a graphical representation of these relationships.

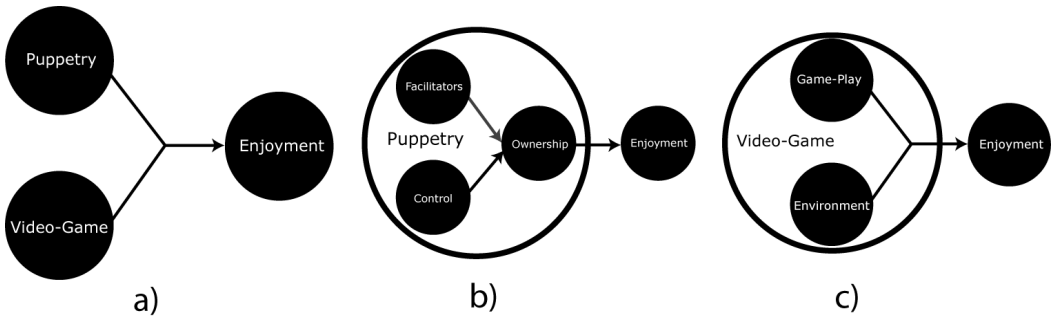

Figure 7.1: The relationship among the constructs. a) On a higher level, puppetry and video game produce enjoyment. But both of these categories are formed by a series of constructs, in b) it is possible to observe the constructs that form puppetry and in c)those that belong to video game.

As latent variables cannot be directly measured, it is necessary to do it through observable variables. The observable variables were also described in Chapter 5. The observable variables were the items of the questionnaire produced in the previous chapter.

It is possible to represent all these relationships graphically following these conditions: latent variables are represented in circles while observable in squares. If construct A produces construct B, then an arrow is drawn from A to B; observable variables are drawn with an incoming arrow from the latent variable. Expanding this last point, observable variables help in describing the behaviour of their latent counterparts. However, by themselves the observable variables have no real meaning in the overall abstraction of the CEGE, thus it is possible to say that observable variables depend on the latent variables, hence drawing the arrow from the latent to the observable variable.

This abstraction of the CEGE into the graphical representation of Figure 7.2 is the beginning of the turning of it into the CEGE Model. This graphical representation can be seen in Figure 7.2. The figure was already used in Chapter 5, but it was produced from this analysis and its inclusion on the previous chapter was to facilitate the visualisation of the ideas being presented. In the next section the formal modelling using structural equation analysis is discussed. This modelling technique is then used to validate the model.

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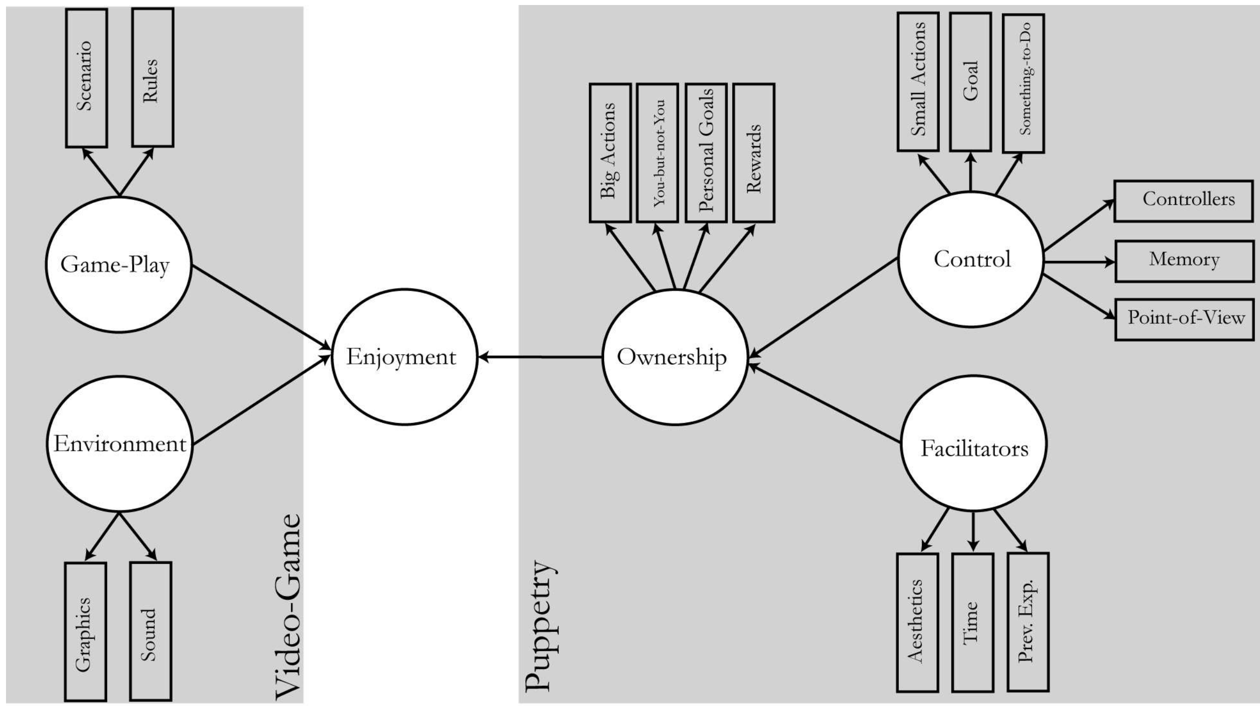


Figure 7.2: The CEGE-SEM Model. The complete relationship among latent and observable variables; latent variables are represented in circles while observable ones are in squares.

7.2 The CEGE Model Using Structural Equations

The CEGE is modelled using Structural Equations (Long, 1983a,b; Kelloway, 1998). The model is implemented in LISREL 8 for Windows (Jöreskog and Sörbom, 1993). The reporting of the results follows the guidelines proposed by Raykov et al. (1991).

A Structural Equation Model (SEM) can be used as a theory testing technique (e.g. Hackman and Oldham, 1976; Wheaton, 1980; Barling et al., 2002). Using SEM, it is possible to determine if the different observable variables of CEGE belong the specified latent variables, and if the specified relationships among latent variables are valid (Long, 1983a). The theory proving is done by testing the pertinence of the relationships of the constructs. There are different examples of using SEM for theory testing in Information Systems (e.g. Goles and Chin, 2005; Salisbury et al., 2006; Glassberg et al., 2006). And it has been recently used in HCI type problems (e.g. Quaddus et al., 2005; Woon and Kankanhalli, 2007). Using SEM for the CEGE model permits to test the different relations among constructs presented in Chapter 5, and also it would verify the structure of the different constructs and their observable variables.

SEM consists of two parts: the measurement model and the structural model. The former relates latent and observable variables, while the latter models the relationships among the constructs. The model is validated as follows: given a set of k observations on n variables, let the $n \times n$ matrix S be the covariance matrix of those observations. The model fits the solution if the matrix S can be replicated with the model. Considering the novelty and limited use of the modelling technique, particularly in HCI, this section explains the basic properties of SEM while showing how to construct the CEGE-SEM.

7.2.1 The Measurement Model

The relationship between the observed and latent variables can be described in the following way: the observable variable of controllers (x) is affected by the latent variable of control (ξ), thus $x \propto \xi$. A change in control would produce a linear change in the controllers. Assuming that x is measured with an error δ, the relationship between x and x_i could be written:

$$x = \lambda\xi + \delta \tag{7.1}$$

where λ is the loading factor of x on ξ with $E(x) = 0,\ E(\xi) = 0,\ E(\delta) = 0$.

There are two types of variable in the model, exogenous and endogenous variables. Exogenous variables are those whose behaviour is external to the model. Endogenous are those whose behaviour the model predicts. Changing Equation 7.1 to reflect these two types of variable, Equation 7.2 is for endogenous variables and Equation 7.3 for exogenous variables.

$$x = \lambda_x \xi + \delta \tag{7.2}$$

$$y = \lambda_y \eta + \epsilon \tag{7.3}$$

Equations 7.2 and 7.3 refer to the set of variables. An individual observable variable x_i is given by the equation $x_i = \lambda^x_{i,j}\xi_j + \delta_i$, with $x_i \in x,\ \lambda^x_{i,j} \in \lambda_x,\ \xi_j \in \xi,\ \delta_i \in \delta$. The sizes of x and δ are the same as the number of observable exogenous variables, which can be represented in a vector matrix of size $(q \times 1)$ and the size of ξ is the same as the size of exogenous latent constructs, and can also represented in a vector of size $(s \times 1)$, with $i \leq q$ and $j \leq s$. A summary of the different matrices used in the measurement model is presented in Table 7.2.

Table 7.2: Summary of the Measurement Model. Adapted from (Long, 1983a, p.25) and (Long, 1983b, p.21)

Matrix	**Dimension**	**Mean**	**Covariance**	**Dimension**	**Description**
ξ	$(s \times 1)$	0	$\Phi = E(\xi\xi')$	$(s \times s)$	Common Exogenous Factors
x	$(q \times 1)$	0	$\Sigma_{xx} = E(xx')$	$(q \times q)$	Observed Exogenous Variables
Λ_x	$(q \times s)$	-	-	-	Loadings of x on ξ
δ	$(q \times 1)$	0	$\Theta_\delta = E(\delta\delta')$	$(q \times q)$	Unique Factors
η	$(r \times 1)$	0	$COV(\eta) = E(\eta\eta')$	$(r \times r)$	Common Endogenous Factors
y	$(p \times 1)$	0	$\Sigma_{yy} = E(yy')$	$(p \times p)$	Observed Endogenous Variables
Λ_y	$(p \times r)$	-	-	-	Loadings of y on η
ϵ	$(p \times 1)$	0	$\Theta_\epsilon = E(\epsilon\epsilon')$	$(p \times p)$	Unique Factors

There are three latent endogenous variables and three latent exogenous variables: enjoyment, control and ownership for the former and facilitators, game play and environment for the latter. One way to determine if a variable is endogenous is to look for incoming arrows into the variables in Figure 7.2. Enjoyment and ownership have incoming arrows, while control influences one observable variable that also influences ownership. The observable variables were measured with the questionnaire introduced in the previous chapter. The following considerations were taken when using the items in the model: There are three items, 6, 21 and 25, that are associated directly with three latent variables, control, ownership and puppetry respectively, without an observable variable. These items from the questionnaire are kept in the modelling by considering that item 6 loads directly into control, item 21

into ownership, and item 26 into both control and ownership. Effectively, these three items are being considered as observable variables. This is because those three items were created with the intention of measuring the construct directly; however, it is acknowledged that the constructs are multidimensional thus requiring the other items to complete them. For the exogenous variables, it was decided to use the higher constructs, facilitators, game play and environment. The relationship between variables and the items in the questionnaire is presented in Table 7.3, and a graphical representation of both measurement models is presented in Figure 7.3.

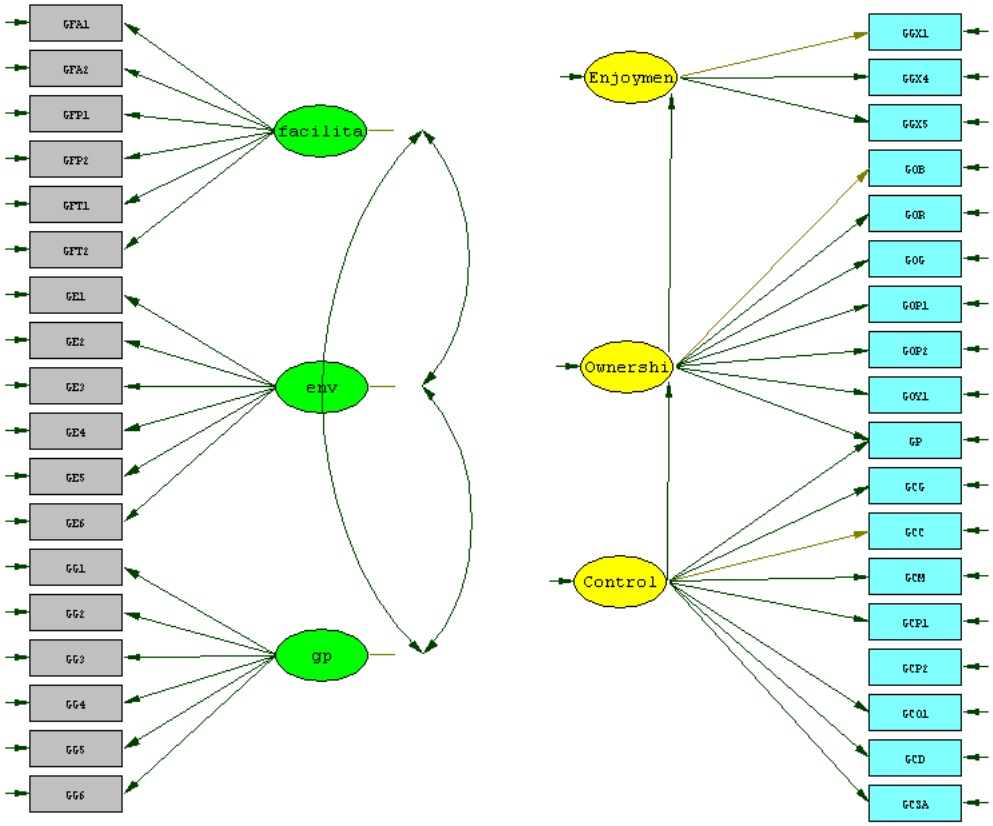
Table 7.3: Observable variables and their corresponding items in the questionnaire.

Type	Construct	Observable	Item No.	Item Code
Endogenous	Enjoyment	Enjoyed Playing	1	GGX1
Endogenous	Enjoyment	Enjoyed the Game	4	GGX4
Endogenous	Enjoyment	Enjoyed the Game	5	GGX5
Endogenous	Ownership		21	GOG
Endogenous	Ownership	Big Actions	19	GOB
Endogenous	Ownership	Personal Goals	22,23	GOP1,2
Endogenous	Ownership	You but not You	24	GOY1
Endogenous	Ownership	Rewards	20	GOR
Endogenous	Ownership & Control		25	GP
Endogenous	Control		6	GCG
Endogenous	Control	Small Actions	39	GCSA
Endogenous	Control	Controllers	7	GCC
Endogenous	Control	Memory	8	GCM
Endogenous	Control	Point of View	9,10	GCP1,2
Endogenous	Control	Goal	11	GC01
Endogenous	Control	Something to Do	12	GCD
Exogenous	Facilitators	Time	16,17	GFT1,2
Exogenous	Facilitators	Aesthetic Value	13, 14	GFA1,2
Exogenous	Facilitators	Prev. Experiences	15, 18	GFP1,2
Exogenous	Environment	Graphics & Sound	26-31	GE1-6
Exogenous	Game-Play	Rules & Scenario	32-37	GG1-6

Once the relationship between observable variables and latent factors has been established, it is necessary to describe the different covariance within each of the measurement models. The covariance matrices are used to assess the fitness of the model with the collected data. As part of the model, it is assumed that all the variables are measured as deviation from their means: $E(x) = E(\delta) = 0$, $E(\xi) = 0$, $E(y) = E(\epsilon) = 0$ and $E(\eta) = 0$. Also, the unique factors (or error of measurements) are assumed to be uncorrelated from the latent constructs: $E(\xi\delta') = 0$, $E(\delta\xi') = 0$, $E(\eta\epsilon') = 0$ and $E(\epsilon\eta') = 0$.

As it is being assumed that the different variables are measured with a mean of zero: $COV(X,Y) = E((X-\mu)(Y-\nu))$[1], and as $\mu = \nu = 0$ then $COV(X,Y) = E(XY) = E(X \cdot Y)$. Table 7.2 defines different covariance matrices that would be used in the model. The covariance of η is not defined with a unique name as its definition is further discussed once the structural model is presented.

[1] X, Y are two real valued random variables.



(a) The exogenous measurement model.

(b) The endogenous measurement model.

Figure 7.3: The CEGE Model: The measurement models.

Matrix $\Sigma_{xx} = E(xx')$ gives the correlation among the observed exogenous variables, which can be expanded as follows:

$$\begin{aligned}
\Sigma_{xx} &= E(xx') \\
&= E[((\lambda_x\xi + \delta) + (\lambda_x\xi + \delta)')] \\
&= E[\lambda_x\xi\xi'\lambda' + \lambda\xi\delta' + \delta\xi'\lambda' + \delta\delta'] \\
&= E(\lambda_x\xi\xi'\lambda') + E(\lambda\xi\delta') + E(\delta\xi'\lambda') + E(\delta\delta') \\
&= \lambda E(\xi\xi')\lambda' + \lambda E(\xi\delta') + E(\delta\xi')\lambda' + E(\delta\delta')
\end{aligned}$$

Substituting $\Phi = E(\xi\xi')$, $\Theta_\delta = E(\delta\delta')$, $E(\delta\xi') = 0$:

$$\Sigma_{xx} = \lambda_x\Phi\lambda_x' + \Theta_\delta \tag{7.4}$$

The observed endogenous variables can also correlate with each other, and this would define the matrix $\Sigma_{yy} = E(yy')$, which can also be deduced in similar fashion, :

$$\Sigma_{yy} = \lambda_y COV(\eta)\lambda_y' + \Theta_\epsilon \tag{7.5}$$

Observable endogenous and exogenous variables can also correlate with each other, defining the matrices $\Sigma_{xy} = E(xy')$ and $\Sigma_{yx} = E(yx')$, which are defined as follows:

$$\Sigma_{xy} = \lambda_x COV(\xi, \eta)\lambda'_y \tag{7.6}$$

$$\Sigma_{yx} = \lambda_y COV(\eta, \xi)\lambda'_x \tag{7.7}$$

The covariance among latent constructs would be defined later on, when discussing the structural model. It is possible to define the variance and covariance matrix of the observable variables as follows:

$$\Sigma = \left[\begin{array}{c|c} \lambda_y COV(\eta)\lambda_{y'} + \Theta_\epsilon & \lambda_y COV(\eta, \xi)\lambda_{x'} \\ \hline \lambda_x COV(\xi, \eta)\lambda_{y'} & \lambda_x \Phi \lambda_{x'} + \Theta_\delta \end{array}\right] \tag{7.8}$$

The measurement model is obtained using Confirmatory Factor Analysis (CFA). In other words, after performing the CFA it is possible to determine if the items load into the constructs. Loading values above 0.3 are considered satisfactory.

7.2.2 The Structural Model

The advantage of using SEM, is that it allows an understanding of how the non measurable elements of the model are influenced by each other. As explained above, there are two types of variable: exogenous and endogenous. Exogenous variables have an influence in the model, but their behaviour is outside of the scope of the model. In practical terms, this means that exogenous latent variables can influence endogenous variables, but they cannot be influenced by anything; in other words, there are no incoming arrows to an exogenous latent variable. Endogenous latent variables are those that the model is trying to explain, they can be influenced by exogenous latent variables and by endogenous variables. The relationship among latent constructs is expressed in Equation 7.9.

$$\eta = B\eta + \Gamma\xi + \zeta \tag{7.9}$$

Where B is the influence that endogenous variables have on each other, Γ is the influence that exogenous variables have on latent variables and η is a vector of errors in the equation. A full description of the sizes of the matrices used in SEM can be found in Table 7.4. The following assumptions are considered: variables are measured from their means; common and unique factors are uncorrelated; unique factors and errors in equations are uncorrelated across equations; exogenous variables and errors in equations are uncorrelated; and none of the structural equations are redundant.

Table 7.4: Summary of the Structural Component of the Covariance Structure Model. Adapted from (Long, 1983b, p.27)

Matrix	Dimension	Mean	Covariance	Dimension	Description
η	$(r \times 1)$	0	$COV(\eta) = E(\eta\eta')$	$(r \times r)$	Endogenous Variables
ξ	$(s \times 1)$	0	$\Phi = E(\xi\xi')$	$(s \times s)$	Exogenous Variables
ζ	$(r \times 1)$	0	$\Psi = E(\zeta\zeta')$	$(r \times r)$	Errors in Equations
B	$(r \times r)$	-	-	-	Direct Effects of η on η
$\ddot{B}$	$(r \times r)$	-	-	-	Defined as $(I - B)$
Γ	$(r \times s)$	-	-	-	Direct Effects of ξ on η

Equation 7.9 has η on both sides. This is due to the fact that endogenous variables can be affected by other endogenous variables. Although it helps to understand conceptually the relationship among factors, it would be easier if η would appear only on the left hand side of the equation. Let $\ddot{B} = I - B$, and adding $-B\eta$ to both sides of the equation, then the relationship is given by Equation 7.10, and rewriting for η in Equation 7.11.

$$\ddot{B}\eta = \Gamma\xi + \zeta \tag{7.10}$$

$$\eta = \ddot{B}^{-1}\Gamma\xi + \ddot{B}^{-1}\zeta \tag{7.11}$$

The covariance among constructs can now be fully described in terms of the structural equations. That is, Equation 7.8 would be rewritten to expand on $COV(\eta)$, $COV(\eta\xi)$ and $COV(\xi\eta)$, as shown in Equation 7.12.

$$\Sigma = \left[\begin{array}{c|c} \lambda_y\ddot{B}^{-1}(\Gamma\Phi\Gamma' + \Psi)\ddot{B}^{-1}\lambda_y' + \Theta_\epsilon & \lambda_y\ddot{B}^{-1}\Gamma\Phi\lambda_x' \\ \hline \lambda_x\Phi\Gamma'\ddot{B}'^{-1}\lambda_y' & \lambda_x\Phi\lambda_x' + \Theta_\delta \end{array}\right] \tag{7.12}$$

The importance of the covariance equation (7.12) is that it is used to assess if the model fits the obtained data. The questionnaire, via the observable variables, produce a variance & covariance matrix S. The fitness between S and Σ is what determines the pertinence of the model. Figure 7.4 presents the complete SEM for the model.

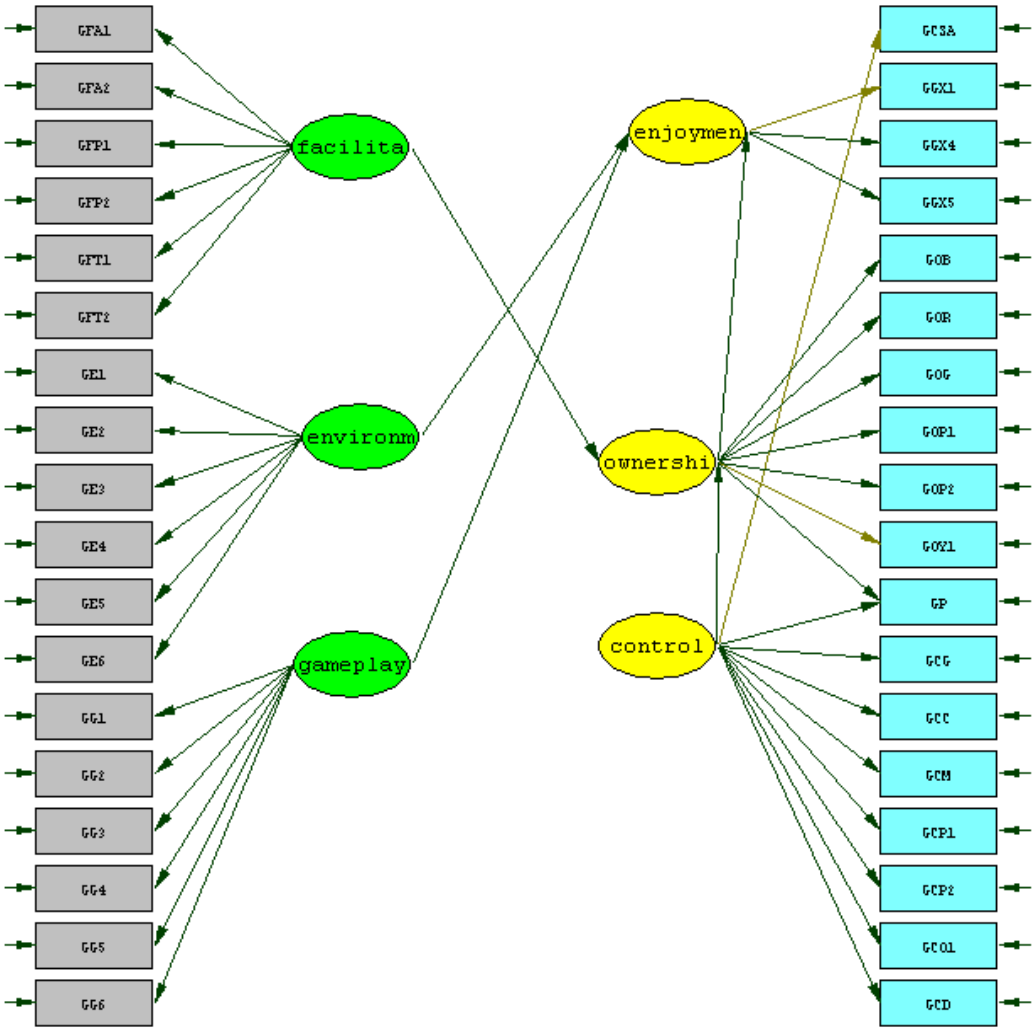


Figure 7.4: The CEGE Model: The complete model.

7.2.3 Identifying the Model

Before finding a fit for S with Σ, the model should be identified. That is, it has to be ensured that Σ does not have multiple solutions. Identifying a model can be a complex task, as there is no analytic procedure that can be considered necessary and sufficient to identify a SEM model. To ensure the identification of the model, the following recommendations were followed (Kelloway, 1998):

1. There were at least two observed variables per latent variable.

2. For the endogenous variables, one path had a fixed value of 1 to start the estimation.

3. For the exogenous variable, the correlation matrix was defined as symmetrical with ones in the main diagonal.

7.2.4 Estimation and Assessment of Fit

Once the model has been identified, the variance and covariance matrix $\widehat{\Sigma}$ has to be estimated. $\widehat{\Sigma}$ is defined by an equation similar to 7.12, but the $\widehat{\ }$ indicates that the elements are estimates of the population parameters. The objective of the estimation is to "fit" the sample matrix S with the population matrix $\widehat{\Sigma}$. They are estimated and fitted using either unweighted least squares (ULS), generalised least squares (GLU) or maximum likelihood (ML). LISREL and AMOS implement all the procedures of estimation and fitness.

Assessment of fit is done by reviewing the following guidelines:

Values of the parameters Negative variances, correlations greater than one and unreasonably larger parameter estimates might imply an unidentified model.

Variances and covariances of the parameters Large correlations indicate that it is difficult to distinguish between the two parameters.

χ^2 **goodness of fit tests** Degrees of freedom are defined by $\frac{1}{2}(p+q)(p+q+1)-t$ where t is the number of independent parameters estimated; p and q are defined in Table 7.2. Large values of χ^2 relative to the degrees of freedom suggest a poor fit.

Modification Indices If the model does not fit, it can be changed in a search for a better fit. It is recommended to use different sets of data per model. Also, parameters that have small values can be dropped.

Although several criteria exist to determine the fitness of the model, there is not a universal consensus on which criteria to use. Most parameters used rely on the expertise of the researcher. For example, one of the parameters recently reported as a good measure of fitness, dividing the χ^2 statistic over the number of degrees of freedom, has been dismissed as inaccurate (Kelloway, 1998). In this work, the criteria followed to assess the fitness of model was mainly one: the root mean error square approximation (RMESA) value, with a value less than 0.1 specifying a good fit, a value less than 0.05 indicating a very good fit, and a value less of 0.001 would indicate an exceptional good fit, but this is hard to find. Kelloway suggests using the measure to assess the fitness of the model, but to also present the goodness of fitness index (GFI), adjusted goodness of fitness index (AGFI) and the comparative fitness index (CFI). These indexes are usually used when comparing the model to another competing model, while RMESA can be used as an absolute fit indicator. It is important to notice that when using the data with missing values only the RMESA, χ^2, and degrees of freedom are provided by the data.

The strategy to follow is the following one: first the proposed model will be analysed looking for an absolute fit. If the model has a good fit (RMESA$<$0.1), then the model

would be considered acceptable. Otherwise, a nested model comparison would be pursued.

7.3 Validation: Method & Procedure

The model was operationalised with LISREL 8 (Jöreskog and Sörbom, 1993). At the time of writing, LISREL is not common a tool within HCI. It is for this reason that personal reflections on its usage are added.

7.3.1 Data

Using the data obtained with the questionnaire, discussed in the previous chapter, two sets were used: one set (Model 1) is with missing values, and in the second set (Model 1a) the missing values have been replaced by imputed values, with the EM algorithm, as recommended by Hair Jr. et al. (1998).

7.3.2 Apparatus

The model was operationalised using a complete SEM and estimated using LISREL 8. The version of LISREL 8 it is licensed for 6 months. LISREL has a very poor graphical user interface. The models can be drawn, but then they have to be converted into LISREL language. The program does not provide an opportunity to save the drawing; more than once the program would crash in this conversion process, which required starting over again.

Once the model was loaded into LISREL, it would provide two different outputs, the path diagram (the drawing) and an output file. These files sometimes could not be opened, with LISREL providing no information. The solution used was to change the files to a different directory.

Several programs can be used for SEM. LISREL was chosen because it is the most common in the literature. AMOS, a SPSS suite, required an expensive license to use it, and when a demo was tried, it was found to be more complicated than LISREL. MX, a freeware, was not properly documented in how to use it. Due to this reasons, it was decided to keep using LISREL, in spite of all its kinks.

7.3.3 Procedure

The model was simulated in three different steps. First a CFA was done on the endogenous side of the model, then a CFA on the exogenous side of the model. Finally, the complete model was simulated. Both Models were used for the simulations. As mentioned earlier, valid loading values are those above 0.30, and a valid model is that with a RMESA value less than 0.1.

7.4 Validation: Results

The proposed CEGE model has a good absolute fit with sets of data, as the model obtains a good value of RMESA (0.074 & 0.071). For the purpose of this discussion, Model 1 is going to be used as the valid model. As both models provide a comparable level of fitness, it is better to use the data with the missing values as this one is the raw data obtained directly from the participants. The results of fitness are presented in Table 7.5.

Table 7.5: Fit Indexes for the Model.

Model	χ^2	**df**	**GFI**	**AGFI**	**NFI**	**CFI**	**RMESA**
Model 1	2468.71	585					0.074
Model 1a	2260.93	585	0.82	0.80	0.87	0.90	0.071

The loading factors for the endogenous side of the model are presented in Table 7.6. Most observable variables have an adequate loading into their constructs. The only exceptions are “Personal Goals 2” and “Puppetry”, as they have a loading of less of 0.30 into Ownership.

Table 7.6: Factor loadings for the endogenous variables (λ_y)

	Model 1				**Model 1a**			
	Enj.	*Own.*	*Ctrl.*	R^2	*Enj.*	*Own.*	*Ctrl.*	R^2
Enjoyment1	0.88			0.77	0.79			0.62
Enjoyment2	0.88			0.77	0.80			0.64
Enjoyment3	0.80			0.64	0.65			0.42
Big Actions		0.30		0.09		0.13		0.02
Rewards		0.56		0.31		0.51		0.26
Ownership		0.40		0.16		0.25		0.06
Personal Goals		0.37		0.14		0.29		0.08
Personal Goals2		0.16		0.02		0.04		0.00
You but not You		0.45		0.20		0.15		0.02
Puppetry		0.22	0.40	0.30		0.12	0.36	0.18
Control			0.67	0.45			0.47	0.22
Controllers			0.77	0.59			0.64	0.41
Memory			0.67	0.45			0.48	0.23
Point of View			0.64	0.41			0.49	0.24
Point of View2			0.63	0.40			0.27	0.07
Goal			0.72	0.52			0.48	0.23
Something to Do			0.34	0.12			0.11	0.01
Small Actions			0.63	0.40			0.56	0.31

In the exogenous side of the model, all observable variables have an appropriate loading factor into their respective construct. See Table 7.7.

Table 7.7: Factor loadings for the exogenous variables (λ_x)

	Model 1				**Model 1a**			
	Fac.	*Env.*	*G.P.*	R^2	*Fac.*	*Env.*	*G.P.*	R^2
Aest. 1	0.81			0.65	0.65			0.42
Aest. 2	0.51			0.26	0.38			0.15
Prev. Exp 1	0.82			0.67	0.65			0.42
Prev. Exp 2	0.58			0.33	0.42			0.18
Time 1	0.63			0.40	0.58			0.33
Time 2	0.64			0.41	0.51			0.26
Env. 1		0.80		0.63		0.55		0.31
Env. 2		0.84		0.71		0.77		0.59
Env. 3		0.58		0.34		0.48		0.23
Env. 4		0.77		0.59		0.56		0.31
Env. 5		0.80		0.64		0.72		0.52
Env. 6		0.40		0.16		0.24		0.06
G.P. 1			0.49	0.24			0.23	0.05
G.P. 2			0.77	0.59			0.40	0.16
G.P. 3			0.61	0.38			0.42	0.17
G.P. 4			0.42	0.18			0.23	0.05
G.P. 5			0.69	0.48			0.60	0.36
G.P. 6			0.74	0.55			0.58	0.33

The beta and game values obtained suggest that most of the proposed hypotheses are true. The beta values indicate the relationship between endogenous variables, see Table 7.8. The hypothesis that the enjoyment or a positive experience is produced by the ownership of Puppetry seems to hold true; evidenced by the beta with the value of 0.45. Control produces ownership with a beta value of 0.51.

Table 7.8: Loadings among endogenous constructs (β)

	Model 1			**Model 1a**		
	Enjoyment	*Ownership*	*Control*	*Enjoyment*	*Ownership*	*Control*
Enjoyment		0.45			0.71	
Ownership			0.51			0.39
Control						

In the relationship of exogenous and endogenous variables, Table 7.9, the following hypotheses can be addressed: facilitators produce ownership, with value of 0.87. Game play has an influence on enjoyment with a value of 0.31 . The only part of the hypothesis that does not hold is the relationship between environment and enjoyment with a value of -0.26.

Table 7.9: Loadings of the exogenous constructs on the endogenous constructs (γ)

	Model 1			**Model 1a**		
	Facilitators	*Environment*	*Game-play*	*Facilitators*	*Environment*	*Game-play*
Enjoyment		-0.26	0.80		-0.09	0.31
Ownership	0.87			0.92		
Control						

7.5 Discussion

The level of fitness of the model with the data suggests an adequate fit. This indicates that the proposed CEGE model is a correct abstraction of the CEGE. The validation of the model corroborates the theoretical framework presented previously.

Although the level of fitness is adequate, it is not optimal (RMESA less than 0.01) or a very good fit (RMESA less than 0.05). Even though optimal models are seldom found, it could be possible to continue more studies to obtain a better fit of the data. In order to do so, it might be necessary to design a new questionnaire. This is because the values obtained for two items that belong to ownership were a under the cut-off value. Also, in the previous chapter, it was shown that ownership provided a poor reliability coefficient. In favour of keeping the model is the argument that the model is providing a good fit of the data, and that although it might be possible to obtain a better fit of the data, the obtained values suggest that it is good enough. A new questionnaire might provide a better fit, but in the general argument, it would still produce a valid model.

It is common practice within SEM to test for fitness in a recursive fashion. This was not done in this study, rather only two models were presented, one with the data as it was and one with the data with imputed values. Both models were valid using the RMESA criteria. It was decided to keep the model with missing data because it provided a raw approach to the experiences of the participants, as well as better loadings.

Using a recursive approach to test the model it would have been necessary to create several alternatives of the model and see which one provides a better fit. Here the argument of Kelloway (1998) was followed, in which he proposes using only the RMSEA value if it provides a good value. Testing several alternatives of the model would have required having a bigger sample of data, as each model has to be tested with a fresh set of data. It is important to remember that the minimum number of samples is around 200. Again, this extra effort would have been futile as the conclusion would have been the same: the model is valid hence the ideas of the theoretical framework are corroborated.

The efforts to find a better fitting model should not be discouraged with the above

comments. It is important in the development of science to find the best abstraction of the real world. However, those efforts are out of the scope of this thesis. This point is addressed again in the discussion chapter of the thesis.

7.6 Summary

In this chapter, the CEGE theoretical framework has been abstracted into a model using structural equations and the questionnaire developed in the previous chapter. The results obtained corroborate the framework via the validation of the proposed model. In the results, it was also shown that the construct of Ownership is valid, with the caveat that the observable variables of "personal goal 2" and "puppetry" have a low loading value.

So far, it has been shown that the proposed framework of Core Elements of the Gaming Experience can be corroborated. The framework was formulated using a grounded theory method, and based on it an instrument, a questionnaire, was developed and validated to assess the elements of the framework. The instrument was used to validate a model obtained from the framework. The next step is to use this to describe gaming experiences when the video game is influenced by different input devices.

Chapter 8

Differentiating Experiences Using the CEGE Theoretical Framework

The argument driving this thesis is that the gaming experience should be assessable or falsifiable. It was claimed that, by looking at the process of the experience it would be possible to identify the common elements that build the basic experience. These elements allow falsifying and generalising statements regarding the gaming experience.

Toward this end, the Core Elements of the Gaming Experience (CEGE) was formulated. This theoretical framework looks at the necessary but not sufficient elements for a positive experience. In other words, the framework aims at describing the prosaic experience of playing video games; the experience of playing a video game without necessarily reaching an optimal experience, e.g. immersion or flow, but only a positive one. Using this framework, the CEGE questionnaire (CEGEQ) was formulated and used to collect data; which in turn was used to corroborate the theoretical framework using a model. Now, it is turn to put the framework to use.

On the experiments presented on Chapter 4, it was not possible to provide a general description regarding the gaming experience that would allow comparisons. The approach used then, in which participants were asked to describe their experiences with a narrative, followed the status quo regarding user experience: "Experience is personal". This meant that participants would have to be queried individually to understand the factors that affected the experience. In those experiments, the objective was to compare the gaming experiences produced when engaging with a game using different input devices. By querying the participants, it was possible to understand how the participant felt in each experience, but this approach failed when comparing the experiences. It was not possible to identify the elements that would produce such changes besides of being a personal preference of the participant.

To find a differentiation on the experiences, the CEGE provides an explanation of

the process needed to build a positive experience. The framework provides the tools to identify the differences and compare among those experiences. Further more, the framework also permits to find a description of the prosaic gaming experience.

In this chapter, two experiments from Chapter 4 are replicated. The objective of the chapter is to show how to use the framework to explain gaming experiences. As the replicated experiments are performed in controlled conditions, i.e. participants playing in labs for a predefined amount of time rather than playing at their own will, the framework is used to manipulate the elements of the experience and make predictions about it. In the experiments, the elements to be manipulated are directly related to the control part of the experience such as controllers and goal. In one experiment previous experiences are a grouping condition.

The chapter is divided in four sections. The first section discusses the type of experiments to be performed. The next one, describes the experience in which participants play Tetris using two different input devices. The third section presents the experiment in which GuitarHero is played with two different input devices and by two different types of participants. Section four discusses the results obtained and the role of CEGE in describing the experiences. A summary of the chapter with links it to the last and final chapter is presented last.

8.1 On the Types of Experiments

The main elements of the CEGE framework, environment, game play, facilitators, control and puppetry had a direct dependency on the participant or the video game itself. They describe the interaction process, and as such, they depend on the members of the interaction. In this thesis there was no possibility of modifying, or producing high quality, video games. This lack of materials did not allow the production of experiments for which the environment or the game play could be directly altered. There could have been solutions such as turning the sound off or programming games. However, these options were not necessary as they were not fundamental to the key arguments presented in the thesis. The market already offers a good set of games ready to be used. The video games used in these experiments have been proven to be successful in achieving their goal, providing positive experiences.

As mentioned earlier, controlling for elements of Ownership required also access to the video game, which was not available, or to the subjective self of the participant, which we did not have either. An ethnomethodological study could have been a suitable solution to identify the different elements of the CEGE framework, but this option was not followed and controlled experiments were chosen instead. Controlled experiments are up to a point not ideal for playing. People play ought to play because they want to, not because they are made to. And although all the participants signed-in voluntarily to take part in the experiments, there was still a level of commitment and

time limiting that might not be necessary present in a normal life play activity. This controlled factor hindered the types of variables that could be manipulated. Thus, it was decided to manipulate those which were more suitable for this endeavour. This was the reasoning behind controlling for input devices and the goal of the game.

Based on the above reasoning, it was decided to pursue two experiments described in the previous chapter. They controlled the input device and used successful games. But in the previous version the experiments were to be analysed qualitatively, in this case, the analyses were quantitative. The Tetris experiment was carried out in the same way. The GuitarHero experiment was adapted to separate for expertise to isolate the variables better. The third experiment of the previous chapter was not conducted, comparing two different actives such as playing and watching was considered out of the scope of the CEGE framework. The framework provided elements to study the experience of playing video games, using it to measure watching a game it would be akin to using social theories to explain the behaviour of light; it might offer results, but they are not coherent with the intended framework behind it.

8.2 Experiment 1: Playing Tetris

Experiment 1 explores how two different input devices affect the gaming experience. The devices used are a keyboard and a knob-like, as was used in the original experiment. The former is a standard device for Tetris, while the latter was adapted based on what was thought to be a "more natural" interaction; this is assumed as Tetris is a game based in rotations, and the knob would provide a direct relationship with such action. In the results obtained in Chapter 4, participants felt that the knob was enjoyable to play with, but overall they preferred using the keyboard. The hypothesis is that players using the keyboard would have higher control, and higher enjoyment than those using the knob.

In this version of the experiment, the aim is to use the CEGE framework to find what makes the experience different one from the other. The working hypothesis is that the keyboard would provide a more positive experience than the knob. In some sense, it provides the same answer that was obtained from the previous experiment. The difference being that this time, we have an objective theoretical framework that allows not only the description of the experience, but also to make falsifiable statements regarding the experience. The falsifiable statements are: the keyboard provides a more enjoyable experience because it offers a better sense of control. The Video game, environment and game play, would be experienced in the same way by both groups of participants as it would stay constant for both of them.

8.2.1 Method

Design

The experiment used a within-subjects design. The independent variable was the type of controller used. Two types of controllers were used and the order in which the controllers were used was balanced. The dependent variable was the gaming experience, which was assessed using the CEGEQ.

Participants

Fifteen participants took part in the experiment. There were 7 women and 8 men. The age group of the participants was divided as follows: 4 were between 18-20; 2 between 21-25; 2 between 26-30; 2 between 31-35; 2 between 36-40; 1 between 41-45; and 1 above 51. Participants were recruited with emails to students within UCL and neighbouring colleges.

Apparatus and Materials

Tetris was installed in a PC using a shareware Java implemented version. This version of Tetris does not have sound. The input devices used were the standard QWERTY keyboard and a knob like device (Figure 8.1). Both devices can be used to play Tetris, the mappings of the devices are presented in Table 8.1.

Figure 8.1: The PowerMate by Griffin Technologies was used as the knob like device.

Table 8.1: Mappings of both input devices in order to play Tetris.

Tetris	**Keyboard**	**Knob**
Drop	Down Arrow	Push
Move Left	Left Arrow	Rotate Counterclockwise
Move Right	Right Arrow	Rotate Clockwise
Rotate Counterclockwise	Up Arrow	Push-Rotate Counterclockwise
Rotate Clockwise	Shift-Up Arrow	Push-Rotate Clockwise

The CEGEQ (see Appendix E) has 38 items with a 7-point Likert scale. It was modified by removing the 4 items that query about sound, leaving a total of 34 items. The questionnaire provides 7 different scores: Enjoyment, Frustration, CEGE, Puppetry, Video game, Control, Facilitators, Ownership, Environment and Game play. A general survey asking about the participants' data, such as age and gender, was also used (see Appendix G).

Procedure

Participants carried out the experiment individually. They started the experiment with a briefing of the experiment, verbally and written, after which they were asked to sign a consent form and complete the general survey form. Participants were asked to try to forget they were in a lab and think they were in the place where they usually engaged with video games.

The order in which the participants used the input device was randomised. Each participant was given an explanation of how to play the game with each device. Participants would play for approximately 15 minutes for each condition, and then they would complete the questionnaire and perform the second condition.

8.2.2 Results

The CEGEQ provides a series of scores that can be separated in three groups. These groups are Enjoyment, Frustration and CEGE. There is no overall score for the questionnaire. A related samples t test was used to compare the mean of the enjoyment score for the Keyboard condition ($M = 0.739,\ S.D. = 0.176$) with the Knob condition ($M = 0.568,\ SD = 0.169$). The alpha level was 0.05 two tailed. The test was found to be statistically significant, $t(14) = 3.24$, $p = 0.006$, meaning that the Keyboard provided a more positive experience than the knob.

Since there was significance in the results, the CEGE scores were considered in more depth. Comparing with a related samples t test the mean score for the Keyboard condition ($M = 0.644,\ SD = 0.051$) with the Knob condition ($M = 0.610,\ SD = 0.044$)

using the same alpha level as before. The test was found to be statistically significant, $t(14) = 3.08$, $p = 0.008$, with the Keyboard scoring higher.

Having found a statistically significant difference, the two major categories of CEGE, Video game and Puppetry, are also analysed. The t test comparing the means of Video game (Keyboard condition: $M = 0.735,\ SD = 0.083$; Knob condition: $M = 0.732,\ SD = 0.074$) resulted in a non significant result, $t(14) = 0.252$, $p = 0.805$. While the t test of the means of the Puppetry score (Keyboard condition: $M = 0.735,\ SD = 0.071$; Knob condition: $M = 0.682,\ SD = 0.063$) was found to be statistically significant, $t(14) = 2.97,\ p = 0.01$, again with the Keyboard scoring higher.

Pursuing further the variables that constitute Puppetry, it was found that comparing the Control scores of the Keyboard condition ($M = 0.817,\ SD = 0.118$) with the Knob condition ($M = 0.728,\ SD = 0.093$) was significantly different, $t(14) = 3.28$, $p = 0.005$. The other two variables, facilitators (Keyboard: $M = 0.657,\ SD = 0.118$; Knob: $M = 0.628,\ SD = 0.117$) and ownership (Keyboard: $M = 0.690,\ SD = 0.078$; Knob: $M = 0.666,\ SD = 0.081$) were not significant with the following t test respectively: $t(14) = 1.545$ and $t(14) = 1.221$.

Lastly, the score of Frustration (Keyboard: $M = 0.476,\ SD = 0.180$; Knob: $M = 0.685, SD = 0.196$), was also found to be statically significant higher for the knob condition, $t(14) = -3.55$, with $p = 0.003$. The level of frustration for the knob is higher than the mean of the total scores presented in Table F.1.

In order to establish a relationship between control and enjoyment, a correlation and regression analysis was performed in each of the different conditions. The obtained correlations for the two different conditions are presented in tables 8.2 and 8.3. The regression model, based on the CEGE model for which enjoyment is produced by puppetry (control, facilitators and ownership), is defined by the equation: $E = b_0 + b_1C + b_2F + b_3O + \epsilon_1$, where E=Enjoyment, C=Control, F=Facilitators and O=Ownership. The results of the regressions are presented in Table 8.4. It has to be noted that there are only 15 participants in this experiment, and that there are 3 predictors in the model, so the sample size is smaller than desired (Hair Jr. et al., 1998).

Table 8.2: Correlations obtained by those participants using the keyboard. Correlations marked with (**) denote significance at the 0.01 level (N=15).

		Enjoyment	Frustration	Control	Ownership	Facilitators	Game-play	Enviroment
Enjoyment	Pearson Correlation	1	0.13	0.09	0.32	0.70(**)	0.12	-0.12
	Significance		0.63	0.74	0.25	0.00	0.68	0.67
Frustration	Pearson Correlation	0.13	1	-0.46	-0.44	-0.04	0.06	0.32
	Significance	0.63		0.08	0.10	0.88	0.83	0.25
Control	Pearson Correlation	0.09	-0.46	1	0.30	0.00	0.49	0.14
	Significance	0.74	0.08		0.28	0.99	0.06	0.62
Ownership	Pearson Correlation	0.32	-0.44	0.30	1	0.36	0.17	-0.49
	Significance	0.25	0.10	0.28		0.19	0.55	0.06
Facilitators	Pearson Correlation	0.70(**)	-0.04	0.00	0.36	1	-0.25	-0.17
	Significance	0.00	0.88	0.99	0.19		0.37	0.55
Game-play	Pearson Correlation	0.12	0.06	0.49	0.17	-0.25	1	0.06
	Significance	0.68	0.83	0.06	0.55	0.37		0.82
Environment	Pearson Correlation	-0.12	0.32	0.14	-0.49	-0.17	0.06	1
	Significance	0.67	0.25	0.62	0.06	0.55	0.82	

Table 8.3: Correlations obtained by those participants using the knob. Correlations marked with (**) denote significance at the 0.05 level (N=15).

		Enjoyment	**Frustration**	**Control**	**Ownership**	**Facilitators**	**Game-play**	**Enviroment**
Enjoyment	Pearson Correlation	1	-0.32	-0.07	0.01	0.16	-0.01	-0.52(*)
	Significance		0.24	0.79	0.97	0.57	0.96	0.05
Frustration	Pearson Correlation	-0.32	1	-0.35	-0.22	-0.05	0.38	0.44
	Significance	0.24		0.20	0.43	0.85	0.16	0.10
Control	Pearson Correlation	-0.07	-0.35	1	0.39	-0.11	0.18	0.27
	Significance	0.79	0.20		0.15	0.70	0.52	0.33
Ownership	Pearson Correlation	0.01	-0.22	0.39	1	0.31	-0.21	-0.25
	Significance	0.97	0.43	0.15		0.26	0.46	0.36
Facilitators	Pearson Correlation	0.16	-0.05	-0.11	0.31	1	-0.01	-0.11
	Significance	0.57	0.85	0.70	0.26		0.97	0.69
Game-play	Pearson Correlation	-0.01	0.38	0.18	-0.21	-0.01	1	0.28
	Significance	0.96	0.16	0.52	0.46	0.97		0.31
Environment	Pearson Correlation	-0.52(*)	0.44	0.27	-0.25	-0.11	0.28	1
	Significance	0.05	0.10	0.33	0.36	0.69	0.31	

Table 8.4: Regression analysis for the results obtained. The model aims to predict if puppetry (control, ownership and facilitators) produce enjoyment in both conditions. B are the b_i indexes and SEB is the standard error. The β marked with (**) denotes significance at the 0.05 level (N=15).

		B	SEB	β
Keyboard				
	Constant	-.101	.392	
	Control	.119	.335	0.80
	Ownership	.113	.543	0.50
	Facilitators	1.013	.343	.681**
Knob				
	Constant	.515	.532	
	Control	-.090	.607	-.050
	Ownership	-.039	.729	-.019
	Facilitators	.231	.466	.161

8.2.3 Discussion

The results show that participants had a more enjoyable experience playing with the Keyboard than the Knob. They also show a non-significant difference in the Video game score, reflecting that in both conditions the elements of video game stayed constant. Finally, they showed that participants with a higher level of enjoyment experienced a higher level of Puppetry, and a higher sense of control; thus the participants using the keyboard scored higher than those using the knob. As expected, there were no differences in ownership and facilitators. Using the CEGE questionnaire, it is possible to identify what produces the difference in both experiences. The CEGE framework provides a hierarchical approach to understand the gaming experience. This approach allows identifying that there is a significant difference in the level of enjoyment with each device. Methodically, it is identified that this difference is due to the sense of CEGE, then puppetry, specifically to the level of control that the participants had over the game. Participants experienced the video game in similar way with both devices. This was to be expected as the graphics, rules and scenario of the game did not change.

Regarding puppetry, the main difference is in the sense of control. The sense of ownership and facilitators did not change between both games. That meant that players were still able to overcome the lack of control in order to concentrate on the game. However, the difference of control might had a final impact on the level of enjoyment. Answering the original question, the difference between both input

devices is that the keyboard gives the player better control of the experience. Even though both devices let users perceive the game equally while making it their own, it was the lack of control with the knob made the difference in the gaming experience. Further more, there was such a lack of control with the knob that it actually marred the experience. That is, one of the CEGE was missing thus providing a negative experience.

Regarding the regression analysis performed, the results obtained for the keyboard suggest that the facilitators had a higher influence on the final enjoyment. The fact that only one of the predictors had a significance influence on the final level of enjoyment may be due to the small sample size. For the knob, none of the predictors had a significant influence on the final level of enjoyment. These results confirm the statements made above that the experience with the knob was actually negative, thus the CEGE were not present.

Plotting the obtained means of the scores, see Figure 8.2, it is possible to observe the differences in both experiences. The shapes of both figures help to understand how the experience was affected by both input devices. There are three clear differences in the obtained scores: Enjoyment, Frustration and Control. The first two can be seen as being almost inverted scores in both conditions. The graph shows how participants with the keyboard experienced a better sense of control, which had a direct impact on the enjoyment of the game. The levels of ownership and facilitators are non-significantly different for both experiences. This could be due to the simplicity of the game. Even though both of these constructs have an impact on the final experience, in this case they were subjugated to the control.

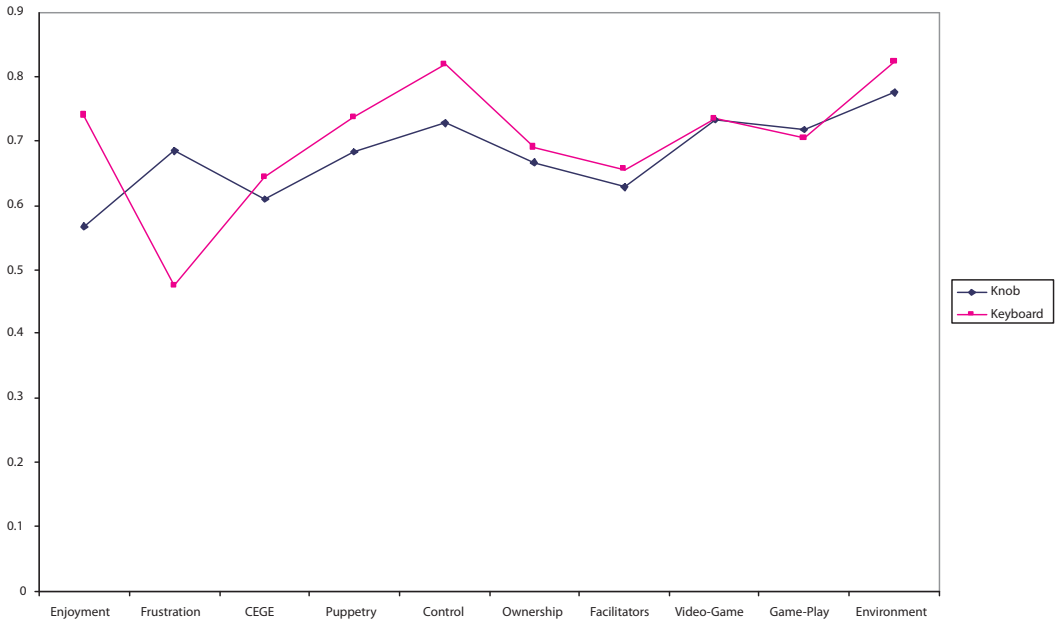


Figure 8.2: Experiment 8.1: Plots of means for all the scores obtained during the experiment.

8.3 Experiment 2: Playing GuitarHero

The experiment asks participants to play the game of GuitarHero with two different input devices: a guitar shaped controller and the PS Dual-Shock. The former is the default controller for the video game, while the latter is the standard controller for the PS console, and it is not recommended by GuitarHero to play the game. The hypothesis is that participants using the guitar would have a better experience than those than using the PS Dual-Shock. To measure the experience the CEGE questionnaire was used. Since GuitarHero is a popular game, participants would be expecting to play with the guitar, so when doing the comparison, they could already be biased toward that type of controller. For this reason, it is suggested to do a between subjects experiment and separate participants according to their expertise. This group separation leads to a second hypothesis, participants that have played the game previously would have a worst experience when using the PS Dual-Shock, so they would have to rely more on previous experiences to have a positive experience. The hypotheses of the experiment can be summarised as follows:

- Participants playing with the guitar would score higher on enjoyment.
- Participants with previous experience would score higher on facilitators.
- The other elements of the experience would remain unchanged.

8.3.1 Method

Design

The experiment used a two-way, unrelated samples design. The independent variables were “Expertise” and “Controller”. Expertise was classified as having played before the game or not. Two different types of controllers were used. The dependent variable was the experience of playing video games, which was assessed using the CEGE questionnaire which provides 10 scores.

Participants

Thirty-nine participants took part in the experiment. There were nineteen women and twenty men; see Table 8.5 for a break down of participants per gender per group. The majority of participants were between 21 and 35 years old, for a full description of the participants’ age see Table 8.6. Participants were recruited with emails to students within UCL and neighbouring colleges. They were allocated to their corresponding expertise group and randomly assigned a controller. All data regarding the participants identity was kept anonymously. Ten participants were allocated per group except for the group that had previous experience and used the guitar, which had nine participants.

Table 8.5: Exp. 8.2 Gender of Participants Divided per Group

	Male	Female
Played GH - used Guitar	6	3
Played GH - used DualShock	4	6
Not Played GH - used Guitar	5	5
Not Played GH - used DualShock	5	5

Table 8.6: Exp. 8.2 Age of Participants Divided per Group

	18-20	21-25	26-30	31-35	36-40
Played GH - used Guitar	2	3	3	1	0
Played GH - used DualShock	4	5	1	0	0
Not Played GH - used Guitar	3	3	1	1	2
Not Played GH - used DualShock	3	4	1	1	1

Materials and Apparatus

The game GuitarHero 2 was used on a PlayStation 2. Two different types of controllers were used: A guitar shaped controller standard with GuitarHero and the PS DualShock controller (see Figure 8.3 and Table 8.7). The CEGE questionnaire was used to assess the experience. The questionnaire asked participants to rate different statements regarding the experience using a 7-point Likert scale, anchored at 1 (completely disagree) and 7 (completely agree). A general survey that asked the expertise of the participant with video games and GuitarHero, and the age group and gender of the participants was also used. Forms and the general survey questionnaire are presented in Appendix G and the CEGE questionnaire is in Appendix E.

Table 8.7: Exp. 8.2 Mappings of both input devices in order to play GuitarHero.

GuitarHero	**Guitar**	**DualShock**
Red Fret	Red Fret	L2
Green Fret	Green Fret	L1
Yellow Fret	Yellow Fret	R1
Blue Fret	Blue Fret	R2
Orange Fret	Orange Fret	X
Strum Bar	Strum Bar	N/A
Whammy Bar	Whammy Bar	Left Stick
Star Power	Tilt	Select

(a)

(b)

Figure 8.3: Exp. 8.2 Devices used for the experiment. Two different input devices were used. (a) The standard PlayStation 2 Dual-Shock was controller and (b) the guitar shaped controller.

Procedure

Participants carried out the experiment individually. They started the experiment with a briefing of the experiment, verbally and written, after which they were asked to sign a consent form and complete the general survey form. Participants were asked to try to forget they were in a lab and think they were in the place where they usually engage with video games. Each participant was given an explanation of how to play the game using the allocated controller. Participants that had never played before and used the guitar shaped controller were recommended to start with the game tutorial; other participants were asked to play a song first as training. The researchers stayed in the room during the tutorial or training which lasted for approximately five minutes. The participant played alone for approximately 25 minutes. After that time, the researcher re-entered the room, and given the case, let participants finish the song they were playing. Once they had finished, they completed the questionnaire.

8.3.2 Results

The means and standard deviations of the scores obtained by the CEGEQ are presented in Table 8.8 and the plots of the means for all the groups are presented in Figure 8.4.

Table 8.8: Exp. 8.2: Means and Standard Deviation of the CEGE Scores

	PP-Guitar	PP-DualShock	NP-Guitar	NP-DualShock
Enjoyment	0.852	0.757	0.852	0.814
	(0.159)	(0.156)	(0.137)	(0.146)
Frustration	0.429	0.457	0.493	0.329
	(0.160)	(0.243)	(0.219)	(0.102)
CEGE	0.762	0.747	0.744	0.691
	(0.074)	(0.042)	(0.083)	(0.058)
Puppetry	0.722	0.701	0.696	0.660
	(0.091)	(0.044)	(0.104)	(0.055)
Control	0.780	0.748	0.786	0.714
	(0.159)	(0.102)	(0.110)	(0.079)
Ownership	0.714	0.700	0.664	0.679
	(0.072)	(0.048)	(0.080)	(0.076)
Facilitators	0.638	0.641	0.612	0.581
	(0.089)	(0.091)	(0.151)	(0.086)
Video-Game	0.830	0.827	0.827	0.745
	(0.071)	(0.056)	(0.079)	(0.084)
Game-Play	0.832	0.779	0.812	0.731
	(0.078)	(0.060)	(0.086)	(0.086)
Environment	0.828	0.876	0.843	0.760
	(0.110)	(0.072)	(0.102)	(0.092)

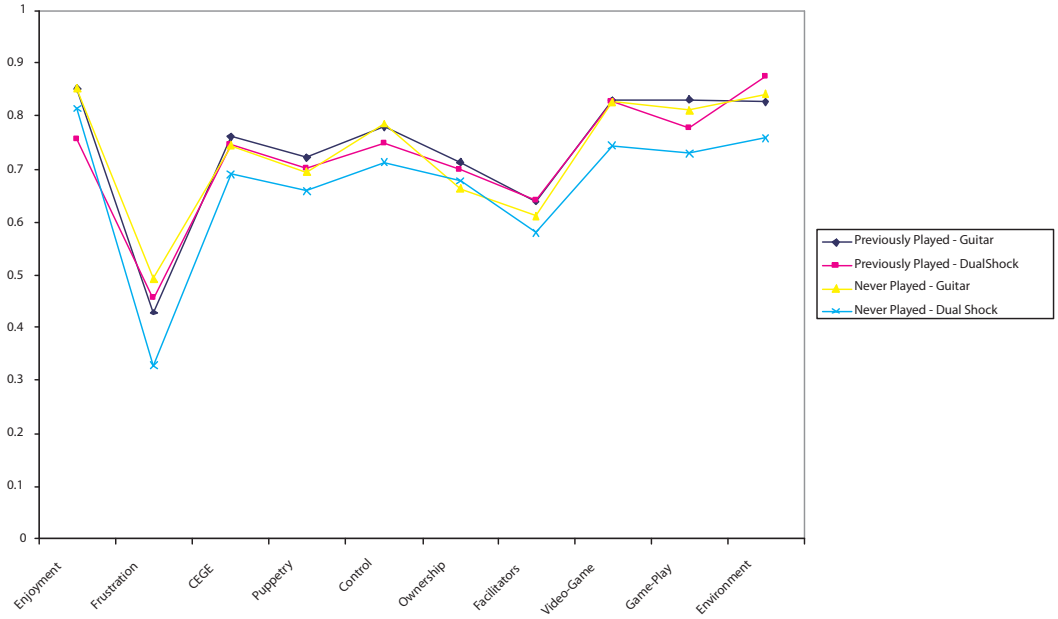


Figure 8.4: Experiment 8.2: Plots of means for all the scores obtained during the experiment.

The CEGEQ provides a series of scores that can be separated in three groups. These groups are Enjoyment, Frustration and CEGE. There is no overall score for the questionnaire. An alpha level of 0.05 was used for all statistical tests. The difference in enjoyment for the four groups was tested using factorial ANOVA for unrelated samples. The analysis was not statically significant indicating that all groups enjoyed the playing the game equally. Both Controller and Expertise had non-significant influence on the level of enjoyment, $F(1,35) = 1.910$, $p = 0.176$ and $F(1,35) = 0.361$, $p = 0.552$ respectively and the interaction is also non-significant $F(1,35) = 0.350$, $p = 0.558$. Looking further, there is a non-significant difference in the level of Puppetry $F(1,35) = 1.317$ for controller and $F(1,35) = 1.876$ for expertise; the interaction was also not significant $F(1,35) = 0.092$. Since the difference in Puppetry is non-significant, it was not proceed with further analysis on its components.

There is a tending to significance difference for Video game $F(1,35) = 3.248$, $p = 0.080$ for both controller and expertise. The interaction of controller and expertise have a non-significant influence on the perception of the video game, $F(1,35) = 2.862$, $p = 0.10$. As it can be seen in Figure 8.4, the difference in the elements of video game might be significant, as it is suggested also in the previous analysis. Looking at its elements, Environment has a non-significant difference depending on the controllers or expertise $F(1,35) = 0.339$, $p = 0.564$ and $F(1,35) = 2.821$, $p = 0.102$, but the interaction effects of controller and expertise produce a significant difference $F(1,35) = 4.696$, $p = 0.037$. Game play has a significant difference due to the controllers $F(1,35) = 7.152$, $p = 0.011$, and not significant for expertise or interaction effects, $F(1,35) = 1.817$,

$p = 0.186$ and $F(1,35) = 0.314$, $p = 0.579$ respectively. The results show that our hypotheses are not true. However, they show that the type of controller used and expertise of participants influenced the prosaic experience of playing GuitarHero.

The analysis of Frustration showed that there was non significant difference, $F(1,35) = 1.239$, $F(1,35) = 0.278$ and $F(1,35) = 2.507$ for controllers, expertise and interaction respectively.

8.3.3 Discussion

The results show that the controllers and expertise influenced the way participants experience the video game. In particular, the controllers changed the way participants appreciated the Game play; while the interaction of controllers-expertise changed the way participants appreciated the environment. The hypotheses to test with the experiment was that participants who used the guitar would have a better experience than those than who used the PS Dual-Shock; and that those participants with previous experience with the game would use more facilitators to compensate when using a poorer control. Both hypotheses were not supported with the obtained results.

These results suggests that it is possible to engage with GuitarHero, regardless of the participants expertise and the type of controller used, the guitar or the Dual-Shock, and still have a positive experience. On the long term, the experience may have difference regarding the ability to reach flow or immersion. But in terms of the prosaic experience, it is possible to have an enjoyable moment. However, it shows that for this game the controller had a direct influence on the rules and scenario. Participants that played with the guitar scored higher than those that used the DualShock on the perception of the Game play. That is, both groups of participants were playing at its core a different video game. For a game like GuitarHero, the controller is not just tool-at-hand, rather it is part of the game when using the guitar. The interaction between controller and expertise also changed the way the participants experienced the environment of the game. The level of Frustration was consistent with the numbers reported in Table F.1, and as the difference was not significant, it is suggested that the CEGE were presented thus providing a positive experience for all groups.

8.4 Using CEGE to Differentiate Experiences

In this chapter, two experiments that used the CEGE framework to describe the gaming experiences were presented. The first experiment, in which participants played Tetris using a keyboard or a knob as input devices, showed that the input device had an effect on the sense of control. These meant that the keyboard provided a better experience than the knob. This result corroborated the proposed hypothesis for the experiment. The second experiment asked participants, divided by expertise, to play GuitarHero using a guitar-shaped controller or the standard DualShock controller.

The experiments showed that the input device changed the gaming experience of the participants, but providing a positive experience in both cases. Leaving the results obtained aside, the CEGE framework allowed to formulate falsifiable statements regarding the experience of playing video games.

It is important to reiterate, as it has been the argument throughout this thesis, that the interest is in the prosaic experience. It was found that for Tetris, playing with the knob-like device did not produce an experience as enjoyable as with the keyboard. This could be informally correlated with the comments given by the participants after they had finished engaging with it. The correlation is informally as no notes were taken. The participants usually utter negative comments about the knob. The same can not be said about the GuitarHero experiment. Few mentioned that they preferred the Guitar, especially in the group with previous experience, or that they would have like to try the Guitar. But in general there was a positive outcome regardless of the group.

These experiments replicate those presented in Chapter 4. In both experiments it is possible to understand the gaming experiences. The key difference, however, is this time it has been possible to differentiate between the experiences for each experiment. The conclusion reached in Chapter 4 stated that it was possible to tell that there was an experience for each input device. However, it was not possible to compare those experiences, as it might have been similar to comparing apples and oranges. This was due to the fact that each participant was telling the outcome of the experience; the internalisation of the process.

Using the CEGE framework, it was possible to re-examine the very same type of experiments presented before. Only this time, it was possible to compare directly the experiences and understand which factors had a direct effect on them. CEGE is not a single measure scale, in order to understand the experience it is needed to look at the whole picture that the questionnaire is providing. In the Tetris experiment, it showed that using a hierarchical approach it was possible to find the element that minimised the positive experience. In the case of this experiment, since it was known that the difference was on the controllers, it could have been possible to start testing directly in the control score. However, the used approach allowed seeing the full power of the CEGE framework to describe, not only predict, the gaming experience. It was possible to first approach the level of enjoyment of the experience in which it was possible to observe a significant difference. This difference was due to the level of puppetry, and then to the level of control. The level of control provided such difference, that it did not matter that participants experience similar levels of ownership and facilitators. The control was enough to alter the enjoyment of the game. Based on the framework, the hypothesis that the controllers were going to influence the experience was made

and corroborated with the experiment.

The second experiment was approached similarly. Only this time, the level of expertise was added as another variable. The results showed that the different groups of participants had a positive experience and that controllers or expertise had a direct impact on the prosaic experience. It was shown that the Puppetry for all the groups was equal. The only difference found was in the perception of the video game. Although the controller made the participants experience two different video games, and the interaction between controller and expertise affected the perception of the environment, the participants had a positive gaming experience. In this experiment, the hypotheses put forward to test were not proved. However, it was possible to explore the different changes on the basic elements of the experience and provide and explanation of it. In essence, all participants had a positive experience, but they were playing different video games depending on the type of controller they were using. For those using the Guitar, they were being rock-stars for whom the Guitar was an essential part. For those using the controller, they were playing a game and wanted the control to get out of the way. For the former group, they did not want to focus of the task-at-hand thus having an invisible tool, they wanted the tool to be part of the game; it is also not only studying the tool, but using the tool as part of the task. While the latter group wanted a tool-at-hand that would let them concentrate on the playing the game being displayed.

The results also showed that when Frustration was present when one of the core elements was lower, arguably missing. This finding suggests that is valid to assess that when the elements are missing then the experience is not positive.

The final point to discuss here is the use of plots to represent the gaming experiences. The plots presented in figures 8.2 and 8.4 help to give a quick overview of the experience. In Figure 8.2, it is possible to see that the graph has a different shape at the beginning in comparison with the other plots. This difference is due to the low score on enjoyment and higher on frustration. In the second experiment, this visual representation gave a quick overview of which elements to test future experiments. The plots help in giving a quick description of the scores obtained for each experience.

8.5 Summary

This chapter presented how to use the CEGE framework to describe gaming experiences. The experiments replicate those discussed in Chapter 4. Using the CEGE framework, it was possible to differentiate, provide a description and falsifiable statements regarding the prosaic experience. In the next chapter, the conclusions of the thesis are presented. The chapter will bring together all the concepts discussed here and will relate them to previous points made during the thesis, or with new theories or concepts that were not included in the literature review.

Chapter 9

Assessing the Gaming Experience

This chapter brings the thesis to a close. It does so by reviewing how the aim of the thesis was met, as well as the answer to the proposed research question. Toward this endeavour, the chapter is divided as follows. First, a description of the aim is presented and, based on that aim, the formulation of the research question is revisited. Then, it discusses the answer to the question and its validity. Once this has been established, it reviews how the aim of the thesis was met. The thesis then summarises and discusses its contributions and limitations, and finalises with future work that can be done based on this research.

9.1 On Revisiting the Aim

The motivation of this thesis is drawn from the experiments presented in Chapter 4. There, two experiments were performed to understand how a change in the input devices affected the experience, and, which one was better. The analysis was done using the understanding that experience was subjective and personal. The results showed that indeed there are different experiences when interacting with different input devices, but besides a personal classification, it was not possible to generalise over which device provided a better experience. User experience, in as much as it is subjective, does not allow for comparison.

The main claim of this thesis is that it is possible to assess user experience under a critical rationalism perspective, that is, whether is it possible to produce generalisable and falsifiable statements regarding user experience. The conclusions reached from this work suggest that it is possible to do so for the video game domain. The theoretical framework proposed in Chapter 5, and corroborated in Chapter 7, proposes a series of statements regarding the experience of playing video games. These statements are aimed at providing a general description of the given experience; this general description is a series of characteristics that ought to be present in order to have a positive experience. It provides a framework that is beyond the subjective interpretation, but that it is described in term of a series of common elements. These

common elements are present in the questionnaire designed in Chapter 6. And although for each experience the participant would answer each of the items differently, the general element comes from the fact that the elements are common among the experiences. User experience, both words as a term, is a concept that has been in vogue within the human computer interaction community for quite a while. A full discussion can be found in Chapter 2. User experience has been considered as personal and subjective. The term was little by little migrating into the research and engineering worlds. It was personal, but it implied context, satisfaction, right use, competitors' edge, etc. It became many things, and it was necessary to be designed and evaluated. However, how is it possible to evaluate something that it is personal? It is, in this case, the job of the individual to assess such concept as it is personal. User experience is by definition part of World 2, it is subjective thus part of the subjective knowledge world. The evaluation of subjective knowledge is then based on the subjective interpretation of the individual; no general knowledge could come from User Experience if it is only subjective, evaluated by the individual based on a particular series of standards that are neither general nor falsifiable. There is nothing wrong with seeing user experience as part of subjective knowledge. Many things reside in that world and it is an important part of the human experience. Psychotherapy has been used quite widely to understand World 2 in the mind of an individual. However, it might be a bit cumbersome to psychoanalyse every human being in order to understand how to design the next Windows. The question becomes not, what it is wrong or what is right regarding user experience, it becomes, is it possible to understand user experience as a scientific concept that can be fully assessed? The answer I propose, in Chapter 2, is yes and no. No, because there is something personal about the everyday interaction of an individual with the world. No, because there is a context, there is a time, there is a mood, which surrounds the individual every time there is interaction. Yes, because it is possible to understand the process that forms such outcome. Yes, because that process has common elements that allows the personal experience to be shared, but not replicated, among many individuals. The process of the experience provides falsifiable and generalisable statements regarding the user experience. They are generalisable because they are common, not only due to a personal interpretation; falsifiable because they can be tested.

This was the first contribution of this thesis: experience is a dual concept, it is process and it is outcome; it is objective and subjective. Although this might seem like a contradiction in terms, understanding user experience as a dual factor brings it closer to World 3. It comes closer because by looking at the elements that form the process it is possible to create theories about their role in the building of the experience. These theories can be evaluated because they are building on a shared

understanding of the process of the experience. Evaluating the outcome is subject to a persona set of standards; evaluating the process is subject to a shared set.

Since, in the definition, it is acknowledged that experience, and the user experience, is bound to a context and environment, the thesis is focused in one type of experience: the experience of playing video games. Chapter 3 presented a full review of the video game experience. The common understanding seen from that chapter is that video games are understood by many different angles. They can be viewed as media, as narratives, as stories, as puzzles, as computer programs, etc. The experience of playing video games then gets lost in the implementation and the narrative of the game. What can be said about the individual's relation with the game when everything we see is the game and not the interaction? Those studies that look at the individual, do so looking at the after effect of the game: are games making people more violent? Are games making you dumber? Another, and still forming, way of looking at video games is by understanding how games can alter the individual by creating, what I called, extreme experiences. Is the individual reaching immersion? Why is the individual reaching immersion? The prosaic experience of playing games then tends to be overlooked. What is it in a game that makes it enjoyable? That involves playing a game without getting immersed that might be too abstract to change the behaviour of the individual. An experience that produces flow or immersion should be based on the prosaic experience of playing video games, thus understanding it would provide a better understanding to all the different experiences of playing video games.

Based on the understanding of user experience presented previously and then findings just discussed, the aim of the thesis was reduced to one simple question: which are the elements that form the process of the experience of playing video games?

The question was bound in order to make it treatable in the course of a normal PhD work. First, the time of the experience was reduced to the moment when players have already decided which game to play. Then, it bound the context to the one to one relationship between player and game; the social context was excluded. This experience was coined as the gaming experience. Finally, the elements were reduced to the basic elements, those elements that if missing would mar the experience, but if present would not guarantied a positive experience. These elements were called the core elements of the gaming experience.

Bounding the experience in this way has disadvantages. There are contextual elements that are being ignored, such as the process of selecting the game or playing with friends. There is also the problem of ignoring other elements that can make the experience even better. However, the bounding of experience provides a more manageable question, whose answer provides a firm basis for the not addressed elements.

The research question can be re-stated as: **Which are the core elements of the gaming experience?**

9.2 On Addressing the Question

To find the answer to the above question, I conducted a qualitative study using grounded theory. The study produced a framework based on the way that game-reviewers, mainly, players and game-designers described the experience of playing video games.

The decision to pursue a qualitative study was grounded in the very nature of the question: identifying a part of the human experience. The focus was to find and isolate a series of common elements among different experiences while playing video games. Grounded theory was used as this method allows building a framework based on iterative codes by looking at the common semiotics of the experience. The limitations of the obtained framework are inherent to the limitations of qualitative research.

Going further, and exploiting one of the characteristics of grounded theory, I propose to use the metaphor of Puppetry to describe the interaction process between individual and game. Grounded theory relies on a series of codes, and each code is named under a term that encapsulates the meaning of several other codes. The term Puppetry was used to describe such codes, which evolved into a metaphor to describe the gaming experience. At the end of Chapter 5 there is a discussion regarding the similarities of Puppetry in theatre with the gaming experience. The advantage of using a metaphor is that it automatically places the concept within a concept that it is easy to understand, it provides simplicity to the underlying framework and story that gives cohesion to the framework. On the other hand, using the metaphor also brings baggage which could cause an instant reaction to the overall framework, discarding the finer details in favour of the general description.

Returning to the original question, *which are the core elements of the gaming experience?* video game and Puppetry. Video game is the individual's interpretation of the game, while puppetry is the interaction with such game. These two basic elements build the start of the gaming experience. They provide the building blocks to a positive user experience. The framework explains the core elements of the gaming experience as well as their relationship among each other.

The framework provides a clear differentiation between the tool, video game, with the interaction, puppetry. This differentiation is consistent with the phenomenological perspective drawn previously regarding the process of the experience. It also provides a pragmatic implication of the outcome of the experience, there is a parallel with puppetry that brings the two elements together. The interaction between individ-

ual and game is through the video game; the individual internalises this interaction resulting in a personal outcome.

The Core Elements of the Gaming Experience is another contribution of this thesis. The results have been published in Calvillo-Gámez et al. (2008, 2009a). The use of Puppetry as a metaphor to describe the gaming experience is another contribution, which has been published in Calvillo-Gámez and Cairns (2008).

9.3 On Validating the Answer to the Question

With the framework formulated, the next step was to corroborate its finding. The procedure followed looked at internal validity. How consistent is the framework with itself. To do so, a questionnaire was devised in order to provide a tool to validate the different concepts, or constructs, formulated in the framework.

Chapter 6 presents the discussion of how the questionnaire was formulated and validated. The development of the questionnaire followed Nunnally and Bernstein (1994) guidelines in constructing a questionnaire for construct validation. For each of the constructs of the CEGE framework, a set of items were devised. Following an iterative procedure, items were either discarded or corrected. Once a final set of 40 items was selected, the questionnaire was deployed to approximately 600 participants. The results obtained suggested that the questionnaire was adequately designed to assess the majority of the intended constructs. However, two of the constructs showed a particular low level of reliability, ownership and game play. It is important to notice that the analysis showed that the questionnaire as a whole was a reliable tool, more time could have been dedicated to improve the different scores obtained thus providing an even better tool. However, the aim of the questionnaire was not to be developed as an excellent tool, rather, it was devised to test the validity of the framework, and also be used as tool to assess gaming experience. There is future work in developing a better questionnaire, but for the current thesis, and following the advice of Nunnally and Bernstein (1994), the current questionnaire would suffice. The low reliability of the ownership and game play, was overcome when further analyses, to be discussed, showed that the items did belong to the same construct. The questionnaire, another contribution of this thesis, is presented in Appendix E and it was also reported in Calvillo-Gámez et al. (2009a).

The CEGE framework was abstracted into a model, called the CEGE model. The model, unlike the framework, offered the possibility of being validated. This validation would corroborate the framework. To validate the model, a statistical modelling technique called Structural Equation Modelling (SEM) was used. This modelling and analysis were presented in Chapter 7. SEM analysis provides a relationship among different items that form a construct while investigating the relationship among the constructs. Using the data already collected, the SEM analysis showed that the CEGE

model was indeed valid. The SEM model allows for model modification and comparison to find the best fitting model to the obtained data. In the case of the analysis presented, it is shown that the initial model presented is a good enough fit. Again, as future work it would be possible to find a better fit of the model. The current status of the model was shown to be valid, thus corroborating the framework. The model was reported in Calvillo-Gámez et al. (2009a), but the SEM analysis was not included then. The model and its validation is another contribution of this thesis.

With a valid model, a reliable questionnaire and a corroborated framework, the answer to the question driving this thesis was answered. However, the aim had only been partially addressed. So far, it has been shown the Core Elements of the Gaming Experience, and that there was a reliable tool to address them. To complete the aim of the thesis, the next step was to show these elements and framework would help in objectively studying the user experience of playing video games.

9.4 On Addressing the Aim

In Chapter 8, I look at how to use the framework to understand the gaming experience. In particular, in how to compare two similar experiences, when there is a small change in the context of the implementation of the video game. That is, I don't try to alter the implementation of the video game, rather, I manipulate parts that are needed to engage with the game. These parts do not affect the game play or environment (Video Game). This is similar to the experiments that motivated the aim of the thesis.

In the first two experiments, it is shown that with the framework it was possible to differentiate how the expertise of the participants or the input device used can affect the experience. Again, for both experiments the implementation of the game remains the same. The results show that with the framework it was possible to describe the felt experience. It was found that changing the input device for Tetris affected the sense of control, and this change had an effect on the outcome of the game. Although the game was still playable, it was not as enjoyable to do so.

The second experiment showed that, unlike predicted, everyone had a pleasurable experience regardless of expertise or controlled used. However, it showed that those participants playing with the Guitar experienced a different video game than those playing with the controller. Those playing with the controller saw it as a tool-at-hand, while those playing with the guitar saw the guitar as part of the game, and not something they wanted to necessarily bypass.

The framework, and the tools created based on it, was used to describe the gaming experience. To formulate hypotheses based on the changes made, and to test those hypotheses; which for the second case were proved wrong, but still it was possible to understand what happened.

Using the CEGE framework it was possible to compare experiences. It was possible to objectively study the experience of playing video games. Indeed, it was done under specific conditions in which the object of study is limited. However, it is shown that the overall experience of playing video games can be studied under World 3.

The different concepts that form the CEGE framework can be generalisable and allow formulating falsifiable statements regarding the experience. Further more, they can eventually become autonomous concepts. The elements of the framework are also directly linked to World 2 and World 1. Facilitators are the feedback loop that directly relates previous experience with new experiences. It provides a place for the outcome of the experience to come back and influence the forming of new experiences. Facilitators are part of World 2 and they provide the player with a subjective outlet to store the outcome of the experience. As part of World 1, video game provides the part of the real world that is the object of study and interpretation. video game is also linked directly to World 2 as it provides a subjective interpretation just by observing it, but when the individual interacts with it, the interaction becomes part of World 3.

The interaction of the individual with the video game, the puppetry, isolates two elements, control and ownership, that are the necessary but not sufficient conditions to have a positive experience. The player needs to have control of the game. The elements that the framework proposed is a sense of control that are represented in six conditions: small actions, is the player aware of the basic actions that the objects of the game can perform?; controller, does the player know how to use the input device to influence the small actions?; memory, is the player able to remember the small actions and the mapping to the controllers?; point of view, is the player able to see all the information needed in the correct fashion?; goal, is the player aware of which is the main objective of the game; and last, something-to-do, is the player busy while engaging with the game?. These six elements provide the individual with a basic sense of control, with an idea that the individual is manipulating the actions faced upon, and that by the overall control of the game would eventually lead to a sense of ownership over the game. Game is what we play, video game is how we play it. There is a difference between playing the game and controlling the video game. Playing refers to the whole of the interaction, controlling refers to the six elements described above. Instrumental interaction (Beaudouin-Lafon, 2000) looks at this duality. It provides a differentiation between the instrument that it is used and the task that is being done. Instrumental interaction provides a differentiation between the actual devices used to manipulate the widgets of a GUI, versus the actual implications of such movements. In order to push a button, the user needs to go through the mouse to do so; although most users would associate both activities as the same. Once the application changes device, such as using a touch screen or a computer without a

mouse, the application stays the same. The button stills needs to be pushed, but now, this can done be via the keyboard or by putting pressure on the surface of the screen. In the gaming experience this is also present: small actions and controllers. They provide a differentiation between what the objects in the game can do, and what the player has to do in order to do them. Further more, this relationship is also dependent on memory, can the player remember all the actions that can be done? And if not, does the interface help in bringing them to memory? This is basic usability and already discussed by Norman (2002). However, applications still do not help users in making the link between action in the screen and action in the real world. Once the player has control of the game, there is the opportunity to gain ownership. It is from ownership that there is a direct link to a positive experience. Would a user of a normal application feel that what is happening with the application is her own? The elements of ownership, Big actions, is the player using the small actions to implement a strategy?; Rewards, is the game acknowledging the actions of the player by providing rewards?; Personal goals, is the player able to include his own goals while playing the game?; last, you-but-not-you, is the player living a series of events alien to his reality? The concept of Ownership is somewhat similar to the concept of appropriation (Dix, 2007). In order to have a sense of ownership in video games, there are four different elements. Not all of them are applicable to different experiences, but they are still valuable to explore. The different elements that describe the gaming experience can be considered as autonomous as they evolve within their own right; as it was presented in the concepts above. This discussion was presented in Calvillo-Gámez et al. (2009b).

In conclusion, the aim of the dissertation was met. The framework was put to use and it showed that the user experience can be objectively assessed. The tested hypotheses were either proved correct or not, but they were able to be tested. There was also a considerable decrease in the amount of time needed to examine the results of the experience. Completing the questionnaire does not take more than 5 minutes, and the analysis of the results can be done in comparably short time.

In the next two sections, I present a summary of the contributions and limitations of the thesis, already discussed above, as well as future work.

9.5 Summary of Contributions & Limitations

Claiming that the theoretical framework herein proposed is the definitive or final answer regarding the experience of playing video games would be step in the wrong direction. In proposing a new theoretical framework for the experience of playing video games, there are inherit pros-and-cons to the field of studies. A new framework provides a new way to understand the domain, but because of the reductionist nature that framework formulation requires, there are elements that get lost or do not ac-

counted for by the explanation. As mentioned previously, the theoretical framework proposed does not account for the social aspect of playing video games, which it is acknowledged as an important part of the experience. This omission was not done because of an oversight or a mistake, it was done as part of a reasonable effort to bind the problem into something that can be managed. Above that, the framework is formulated under the notion that knowledge is developed through falsification in the way described by Popper. This, for some, can be a serious limitation of the work. For some, HCI is a discipline that should be studied under a positivist or pragmatic perspective. Not disregarding their arguments, it has been shown here that the critical rationalist perspective advocated by Popper indeed provides relevant results.

In the other hand, for each of the contributions that this thesis presents, there is a series of limitations. Some of them could be philosophical, such as considering those questionnaires are not adequate tools to assess experience; some are more practical. The overall contribution of this thesis is that it provides a methodological approach to study the concept of user experience of playing video games. Regardless, next I summarise the contributions of this thesis, for each contribution it is presented a small summary of it, as it the bigger implications have been discussed above, the chapter in which it was presented, and the publication, if any, in which it has been distributed. Also, for each contribution, there is a summary of the limitations that it includes in the field of human computer interaction, and specifically, to the study of user experience in video games.

1. **Novel Conceptualisation of User Experience** Presented in Chapter 2 and reported in Calvillo-Gámez and Cairns (2008); Calvillo-Gámez et al. (2009a). This contribution proposes to look at the concept of experience as dual phenomenon: process and outcome. The process provides a series of elements that are shared among many individuals; these elements are assessable and can be objectively studied. The outcome provides the internalisation of the experience, it is the personal interpretation and it is personal to the individual; the outcome is subjective.

   The limitations of using this definition of user experience are within a philosophical stance. There can be plenty of argumentation against considering experience as a dual process, or further more, considering experience as something assessable. However, the arguments presented in favour of the definition indeed show that it is a valid conceptualisation.

2. **The Core Elements of the Gaming Experience Framework** Presented in Chapter 5 and reported in Calvillo-Gámez and Cairns (2008); Calvillo-Gámez et al. (2008, 2009a). The framework looks at the necessary but not sufficient elements to provide a positive experience; it specifically looks in the one-to-one experience

of a player interacting with the video game. These elements are named the Core Elements and the moment of the experience it is called the Gaming Experience. The elements are clustered in two main constructs: Puppetry and video game. The former describes the interaction of the player with the game while the latter described the implementation of the game. Puppetry is formed by control, ownership and facilitators; being ownership the element that provides that links to the sense of a positive experience.

The limitations of the theoretical framework are two fold. One, methodological as the framework was formulated using qualitative methods. There are draw backs for the use of such methods, such as the problem of replication or interpretation. Qualitative data is composed of words and the concepts derived from it are due to the sense making process of the person conducting the research. The qualitative methodology guides how is the data compacted in order to interpret the results that it provides, but this process can provide different researchers to interpret the data differently. However, the process of verifying the results obtained by qualitative data is not subject to interpretation, rather, it should be demonstrated how the data supports the proposed abstraction.

The second limitation comes from the bounding the problem. The definition of the type of elements and the type of experience do provide a reduced version of the problem. The process of the experience was defined as the user engaging with the game, ignoring other different aspects that can also influence the experience. The objective was to focus the study on those elements that defined the experience as of playing video games. The reasons behind selecting a video game might have an influence on the experience, although they are accounted for in the previous experience element of facilitator, but it is not the focus of the study. Social interactions and the mood of the player were not taken into consideration.

3. **Puppetry as a Metaphor for the Gaming Experience** Presented in Chapter 5 and reported in Calvillo-Gámez and Cairns (2008). Puppetry was used a metaphor to describe the experience because, as puppets are defined because of the way they are experienced rather that their physicality the same can be said about games. It is possible to recognise a game when we see one, but it is hard to describe them. There is also a shared sense of experience creation, the video game, just as the puppet, needs someone to manipulate it and someone else to bring it to life. In the case of the puppet these two functions are done by the puppet artist and the audience, in the case of the video game this is done by the player. This metaphor brings a succinct and clear description of the dual process needed to reach, if possible, a positive experience: control and life-giving, or in the terminology proposed, ownership.

The limitation is that bringing a concept from another field of study also brings most of its disadvantages. Puppets and puppetry bring to the reader an immediate ground which might overlook the details of the framework. Readers may infer puppets as metaphor of dolls with strings, expecting that the same would be said about video games, thus providing hard to understand why games like Tetris, where there are no anthropomorphic figures, exists puppetry.

4. **The CEGE Questionnaire to Assess the Gaming Experience** Presented in Chapter 6 and partially reported in Calvillo-Gámez et al. (2009a). This contribution was the first step towards the operationalisation of the concept of the experience. The questionnaire was formulated using psychometric framework. The questionnaire was found to be statistically valid and reliable. The full discussion of the formulation is currently being prepared as a journal paper.

   The limitations found here are again two fold. One is the philosophical and the validity of questionnaire to assess constructs; there is a long story on the debate within the sciences if questionnaire can indeed measure what it is supposed to measure. Psychometric framework suggests that it is possible to do so, but some research traditions do not consider this to be the case. Two, it is methodological. The questionnaire provided low reliability scores for two of the constructs. Although this can be improved by the design of another questionnaire that takes into account this problem. The low scales were overcome because the statistical analysis showed that the constructs did exists and have an influence on the overall gaming experience.

5. **The CEGE Model** Presented in Chapter 7 and partially reported in Calvillo-Gámez et al. (2009a). The model is an abstraction of the framework proposed. It isolates the different constructs of the framework and their relationships. It provides a clear reference to understand the elements. The model was validated using Structural Equation Modelling. The full discussion of the modelling is currently being prepared as a journal paper.

   The abstraction of a framework into a model provides an inherit series of limitations. It provides a something more manageable to work with, but it also obviates few of the relationships being studied. Besides the inherit limitations, there is also a limitation with the validating methodology. SEM is a somehow novel method that relies on sophisticated mathematics. The translation of those mathematics into concepts that help interpret the results is still in process. This is specifically true for the determining if a model is fit or not. Still, with its limitations, SEM provides a valuable tool to assess relationships among constructs not

found in other methods. Also, further refinement of the model might provide a better fit, but this could be better done when a new questionnaire is formulated.

6. **Examples of the CEGE model in the real world** Presented in Chapter 8 and partially reported in Calvillo-Gámez et al. (2009a). In this Chapter it is shown that the framework can be used to objectively study gaming experiences. Further more, it is possible to show, and explain, the differences among similar gaming experiences.

   There are two limitations here. One is that the framework is new and it would require further study as its own in order to provide a convincing argument for those who have not seen its formulation. Two, assessing experience under controlled conditions might go against the very idea of experience. Games are usually played because the individual wants to do it, in this case, games were played because individuals were told to do so. Although participants were free to register to participate, and there are many more experiments in UCL from which they are able to choose, they register either because they had credits to complete, do a personal favour, or earn extra cash. However, this is hard to overcome, as even *in-situ* experiments would require participants to leave their reality in order to join an experimental one.

9.6 Discussion

The objective study of user experience provides a better understanding for a domain that it is usually considered as subjective. In a general sense, this allows to define the boundaries of knowledge, and to push them further apart as a better understanding of the concept is acquired. The research pursued in this thesis shows that it is possible to assess the user experience of playing video games. The CEGE framework provides an understanding of a set of elements that form the experience. The framework is not centred on the outcome of the user, but on the interaction between user and game. It does not try to understand how the user reacts to playing games, but at the elements that have to be present to provide a reaction on the user.

The different contributions of the thesis have been presented above, the objective of this section is to encapsulate the different results in a discussion and on possible implications of the results obtained. This discussion is divided in three parts, the overall method of the thesis, and the implications to HCI and the implications to the video game domain.

Methodologically, the thesis was enriched by the use of a multi-method approach; each of the different methods has their strengths and weakness, which were outlined above. The general method followed tried not to only obtain an account of what is the experience of playing video games, but also an assessable framework. Towards this

end, the thesis explored the use of Structural Equation Modelling as a technique to corroborate a framework obtained using the grounded theory method. The subject of validity regarding grounded theory is constantly raised in HCI; the use of this modelling technique can provide insight into such validity. Qualitative methods are usually performed on a small population, making it hard to some people to accept the fact that they result account for a wider population; the quantitative approach on which the modelling technique is based can overcome this issue.

In relation to the HCI domain, the results of thesis show that it is possible to study objectively the concept of user experience. Dividing experience is a two fold phenomenon allowed to focus on the interaction between user and application. The process of the experience, for video games, is divided in terms of how the participant perceives and interacts with the application to perform a task. The framework was corroborated using a model. This model, although intrinsic to the characteristics of video games, can provide insight into the further understanding of the wider user experience. The framework and the model provide a different perspective on experience, in particular from the one advocated by McCarthy and Wright. Rather than only looking at the felt experience, this framework tries to understand the particular elements that build the interaction of a user with technology.

The issue of generalisability of the obtained results depends on the methodological approach followed to study the concept of user experience while playing video games. The results obtained suggest that it is possible to study the concept of user experience under a critical rationalism approach. In order to formulate a valid theoretical framework to study the user experience a series of studies had to be conducted that permitted the corroboration of the proposed framework. Once the framework was corroborated, it was shown that it was possible to use it in an experimental setting. The results obtained from the experiments of Chapter 8 show how to use the proposed framework and the formulated instrument. The theoretical framework was formulated using a wide selection of video games, those found in the reviews from magazines, websites and the experiences of those participants interviewed. It was validated also using a wide selection of video games, as participants were free to play any video game before completing the survey. The experiments performed in chapters 4 and 8 used a smaller subset of video games, mainly GuitarHero and Tetris, as the objective of the experiments was to understand a specific type of experience under a specific set of manipulations, the change in controllers. However, the validity of the results should hold to explain a wider set of gaming experiences, as it was formulated from a wide and representative set of games.

The definition of user experience proposed, specially the argument about process, may have resonance with Activity Framework (AT)(Kaptelinin and Nardi, 2006); origi-

nally proposed by Leontiev. The idea that the individual interacts with a task through a tool is similar to the ethos of AT. AT defines activity as any interaction between a subject with the world, where the activity has precedence over the subject and the object. AT imposes a series of regulations on the activity, such as defining activity as hierarchical structure, humans as objected oriented beings to mention some. All these may make the framework cumbersome to follow (Rogers, 2004). Both approaches are similar in essence, describing the use of a tool as a mediated the interaction between individual and world, but are implemented differently. The approach presented here, does not try to limit what constitutes an interaction of the individual with the environment. The actual use of the approach produced a hierarchical structure of elements, but unlike AT, the elements were selected organically as part of the interaction process, not because they had to fit within an established structure.

For the video game domain, the research here presented introduces a framework and a tool that helps in the evaluation of user experiences. It also introduces the use of the metaphor puppetry to describe the experience. The framework showed to be useful to understand the way in which input devices influence the experience, and that any changes produced by them can be studied. The framework also provided a description of the needed elements to achieve a positive experience. The framework it is new as it does not look directly at the player or for explanations to extreme experiences. Rather, it just tries to describe what it is needed to achieve a prosaic positive experience.

9.7 Future Work

I enumerate three types of future work that can be performed based on this research. One is using the same methodological approach to understand experience in other domains. Two is to explore the CEGE framework in relation with other experience theories. Three is to further the understanding of the different elements that form CEGE.

Using the method here proposed can provide a better understanding of different types of user experiences. The notion that user experience is both process and outcome can be used, but also the approach of using a grounded theory method followed by a modelling technique in order to provide an objective account of the interaction process for a wider population. Also, the design of applications can benefit from the elements that form the process; currently designers already use qualitative methods to understand the user and the task, but the use of the quantitative method can expand those findings.

Other theories to understand experience in video games can be enriched from the insight provided by the CEGE framework. The understanding that CEGE provides of the positive prosaic experience should be provide a better understanding of how users

can reach a state of immersion or Flow when interacting with the game. That is, if the core elements are more intense in extreme experiences, or if they are used as stepping stone of other elements. It can also help in providing a better understanding of why players get addicted to video games, and if the characteristics present in a positive experience are comparable to other elements. Lastly, the social aspect of video games was not accounted in this research. In games, the social aspect is important as it helps in the culture forming process, thus it is also part of the experience. Some players may engage with games because they want to play, some others may just want to hang out with their friends. The CEGE framework can be used to provide this type of insight.

The last category of future work proposes to investigate the elements that form the framework individually and deeper. In this thesis there was not access to manipulate the video game directly. All games were taken off-the-shelf; mainly successful ones. Being able to manipulate the video game, it would be possible to explore in more detail the roles of the environment or game play. It would also be possible to have a direct effect on parts of the facilitators, aesthetics, or of ownership, such as rewards and personal goals. Also, the experiments performed in this thesis were used to test the framework, not necessarily to gain further information of the different elements such as control and ownership. Also, the relation between small-actions and big-actions might be better understood under the scope of epistemic actions (Kirsh and Maglio, 1994). Epistemic actions describe those actions that are made by humans without thinking about them. They have been widely studied in cognitive science, and further research in this area can help to understand how the input device can influence the strategy implemented in a game. That is, some small-actions might have epistemic properties, thus making them more appropriate for games in which strategy have to be developed fast.

9.8 Conclusion

To conclude, this research presented a framework to understand the experience of playing video games. The framework identifies a series of elements that work with each in other in order to build an experience, a negative experience if the elements are missing, and probably a positive one if they are present. These elements identify the perception and the interaction of the user with the video game. The framework identifies that in order for players to have a positive experience, they need to own the game. In order to own the game control and a series of facilitators are also present. But it is with ownership, when the player applies strategies, personal goals, lives a different life and receives rewards from the game, that the player gets closer to a positive experience. It is at this point that the metaphor of puppetry provides a good explanation to the experience of playing video games. The player needs to learn to

control the puppet, but then, the puppet has to be part of the play and become and character. The research was motivated by idea of objective knowledge. The results here presented show that user experience is not only a personal matter, but that also can be objectively studied. User experience of interacting with a task via an application is both a process and an outcome.

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The Stories of the Old Man

I remember the stories of the old man, “It was a different time back then, life was easier, and we had fun, oh yes, we had fun more easily… not like today, with all the gadgets that you kids have”.

The stories were always around the same topic, life now sucks… How much the old man longed for his days, the good ol’ days.

In those days, he would claim, he was able to gather people, especially kids, to sit around to engage with the spectacle. They would hold still, and as the environment developed in front of their eyes, they would little-by-little believe they were part of the world they were entering. One day they could be in space, the next in a fantasy world. Imagination, and a little bit of skill, were the only limits. Everything else was allowed. The old man would ramble for hours without end about the quality of the environment, the realistic sounds, the liveliness of the trees, the horse tapping in front of you, everything, everything was so inviting that the audience had to surrender, suspend their disbelief, and be where the old man wanted them to be.

But it was not always that easy, ”the environment was the first step, but not all of them came because of it, they did because they knew they would be in control, they would be in control by bringing life to something that is otherwise more than dead, that it is just inanimate”. But bringing the inanimate to life required a process. There would be rules, plenty of rules, to keep the audience on their toes. Sometimes they would know the rules beforehand, at others they would discover them little by little. Then, after the rules, there was some cheesy scenario, just cooked up quickly, something that would just bring the right type of people. Sometimes it would be the blue prince on quest to save the princess, sometimes a bunch of elves working in teams to escape from a horrible tyrant, sometimes it was just abstract.

Those elements, well combined, formed the recipe for hours and hours of entertainment. ”They were here, with us in the real world, but as soon as they saw the environment and began to grasp the rules, they were no longer with us. Not that they would disappear, they would be here, but their imagination had taken them into the

world, not to be a part of it, like a tree, or someone just watching. They were the ones in charge". The eyes of the old man would brighten every time he reached this part of the story. The audience gave life, and they were also the ones in charge.

They knew it, as apparently those things were common on those days, that they would need to learn the small actions in order to gather control. They would have to memorise them, enough to survive, and they would have to memorise the means by which they performed these actions. "Some times, the audience would get very confused, especially older people, the concept was just alien. How come that moving one finger made it jump or rotate? The answer to the question was sometimes never understood". They also needed to get used to the point of view they were watching from. It could be from above, sometimes it was from below, regardless, they would always need time to adjust. Then, well, then they needed something to do, a goal, an objective, and enough details to keep them occupied while time was flying by.

I have always been amazed by the story of the old man. Every time I asked him how long it lasted for, his answer was always the same "there is no concept of time when you are saving the world! Rescuing your loved one, becoming your hero". Of course, you would only go to those that you knew you had time for. Some of them last days, months, and years. While others lasted for only minutes. Sometimes you did not even like it, but you had been there before and wanted to try it again.... Some times it was just the environment the one luring you. He would be impatient when I asked these questions, he wanted to focus, he wanted to tell me how the audience became the life giver.

Control is just the beginning. Once you know how to move it, you need to make it work in your favour. And believe, it will. You'll learn that those jumps and rotations meant you were able to escape from a dragon. It meant escaping the dragon would provide you with a new sword, a new love, a new goal. Sometimes it would just give you the pleasure to create your own missions, forgetting what you were told and using your knowledge just for your own goals.

I would be confused, "you had to do it to understand it. You gave life, and suddenly, you were the one in there, living the actions, calling the shots", he would say to try to clarify it. His logic was simple, I needed to grasp control to give it life, and then, it was mine. I was the owner, it was the path to enjoyment.

Most times, the old man would say again, the audience was only one. One audience member that eventually becomes the one in control by manipulating puppets made out of pixels, a magic material that makes dreams come to life - capable of taking any form or sound. One controller making the experience personal. One audience member being the hero and enjoying it all. That was, he always said, the experience of playing video-games. That was the puppetry of the video-game.

The old man, always remembering the days when he was a video-game designer.

Forms Used in the Experiments for Chapter 4

B.1 Consent Form for All Experiments

Title of Study: "Videogames with different input devices"

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected.

I agree to take part in the above study.

I understand that my identity will be kept strictly confidential and any report of the study will not identify me personally.

Participant's name	Signature	Date
Researcher	Signature	Date

B.2 Survey for Tetris Experiment

Date: _____

Please mark as appropriate

Gender: Male Female

Age: 18-25

26-35

36-45

46–

Previous Experience with Tetris :

Never played before

Novice

Medium

Expert

Score obtained playing with keyboard:

Score obtained playing with knob:

B.3 Survey for GuitarHero Experiment

Date: _____

Please mark as appropriate

Gender: Male Female

Age:

Previous Experience with GuitarHero :

Never played before

Novice

Medium

Expert

Appendix C

Pool of Questions

	Question		Constituent	Concept	Element
1	The graphics were appropriate for the type of game	+	Graphics		Environment
2	The graphics were not appropriate for the type of game	-	Graphics		Environment
3	I liked the music of the game	+	Sound		Environment
4	I did not like the music of the game	-	Sound		Environment
5	The sound of the game was appropriate	+	Sound		Environment
6	The graphics of the game were related to the story	+	Sound		Environment
7	The graphics and sound of the game were related	+	General Environment		Environment
8	The sound of the game affected the way I was playing	+	Sound		Environment
9	The sound of the responded to what I was doing in the game	-	Sound		Environment
10	The sound of the game was not appropriate	-	Sound		Environment
11	The game was fair	+	Rules		Gameplay
12	The game was unfair	-	Rules		Gameplay
13	I understood the rules of the game	+	Rules		Gameplay
14	I did not know the rules of the game	-	Rules		Gameplay
15	I understood the basic rules to keep the game going	+	Rules		Gameplay
16	The rules of the game seemed random	-	Rules		Gameplay
17	The game was challenging	+	Rules		Gameplay
18	I did not like the story of the game	-	Story		Gameplay
19	The story of the game was boring	-	Story		Gameplay
20	The I liked the story of the game	+	Story		Gameplay
21	The story of the game was interesting	+	Story		Gameplay
22	The game was too difficult	-	Rules		Gameplay
23	I enjoyed playing this game	+	Enjoyment		General GXP
24	I was frustrated at the end of the game	-	Frustration		General GXP
25	I feel happy that I played the game	+	Enjoyment		General GXP
26	I did not enjoyed playing this game	-	Enjoyment		General GXP
27	I was frustrated whilst playing the game	+	Frustration		General GXP
28	I liked the game	+	Enjoyment		General GXP
29	I did not like the game	-	Enjoyment		General GXP
30	I would play this game again	+	Enjoyment		General GXP
31	I would play this type of game again	+	Enjoyment		General GXP
32	I improved as a player as the game progressed	+	General Puppetry		Puppetry
33	I did not improved as player as the game progressed	-	General Puppetry		Puppetry
34	I knew how to manipulate the character to win the game	+	General Puppetry		Puppetry
35	I did not know how to manipulate the character to win the game	-	General Puppetry		Puppetry
36	I was in control of the game	+	General Control	Control	Puppetry
37	I was not in control of the game	-	General Control	Control	Puppetry
38	I was in control of the characters of the game	+	General Control	Control	Puppetry
39	I was not in control of characters of the game	-	General Control	Control	Puppetry
40	The characters of the game moved as I expected	+	General Control	Control	Puppetry
41	I was frustrated with the controls of the game	-	General Control	Control	Puppetry

	Question		Constituent	Concept	Element
42	The controllers responded as I expected	+	Controllers	Control	Puppetry
43	The controllers did not responded as I expected	-	Controllers	Control	Puppetry
44	The controllers were comfortable to use	+	Controllers	Control	Puppetry
45	The controllers were not comfortable to use	-	Controllers	Control	Puppetry
46	I was familiar with this type of controllers	+	Controllers	Control	Puppetry
47	It was the first time I used this type of controllers	-	Controllers	Control	Puppetry
48	I remembered all the actions that I could perform in the game with the controller	+	Memory	Control	Puppetry
49	I did not remembered all the actions that I could perform in the game with the controller	-	Memory	Control	Puppetry
50	I remember the functionality of each button of the controllers	+	Memory	Control	Puppetry
51	I did not remember the functionality of each button of the controllers	-	Memory	Control	Puppetry
52	I had to look at the manual constantly to verify the functionality of the controllers	-	Memory	Control	Puppetry
53	I pressed the wrong button when I was playing quite often	-	Memory	Control	Puppetry
54	I was able to see in the screen everything I needed during the game	+	Point of View	Control	Puppetry
55	I was not able to see everything in the screen I needed during the game	-	Point of View	Control	Puppetry
56	The point of view of the game that I had spoiled my gaming	-	Point of View	Control	Puppetry
57	The point of view of the game that I had favoured my gaming	+	Point of View	Control	Puppetry
58	The obstacles of the game started appeared on the game before they appeared on the screen	-	Point of View	Control	Puppetry
59	The obstacles of the game started appeared on the game at the same time as they appeared on the screen	+	Point of View	Control	Puppetry
60	I knew what I was supposed to do to win the game	+	Goal	Control	Puppetry
61	I did not know what I was supposed to do to win the game	-	Goal	Control	Puppetry
62	I knew all the actions that the character could perform in the game	+	Small Actions	Control	Puppetry
63	I did not know all the actions that the character could perform in the game	-	Small Actions	Control	Puppetry
64	I was constantly doing something in the game	+	Something to do	Control	Puppetry
65	There was time when I was doing nothing in the game	-	Something to do	Control	Puppetry
66	The game kept me always doing things	+	Something to do	Control	Puppetry
67	The game kept me waiting for something to happen for long periods	-	Something to do	Control	Puppetry
68	I liked the graphics of the game	+	Aesthetic Value	Facilitator	Puppetry
69	I did not like the graphics of the game	-	Aesthetic Value	Facilitator	Puppetry
70	The graphics of the game were appealing	+	Aesthetic Value	Facilitator	Puppetry
71	The graphics of the game were plain	-	Aesthetic Value	Facilitator	Puppetry
72	The game looked good	+	Aesthetic Value	Facilitator	Puppetry
73	The game looked bad	-	Aesthetic Value	Facilitator	Puppetry
74	I like this type of game	+	Previous Experience	Facilitator	Puppetry
75	I did not like this type of game	-	Previous Experience	Facilitator	Puppetry
76	I was looking forward for playing this game	+	Previous Experience	Facilitator	Puppetry
77	I read/heard about this game before I played	+	Previous Experience	Facilitator	Puppetry
78	I usually do not choose this type of game	-	Previous Experience	Facilitator	Puppetry
79	I usually choose this type of game	+	Previous Experience	Facilitator	Puppetry
80	I had enough time to play the game	+	Time	Facilitator	Puppetry
81	I need a lot of time to win this game	-	Time	Facilitator	Puppetry
82	I played for too long	-	Time	Facilitator	Puppetry
83	I would like to play longer	+	Time	Facilitator	Puppetry
84	I like to spend a lot of time playing this game	+	Time	Facilitator	Puppetry
85	I lose on purpose to stop playing	-	Time	Facilitator	Puppetry
86	I had a strategy to win the game	+	Big Actions	Ownership	Puppetry
87	I was progressing in the game	+	Big Actions	Ownership	Puppetry
88	I did not had a strategy to win the game	-	Big Actions	Ownership	Puppetry
89	I was not progressing in the game	-	Big Actions	Ownership	Puppetry
90	I did not know how to make the character of the game win	-	Big Actions	Ownership	Puppetry
91	I knew how to make the character of the game win	+	Big Actions	Ownership	Puppetry
92	I received rewards as I progressed during the game	+	Rewards	Ownership	Puppetry

	Question		Constituent	Concept	Element
93	I did not received rewards as I progressed during the game	-	Rewards	Ownership	Puppetry
94	The only reward I received was when I finished the game	-	Rewards	Ownership	Puppetry
95	The game did not motivated me to keep playing	-	Rewards	Ownership	Puppetry
96	The game kept constantly motivating me to keep playing	+	Rewards	Ownership	Puppetry
97	I received rewards as I moved forward in the game	+	Rewards	Ownership	Puppetry
98	I felt responsible for what I did in the game	+	General Ownership	Ownership	Puppetry
99	I did not feel responsible for what I did in the game	-	General Ownership	Ownership	Puppetry
100	I felt the game as mine	+	General Ownership	Ownership	Puppetry
101	I did not feel the game as mine	-	General Ownership	Ownership	Puppetry
102	I was responsible of the outcome of the game	+	General Ownership	Ownership	Puppetry
103	I was not responsible of the outcome of the game	-	General Ownership	Ownership	Puppetry
104	I had a personal goal while playing this game	+	Personal goals	Ownership	Puppetry
105	I enjoyed completing my personal goals	+	Personal goals	Ownership	Puppetry
106	I was more interested in my personal goals than the game's goals	+	Personal goals	Ownership	Puppetry
107	I did not had a personal goal while playing this game	-	Personal goals	Ownership	Puppetry
108	I did not enjoyed completing my personal goals	-	Personal goals	Ownership	Puppetry
109	I was more interested in the game's goals than my personal goals	-	Personal goals	Ownership	Puppetry
110	I did things that were not necessary to win the game	+	Rewards	Ownership	Puppetry
111	I enjoyed doing things that were not necessary to win the game	+	Rewards	Ownership	Puppetry
112	I only did what was required to win the game	-	Rewards	Ownership	Puppetry
113	I did not enjoy doing things that are necessary to win the game	-	Rewards	Ownership	Puppetry
114	I did not care about the goal of the game	+	Rewards	Ownership	Puppetry
115	I played with my own rules not the rules of the game	+	Rewards	Ownership	Puppetry
116	I felt guilty for the actions the main characters in the game did	+	You but not you	Ownership	Puppetry
117	I dont usually do in the real world what the characters in the game does	-	You but not you	Ownership	Puppetry
118	The main character in the game improved as the game progressed	+	You but not you	Ownership	Puppetry
119	I did not feel guilty for the actions the main characters in the game did	-	You but not you	Ownership	Puppetry
120	I usually do in the real world what the characters in the game does	+	You but not you	Ownership	Puppetry
121	The main character in the game stayed the same as the game progressed	-	You but not you	Ownership	Puppetry

First Draft of the Questionnaire

Please rate the following statements by marking the number that best reflects your experience.

1. I enjoyed playing this videogame
2. I was in control of the game
3. The controllers responded as I expected
4. I was able to see everything I needed during the game
5. I knew all the actions I could perform in the game
6. I remembered all the actions that I could perform in the game.
7. I knew what I was supposed to do to win the game
8. I understood the rules of the game
9. The game was fair
10. I was constantly doing something in the game
11. I had enough time to play the game
12. I need a lot of time to win this game
13. I played for too long
14. I liked the graphics of the game
15. The graphics were appropriate for the type of game
16. I like this type of game
17. I have played this type of game
18. I felt responsible for what I did in the game

19. I had a strategy to win the game
20. I did things that were not necessary to win the game
21. I enjoyed doing things that were not necessary to win the game
22. I was progressing in the game
23. I received rewards as I progressed during the game
24. I felt guilty for the actions the main character in the game did
25. I don't usually do in the real world what the character in the game does
26. I had a personal goal while playing this game
27. I enjoyed completing my personal goals
28. I was more interested in my personal goals than the game's goals.
29. The main character in the game improved as the game progressed
30. I improved as the game progressed
31. I was frustrated playing the game
32. I would like to play longer
33. I was frustrated with the controls of the game
34. I liked the game
35. The game was challenging
36. The game was too difficult
37. I would play this game again
38. I would play this type of game again

The Core Elements of the Gaming Experience Questionnaire (CEGEQ)

Overview: This questionnaire is used to assess the core elements of the gaming experience. Each item is rated with a 7-point Likert scale. The questionnaire is to be administered after the participant has finished playing with the game.

Scales: There are eight scales in the questionnaire: CEGE, Video-Game, Puppetry, Game-Play, Environment, Control, Ownership and Facilitators. Items

Reliability: The Cronbach alpha for the whole questionnaire is 0.794 and for CEGE is 0.803.

Instructions: Please read the following statements and answer by marking one of the numbers that best describes your experience.

1. I enjoyed playing the game
2. I was frustrated at the end of the game
3. I was frustrated whilst playing the game
4. I liked the game
5. I would play this game again
6. I was in control of the game
7. The controllers responded as I expected
8. I remember the actions the controllers performed
9. I was able to see in the screen everything I needed during the game
10. * The point of view of the game that I had spoiled my gaming
11. I knew what I was supposed to do to win the game
12. * There was time when I was doing nothing in the game

13. I liked the way the game looked
14. The graphics of the game were plain
15. * I do not like this type of game
16. I like to spend a lot of time playing this game
17. I got bored playing this time
18. * I usually do not choose this type of game
19. * I did not have a strategy to win the game
20. The game kept constantly motivating me to keep playing
21. I felt what was happening in the game was my own doing
22. I challenged myself even if the game did not require it
23. I played with my own rules
24. * I felt guilty for the actions in the game
25. I knew how to manipulate the game to move forward
26. The graphics were appropriate for the type of game
27. The sound effects of the game were appropriate
28. * I did not like the music of the game
29. The graphics of the game were related to the scenario
30. The graphics and sound effects of the game were related
31. The sound of the game affected the way I was playing
32. The game was unfair*
33. I understood the rules of the game
34. The game was challenging
35. The game was difficult
36. The scenario of the game was interesting
37. * I did not like the scenario of the game
38. I knew all the actions that could be performed in the game

* Denotes items that are negatively worded.

Appendix F

Scores Obtained from CEGEQ

The questionnaire designed in Chapter 6 was completed by 598 participants. The results obtained are presented in Tables F.1 to F.4. The scores are divided by gender and age of the participants, as well as the platform used and the time played. Table F.1 also shows the total scores obtained from the questionnaire.

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Table F.1: Scores by Gender and total scores

Gender		Frustration	Enjoyment	CEGE	Puppetry	Control	Facilitator	Ownership	Video-Game	Game-play	Environment
	Mean	0.452	0.921	0.798	0.790	0.829	0.719	0.810	0.814	0.808	0.820
	Std. Dev.	0.223	0.111	0.083	0.091	0.117	0.116	0.127	0.097	0.106	0.124
Male	Min.	0.143	0.143	0.349	0.357	0.286	0.357	0.143	0.333	0.286	0.314
	Max.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Median	0.429	0.952	0.809	0.800	0.837	0.714	0.833	0.821	0.810	0.833
	Mean	0.417	0.908	0.786	0.767	0.813	0.672	0.803	0.818	0.803	0.835
	Std. Dev.	0.204	0.148	0.090	0.099	0.114	0.123	0.162	0.096	0.111	0.115
Female	Min.	0.143	0.238	0.472	0.375	0.452	0.357	0.143	0.440	0.381	0.429
	Max.	0.857	1.000	0.937	0.957	1.000	0.976	1.000	0.988	0.976	1.000
	Median	0.429	0.952	0.799	0.779	0.833	0.690	0.833	0.833	0.810	0.857
	Mean	0.445	0.918	0.795	0.785	0.825	0.708	0.809	0.815	0.807	0.824
	Std. Dev.	0.219	0.120	0.085	0.093	0.116	0.119	0.136	0.097	0.107	0.122
Total	Min.	0.143	0.143	0.349	0.357	0.286	0.357	0.143	0.333	0.286	0.314
	Max.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Median	0.429	0.952	0.808	0.800	0.837	0.714	0.833	0.821	0.810	0.833

Table F.2: Scores by Age

Age		Frustration	Enjoyment	CEGE	Puppetry	Control	Facilitator	Ownership	Video-Game	Game-play	Environment
	Mean	0.393	0.839	0.728	0.709	0.784	0.701	0.645	0.763	0.769	0.779
	Std. Dev.	0.190	0.222	0.119	0.126	0.151	0.182	0.223	0.108	0.111	0.119
-18	Min.	0.143	0.429	0.524	0.514	0.571	0.429	0.286	0.571	0.643	0.571
	Max.	0.714	1.000	0.844	0.836	1.000	1.000	0.976	0.881	0.905	0.905
	Median	0.393	0.976	0.776	0.757	0.765	0.674	0.686	0.792	0.786	0.831
	Mean	0.457	0.923	0.794	0.788	0.826	0.720	0.808	0.804	0.797	0.811
	Std. Dev.	0.232	0.115	0.090	0.097	0.119	0.121	0.129	0.098	0.110	0.125
18-21	Min.	0.143	0.143	0.349	0.357	0.286	0.357	0.143	0.333	0.286	0.381
	Max.	1.000	1.000	0.964	0.979	1.000	1.000	1.000	1.000	1.000	1.000
	Median	0.429	0.952	0.808	0.800	0.837	0.714	0.833	0.810	0.810	0.810
	Mean	0.423	0.917	0.803	0.796	0.842	0.710	0.820	0.816	0.812	0.823
	Std. Dev.	0.214	0.130	0.085	0.092	0.098	0.124	0.140	0.100	0.114	0.118
21-25	Min.	0.143	0.190	0.478	0.500	0.592	0.393	0.143	0.403	0.371	0.429
	Max.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Median	0.429	0.952	0.808	0.807	0.857	0.714	0.857	0.833	0.810	0.833
	Mean	0.446	0.925	0.796	0.777	0.814	0.698	0.808	0.829	0.813	0.846
	Std. Dev.	0.211	0.085	0.066	0.077	0.117	0.107	0.121	0.084	0.091	0.113
26-31	Min.	0.143	0.667	0.558	0.471	0.486	0.405	0.381	0.631	0.571	0.464
	Max.	1.000	1.000	0.929	0.933	1.000	0.952	1.000	1.000	1.000	1.000
	Median	0.429	0.952	0.808	0.786	0.837	0.714	0.810	0.833	0.810	0.857

Table F.2: Scores by Age

Age		Frustration	Enjoyment	CEGE	Puppetry	Control	Facilitator	Ownership	Video-Game	Game-play	Environment
	Mean	0.445	0.906	0.790	0.763	0.791	0.692	0.801	0.834	0.836	0.829
	Std. Dev.	0.197	0.105	0.093	0.094	0.136	0.113	0.141	0.108	0.104	0.143
32-36	Min.	0.143	0.667	0.424	0.443	0.452	0.452	0.310	0.390	0.452	0.314
	Max.	0.786	1.000	0.946	0.914	1.000	0.929	1.000	1.000	1.000	1.000
	Median	0.429	0.905	0.789	0.771	0.813	0.714	0.810	0.833	0.833	0.833
	Mean	0.546	0.952	0.800	0.788	0.843	0.692	0.809	0.819	0.798	0.838
	Std. Dev.	0.216	0.091	0.062	0.082	0.121	0.107	0.125	0.073	0.080	0.106
37-41	Min.	0.286	0.667	0.647	0.550	0.571	0.429	0.571	0.655	0.667	0.571
	Max.	1.000	1.000	0.922	0.971	1.000	0.929	1.000	0.929	0.952	1.000
	Median	0.500	1.000	0.807	0.800	0.867	0.690	0.774	0.838	0.810	0.845
	Mean	0.262	0.905	0.819	0.798	0.858	0.611	0.921	0.853	0.810	0.897
	Std. Dev.	0.109	0.095	0.042	0.042	0.132	0.122	0.084	0.048	0.095	0.050
42-51	Min.	0.143	0.810	0.774	0.759	0.738	0.476	0.833	0.798	0.714	0.857
	Max.	0.357	1.000	0.857	0.843	1.000	0.714	1.000	0.881	0.905	0.952
	Median	0.286	0.905	0.826	0.793	0.837	0.643	0.929	0.881	0.810	0.881
	Mean	0.452	0.476	0.608	0.592	0.630	0.576	0.583	0.641	0.619	0.667
	Std. Dev.	0.352	0.252	0.131	0.154	0.143	0.164	0.168	0.125	0.048	0.218
52-	Min.	0.214	0.286	0.509	0.493	0.486	0.452	0.405	0.500	0.571	0.429
	Max.	0.857	0.762	0.757	0.770	0.771	0.762	0.738	0.738	0.667	0.857

Table F.2: Scores by Age

Age		Frustration	Enjoyment	CEGE	Puppetry	Control	Facilitator	Ownership	Video-Game	Game-play	Environment
	Median	0.286	0.381	0.557	0.514	0.633	0.514	0.607	0.686	0.619	0.714

Table F.3: Scores by Type of Console

Type		Frustration	Enjoyment	CEGE	Puppetry	Control	Facilitator	Ownership	Video-Game	Game-play	Environment
	Mean	0.463	0.925	0.804	0.790	0.822	0.708	0.830	0.827	0.815	0.837
	Std. Dev.	0.221	0.103	0.080	0.093	0.114	0.125	0.121	0.089	0.100	0.109
Console	Min.	0.143	0.476	0.558	0.471	0.490	0.357	0.381	0.500	0.486	0.381
	Max.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Median	0.429	0.952	0.813	0.800	0.837	0.714	0.857	0.841	0.829	0.857
	Mean	0.357	0.830	0.686	0.683	0.770	0.641	0.617	0.694	0.722	0.696
	Std. Dev.	0.184	0.159	0.114	0.117	0.146	0.151	0.226	0.117	0.148	0.167
Mob. Phone	Min.	0.143	0.476	0.424	0.443	0.452	0.357	0.143	0.390	0.452	0.314
	Max.	0.643	1.000	0.830	0.821	0.959	0.881	0.905	0.845	0.952	0.929
	Median	0.286	0.881	0.723	0.732	0.796	0.679	0.679	0.726	0.750	0.726
	Mean	0.435	0.937	0.801	0.788	0.853	0.685	0.816	0.821	0.804	0.840
	Std. Dev.	0.211	0.082	0.073	0.077	0.096	0.101	0.132	0.096	0.103	0.125
Mob. Con.	Min.	0.143	0.714	0.594	0.549	0.619	0.405	0.457	0.612	0.571	0.464

Table F.3: Scores by Type of Console

Type		Frustration	Enjoyment	CEGE	Puppetry	Control	Facilitator	Ownership	Video-Game	Game-play	Environment
	Max.	0.857	1.000	0.924	0.905	1.000	0.914	1.000	0.988	0.976	1.000
	Median	0.429	0.952	0.813	0.807	0.857	0.690	0.810	0.821	0.810	0.857
	Mean	0.434	0.898	0.786	0.777	0.812	0.718	0.791	0.803	0.803	0.804
	Std. Dev.	0.211	0.147	0.091	0.095	0.116	0.118	0.142	0.107	0.112	0.136
PC	Min.	0.143	0.143	0.349	0.357	0.286	0.405	0.143	0.333	0.286	0.429
	Max.	1.000	1.000	0.964	0.957	1.000	1.000	1.000	1.000	1.000	1.000
	Median	0.429	0.952	0.795	0.786	0.837	0.714	0.810	0.821	0.810	0.810
	Mean	0.438	0.964	0.811	0.808	0.844	0.719	0.847	0.817	0.818	0.812
	Std. Dev.	0.212	0.080	0.059	0.061	0.115	0.079	0.078	0.080	0.095	0.108
PC w/I.D.	Min.	0.143	0.714	0.697	0.688	0.612	0.595	0.690	0.690	0.643	0.571
	Max.	0.786	1.000	0.893	0.893	1.000	0.857	0.976	0.940	0.952	0.952
	Median	0.429	1.000	0.826	0.829	0.857	0.714	0.857	0.821	0.833	0.800
	Mean	0.444	0.949	0.812	0.802	0.863	0.710	0.819	0.827	0.808	0.847
	Std. Dev.	0.254	0.068	0.058	0.072	0.111	0.106	0.103	0.071	0.090	0.090
Wii	Min.	0.143	0.714	0.676	0.595	0.486	0.476	0.548	0.655	0.619	0.595
	Max.	1.000	1.000	0.942	0.936	1.000	0.952	1.000	1.000	1.000	1.000
	Median	0.393	1.000	0.814	0.813	0.887	0.714	0.831	0.827	0.810	0.857

Table F.4: Scores by Time

Time		Frustration	Enjoyment	CEGE	Puppetry	Control	Facilitator	Ownership	Video-Game	Game-play	Environment
15m <	Mean	0.433	0.859	0.728	0.714	0.813	0.655	0.657	0.755	0.742	0.770
	Std. Dev.	0.235	0.168	0.120	0.136	0.146	0.135	0.189	0.115	0.140	0.145
	Min.	0.143	0.381	0.424	0.375	0.457	0.357	0.143	0.390	0.381	0.314
	Max.	0.929	1.000	0.893	0.921	1.000	0.881	0.929	1.000	1.000	1.000
	Median	0.393	0.905	0.752	0.738	0.833	0.667	0.702	0.756	0.767	0.771
15 - 30m	Mean	0.461	0.905	0.777	0.767	0.838	0.684	0.763	0.796	0.806	0.788
	Std. Dev.	0.215	0.139	0.084	0.089	0.117	0.121	0.142	0.104	0.110	0.135
	Min.	0.143	0.238	0.478	0.500	0.452	0.393	0.286	0.440	0.381	0.452
	Max.	0.929	1.000	0.964	0.943	1.000	0.976	1.000	1.000	1.000	1.000
	Median	0.500	0.952	0.779	0.771	0.857	0.690	0.762	0.798	0.810	0.810
30m - 1h	Mean	0.435	0.920	0.791	0.777	0.825	0.697	0.798	0.813	0.806	0.821
	Std. Dev.	0.223	0.099	0.077	0.088	0.120	0.118	0.120	0.087	0.097	0.115
	Min.	0.143	0.429	0.524	0.471	0.393	0.357	0.286	0.500	0.548	0.381
	Max.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Median	0.429	0.952	0.799	0.788	0.837	0.690	0.810	0.821	0.810	0.833
1 - 2h	Mean	0.434	0.933	0.810	0.799	0.828	0.711	0.850	0.830	0.818	0.842
	Std. Dev.	0.218	0.100	0.074	0.079	0.105	0.110	0.107	0.089	0.096	0.114
	Min.	0.143	0.286	0.509	0.514	0.486	0.429	0.457	0.500	0.486	0.429
	Max.	1.000	1.000	0.946	0.940	1.000	0.971	1.000	1.000	1.000	1.000
	Median	0.429	0.952	0.816	0.800	0.837	0.714	0.857	0.845	0.833	0.857

	Mean	0.492	0.925	0.802	0.792	0.815	0.728	0.819	0.818	0.797	0.839
	Std. Dev.	0.230	0.118	0.081	0.087	0.112	0.115	0.114	0.097	0.106	0.119
2 - 3h	Min.	0.143	0.190	0.544	0.550	0.500	0.357	0.500	0.403	0.371	0.429
	Max.	1.000	1.000	0.948	0.971	1.000	0.952	1.000	0.988	0.976	1.000
	Median	0.500	0.952	0.813	0.800	0.816	0.738	0.833	0.831	0.800	0.857
	Mean	0.412	0.911	0.819	0.814	0.818	0.761	0.854	0.831	0.830	0.834
	Std. Dev.	0.189	0.155	0.095	0.100	0.122	0.122	0.148	0.108	0.124	0.120
> 3h	Min.	0.143	0.143	0.349	0.357	0.286	0.476	0.143	0.333	0.286	0.429
	Max.	0.786	1.000	0.929	0.957	1.000	1.000	1.000	0.988	0.976	1.000
	Median	0.429	1.000	0.839	0.829	0.857	0.762	0.881	0.857	0.857	0.857

Forms for Chapter 8

G.1 Consent Form

Title of Study: "Videogames with different input devices"

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected.

I agree to take part in the above study.

I understand that my identity will be kept strictly confidential and any report of the study will not identify me personally.

Participant's name	Signature	Date
Researcher	Signature	Date

G.2 Forms for Tetris Experiment

G.2.1 Information Sheet

Hello and thank you for taking part in this experiment. The objective of the experiment is to understand how different input devices affect your experience of playing video-games. In this session, you will be playing Tetris with the keyboard and the PowerMate. You will be allowed to play for 15 minutes. The first five minutes are used to familiarise yourself with the game, if you are already familiar with it, please use the first five minutes as training.

The only objective of the session is for you to play. Please try to do so as if you were playing in your house, or any other place where you may engage in ludic activities. Try to forget that you are in a laboratory.

Before you start playing, you will be asked to complete a general questionnaire about your gaming habits. When you finish playing with each device, you will be asked to complete a questionnaire about your experience. All the collected data is going to be anonymous and might be published in research journals. If you want to learn the results of this experiment, please leave your email address with me.

Please feel free to ask any question you may have at any point. However, I might not be able to answer all of them. If for any reason you want to leave at any point during the session, please feel free to do so.

Thanks for participating,

Eduardo H. Calvillo Gámez

G.2.2 General Survey

Date: _____

Please mark as appropriated

Gender: Male Female

Age: 18-20

21-25

26-30

31-35

36-40

41-45

46-50

51–

Do you play video-games? Yes No

How often? -

Once a Month						Daily

Have you played Tetris before? Yes No

How often? -

Once a Month						Daily

How would you rate your abilities with Tetris? -

Bad						Good

Participant #:

G.3 Forms for Guitar Hero Experiment

G.3.1 Information Sheet

Hello and thank you for taking part in this experiment. The objective of the experiment is to understand how different input devices affect your experience of playing video-games. In this session, you will be playing either with the standard dual-shock controller from PS2 or with the Guitar that comes with GuitarHero. You will be allowed to play for 30 minutes. The first five minutes are used to familiarise yourself with the game, if you are already familiar with it, please use the first five minutes as training.

The only objective of the session is for you to play. Please try to do so as if you were playing in your house, or any other place where you may engage in ludic activities. Try to forget that you are in a laboratory.

Before you start playing, you will be asked to complete a general questionnaire about your gaming habits. At the end of the session, you will be ask to complete a questionnaire about your experience, it is quick to answer and do not take more than ten minutes in total. All the collected data is going to be anonymous and might be published in research journals. If you want to learn the results of this experiment, please leave your email address with me.

Please feel free to ask any question you may have at any point. However, I might not be able to answer all of them. If for any reason you want to leave at any point during the session, please feel free to do so.

Thanks for participating,

Eduardo H. Calvillo Gámez

G.3.2 General Survey

Date: _____

Please mark as appropriated

Gender: Male Female

Age: 18-20

21-25

26-30

31-35

36-40

41-45

46-50

51–

Do you play video-games? Yes No

How often? -

Once a Month						Daily

Have you played GuitarHero before? Yes No

How often? -

Once a Month						Daily

How would you rate your abilities with Tetris? -

Barely Com-plete a Song						Barely Miss a Note

In which level do you usually play? Easy Medium Hard Expert

Have you "finished" the game? Yes No

Participant #:

Group:

Appendix H

Screenshots from the Questionnaire

The questionnaire designed in Chapter 6 was completed by 598 participants. The questionnaire was deployed online using LimeSurvey, a PHP based application. In this appendix are included the screenshots of the questionnaire so that the reader can have the same view that the participants had when completing the survey.

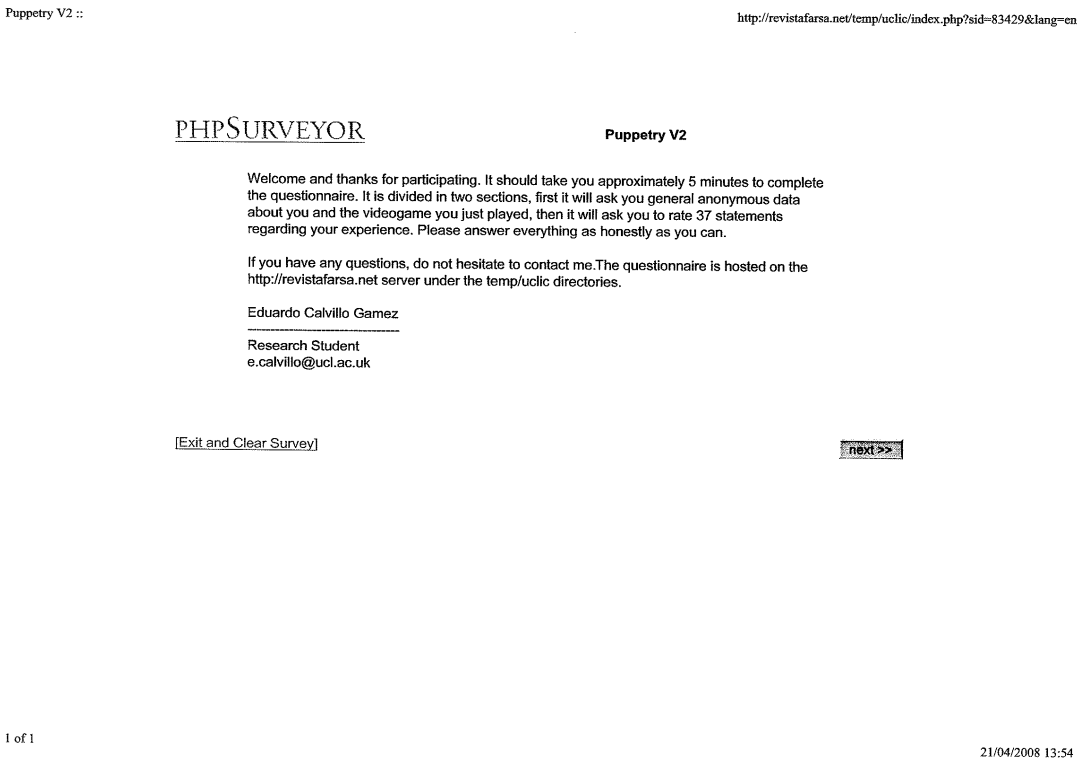

Figure H.1: Screenshot of the welcome page.

PHPSURVEYOR

Puppetry V2

0% 100%

General Data

This questionnaire will ask you about your experience of playing videogames, but before please answer the following general questions.

They are just for statistical purpouse and no data will relate back to you.

After you have finished answering, the next stage is to rate 38 statements regarding your experience of playing videogames.

*What game did you play in your latest playing session?

Which type of console did you use?

Choose one of the following answers

- O PC - Mouse/Keyboard
- O PC - Mouse/Keyboard + Other Input Devices
- O PS2, Xbox, Nintendo, PS3, etc
- O Mobile Phone
- O PSP, Nintendo DS, NGEAR, etc
- O Nintendo Wii

Figure H.2: Screenshot of the first set of general items.

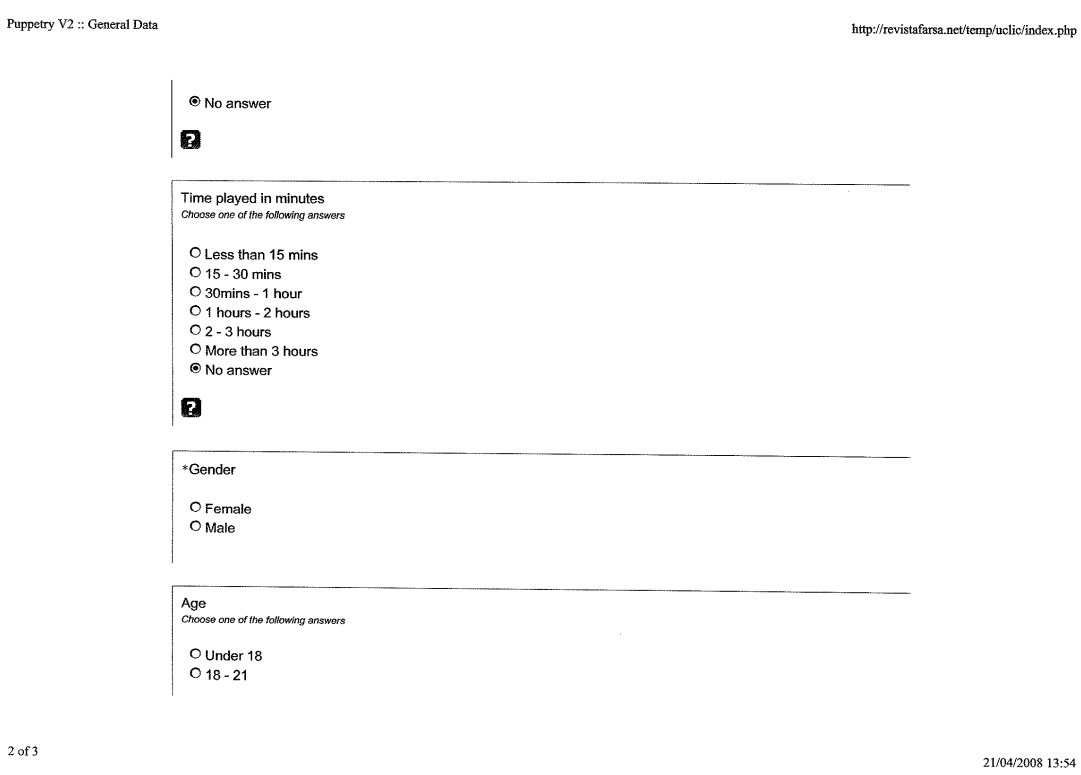

Figure H.3: Screenshot of the second set of general items.

Figure H.4: Screenshot of the third set of general items.

PHPSURVEYOR

Puppetry V2

0% 100%

The Experience of Playing Videogames

Please answer this question taking into consideration the game that you just played. Please as honest as you can.

Please rate the following expressions according to the experience that you just had.

	Strongly Disagree						Strongly Agree	No answer
I played with my own rules	○	○	○	○	○	○	○	◉
The scenario of the game was interesting	○	○	○	○	○	○	○	◉
I would play this game again	○	○	○	○	○	○	○	◉
I usually do in the real world the same type of activities as in the game	○	○	○	○	○	○	○	◉
I challenged myself even if the game did not require it	○	○	○	○	○	○	○	◉
I was frustrated at the end of the game	○	○	○	○	○	○	○	◉
I understood the rules of the game	○	○	○	○	○	○	○	◉
I knew how to manipulate the game to move forward	○	○	○	○	○	○	○	◉
I liked the way the game look	○	○	○	○	○	○	○	◉
The graphics and sound effects of the game were related	○	○	○	○	○	○	○	◉

Figure H.5: Screenshot of the first set of the CEGE items.

I was frustrated whilst playing the game	○	○	○	○	○	○	○	◉
The point of view of the game that I had spoiled my gaming	○	○	○	○	○	○	○	◉
The game was difficult	○	○	○	○	○	○	○	◉
I knew what I was supposed to do to win the game	○	○	○	○	○	○	○	◉
I did not have a strategy to win the game	○	○	○	○	○	○	○	◉
I remember the actions the controllers performed	○	○	○	○	○	○	○	◉
I felt guilty for the actions in the game	○	○	○	○	○	○	○	◉
The graphics of the game were related to the scenario	○	○	○	○	○	○	○	◉
I like to spend a lot of time playing this game	○	○	○	○	○	○	○	◉
I knew all the actions that could be performed in the game	○	○	○	○	○	○	○	◉
The controllers responded as I expected	○	○	○	○	○	○	○	◉
The game was unfair	○	○	○	○	○	○	○	◉
I got bored playing this time	○	○	○	○	○	○	○	◉
The graphics were appropriate for the type of game	○	○	○	○	○	○	○	◉
The graphics of the game were plain	○	○	○	○	○	○	○	◉
	Strongly Disagree						Strongly Agree	No answer

Figure H.6: Screenshot of the second set of the CEGE items.

The game kept constantly motivating me to keep playing	○	○	○	○	○	○	○	◉
I was able to see in the screen everything I needed during the game	○	○	○	○	○	○	○	◉
There was time when I was doing nothing in the game	○	○	○	○	○	○	○	◉
I did not like the music of the game	○	○	○	○	○	○	○	◉
The sound effects of the game were appropriate	○	○	○	○	○	○	○	◉
The sound of the game affected the way I was playing	○	○	○	○	○	○	○	◉
I do not like this type of game	○	○	○	○	○	○	○	◉
I enjoyed playing the game	○	○	○	○	○	○	○	◉
I felt that what was happening in the game was my own doing	○	○	○	○	○	○	○	◉
I was in control of the game	○	○	○	○	○	○	○	◉
The game was challenging	○	○	○	○	○	○	○	◉
I did not like the scenario of the game	○	○	○	○	○	○	○	◉
I liked the game	○	○	○	○	○	○	○	◉
I usually do not choose this type of game	○	○	○	○	○	○	○	◉

Figure H.7: Screenshot of the third set of the CEGE items.