Playing with Computer Games:
An Exploration of Computer Game Simulations and Learning

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1. Abstract

This paper is focused on computer games as learning environments. Specifically, it is concerned with those games that are called or can be categorized as simulations. The study considers the literature on simulations and microworlds, with reference to their use in education. It reviews research regarding the educational power of such computer-based simulations and microworlds, in particular it examines the relationship between the use of microworlds in education and the educational philosophy that has become known as constructionism.

The empirical part of this study is based on research, which focused on the response of three male students playing a computer-based simulation game, ***Call to Power II***. The game was analysed as a tool for constructionist learning through observation and interviews. The relationship between the game and its representation of the historical process is also reviewed, while the boys' understanding of the historical process derived from playing this game is also explored.

This study concludes that whilst games clearly motivated and interested the students in this research, the educational value of the game chosen for this study was limited. This may have implications for the widespread use of educational simulation games in schools.

Index

2. Rationale

A recent Home Office study, cited in a newspaper article, indicates that children who play computer games are more intelligent than average (Travis, 2001, 5). Given the source for this information, it is difficult to examine how this conclusion was reached or whether the authors of the study are suggesting that computer games are making children more intelligent or that more intelligent children play games. Whichever the researchers were suggesting, investigations like these serve to illustrate the continuing interest into computer games and their links to intelligence and learning.

Whether they are seen as promoters of violence or a harmless waste of time, computer gaming is an activity that millions engage in, if the 40 million games sold in Great Britain last year is any indication (Travis, 2001, 5). This study is engaged in an exploration of computer gaming as a learning environment, specifically the sorts of learning activities that are taking place in games that are constituted as simulations. Given that so many young people are engaged in computer gaming and computer games are often used as educational tools in classrooms, it appears to be an important issue to address.

3. Introduction

3.1 ***The Study***

This study is an exploratory examination of students playing computer simulation games. The primary focus of the study is directed at the game ***Call to Power II,*** chosen mainly on the basis of the association it appears to claim to history, as a subject, a body of knowledge. ***Call to Power II,*** as the game manual indicates, is a turned-based strategy simulation game that asks the player to “nurture a fledgling nation into the most powerful empire in history” (Activision, 2000, iv).

The question to be addressed in this study is not whether the history portrayed by the game is ***correct***, (while it would be of interest to examine this issue and it is touched on briefly), the question to be addressed here is whether the player will learn the historical model used to construct the game environment from playing the game. In order to explore this question, three broad areas of literature need to be examined. The first is the literature concerning simulations as pedagogic environments. From this examination, issues concerning the categorizations and divisions that are often used to describe these environments will be addressed. This will be done in part to determine whether the game in question fits within the broad area of simulations and where it might be specifically placed within these divisions. The second area concerns the nature of computer environments, and how this applies to the specific area of computer games. The third concerns the use of simulations in history education.

3.2 ***The Game: Call to Power II***

In order to contextualize ***Call to Power II*** into the literature that relates to it, it is necessary to provide a brief introduction to the game. ***Call to Power II*** appears to be a game simulating history. Statements by the game's manufacturers, Activision, including statements on the games packaging, for example "the power to change history" and "history is what you make it" (Activision, 2000) (See Appendix A), firmly place the game into a relationship with notions of history. These statements imply that the game is simulating the historical development of civilizations, and suggest that the player will have power over history. While the historical content of the game will be touched upon, it is not the main issue of this paper. How this simulation game constructs this history and whether it is accessible by the player is the main issue in this study.

What does Activision, the game's manufacturer, mean by a "turn based strategy simulation" (Activision, 2000, iv.)? ***Call to Power II*** is turn based, in that the player takes a turn controlling and setting the aspects of a personally managed civilization, then the computer takes a turn making moves and setting parameters for the group of civilizations over which it has direct control. The moves the computer makes are invisible to the player unless those moves have a direct effect on the player's civilization.

For example, the player does not know whether the computer has instructed a city it controls to construct a courthouse. This remains hidden unless the player acquires that city, through conquest or other means. If this conquest takes place, all of the computer opponent's activities in that city will become known to the player. The player is, however, aware of the computer opponent's actions, if, for example, the computer orders one of it's armies to attack the player's empire. (A more detailed walk through of the game environment will be made in the methodology portion of this paper).

Call to Power II is a strategy game in that the player is attempting to create a more powerful civilization than the computer; militarily, scientifically, economically, diplomatically. While the difficulty level can be determined at the start of the game, careful planning is still required in order to beat the computer opponent. The higher the difficulty level, the more challenging the game appears to become.

Lastly, the game describes itself, in its associated literature, as a simulation. It is this statement that makes a convenient entry point into the literature that will allow for the exploration of this particular game.

4. Literature review

4.1 ***Simulations***

Widdison, Aikenhead and Allen, in their examination of simulation use in legal education, began with a simple definition of simulation derived from a dictionary. However, the dictionary definition did not address the notion that a simulation must be a "cut down representation of the real world" (Widdison, Aikenhead & Allen, 1998). In other words, "real life situations are often so complex that a model with characteristics identical to those of the target situation would be unmanageable, prohibitively expensive, or both" (Widdison, Aikenhead & Allen, 1998). Any simulation that is attempting to model a complex 'real world' system or object must be simplified. It would be impossible to know all the influences on a system or situation; therefore a complete model of anything would be an impossibility. Even if the 'real world' were seen to be simple, it would be impossible to recreate it in simulation, because the situation being simulated has the potential to be affected and changed, while the model used to make the simulation stays static (Widdison, Aikenhead & Allen, 1998). All simulations are based on a static, unchanging model. The simulation itself may be dynamic and changing, as it is run, but the underlying model (the program in the case of a computer simulation) remains the same, which cannot be said of the 'real world' situation upon which the model is based. When the real world upon which the simulation is based changes, the simulation model will stay static, until a new model is developed or the old one altered.

There are three components to an educational simulation, "the underlying model, the simulation's scenario, and the instructional overlay" (Rieber, 1996b, 5). A simulation is a model of something, an "attempt to mimic a real or imaginary environment or system" (Reiber, 1996a, 49). This system or environment is hidden behind an interface, such as computer graphics or a game board, that allows the user to access the model and therefore access the system or situation which is being modeled. Rieber also indicates that the model can be based on some imaginary system (Reiber, 1996a, 49). Other researchers place the system being simulated firmly in reality. Guetzkow, for example, as quoted by Ellington, Gordon and Fowlie, saw simulation as "an operating representation of central features of reality" (Ellington, Gordon and Fowlie, 1998, 1) thus placing the object/situation/system being simulated firmly in a real world. Simulations, then, are simplified models of reality, used to understand that real object or system.

If simulations are representations of reality, then why not stick with the real thing? In most cases it is necessary to build a simulation in place of the real system or environment, because the actual system being modeled should not or cannot be experienced directly. Reasons such as "cost, danger, inaccessibility, or time" are often used as the justification for interacting with a simulation rather than the real world object or system (Rieber, 1996a, 49). This clearly has implications for subjects such as history. History is inaccessible, it happened in the past and cannot be repeated. It is only accessible through some form of reconstruction. Simulation may then be an ideal way of presenting history.

At times simulations are not used because of a lack of access to a system, but used simply because they are compelling objects in themselves. The model is not used to understand the real thing being modeled, but simply used because it is of interest in itself (Ogborn, 1994, 11). When a system is too complex, it can be studied by producing a model of it to play with, but the model may be more interesting than that which it is trying to simulate. This notion of simulation can be seen in Ogborn's three characteristics of modeling. The first two aspects, "using one thing (a model) in order to think about another, and choosing for the model something more or less idealized or simplified" are shared by all models (Ogborn 1994, 11). The third proposition, that models can take on their own fascination, becoming "something pursued for its own sake, acquiring its own history and social context" (Ogborn 1994, 11), can be applied to games. Simulation games, it can be argued, are such an instance when the model is pursued for its own sake, not to understand the system, but to have fun with the system. Ogborn argues that this pursuit of modeling, for its own sake takes place because the real world in which we live is "by no means easily predictable and understandable" (1994,12). To deal with this we "construct artificial worlds made up of entities whose behavior we do know because we decided what it should be" (1994,12). This does not make the outcome of the model predictable, but it does allow for control of what goes into it. It is this control that makes simulations attractive in their own right. It is this attraction that needs to be examined in more detail, because of its relationship with play, simulations and learning. Somehow, simulations, it has been argued, “can enhance user motivation by bridging the gaps between work, education and play” (Widdison, Aikenhead & Allen, 1998). The implication is that simulations are powerful motivational tools that can make learning fun. Does ***Call to Power II*** accomplish this?

4.2 ***Types of Simulations***

Having established that a simulation is a simplified representation or model, that mimics important features of some real world entity (Roberts et al, 1983, 3), it becomes necessary to make distinctions between different types or classifications of simulations. Different types of simulations are perceived to possess varying degrees of usefulness in different settings. While they all appear to share the same educational goal, the method used to achieve that goal may be different. This results, at times, in the term simulation being used to categorize a large group. Alternatively it may be used selectively to describe a specific subset.

Yildiz and Alkins differentiate between three types of simulations, physical, procedural, and process simulations (Yildiz and Alkins, 1996, 107). A physical simulation “requires the learner to construct a mental model of how a system functions” by examining the relationships between its components (Yildiz and Alkins, 1996, 107). A procedural simulation is a training tool that teaches the user to “perform certain tasks in a systematic way”, while a process simulation is used to examine the “progress of a dynamic system” and usually allows the user to change the values of the parameters to see how they affect the system (Yildiz and Alkins, 1996, 107). This classification scheme appears to be focused on the outcome or educational intent of the simulation, the learning of the model in order to access the system upon which it is based.

Mellar and Bliss differentiate between three broad modeling types “quantitative, qualitative and semi-quantitative” (Mellar and Bliss, 1994, 3). Quantitative modeling is simply described as “mathematical modeling” and is further subdivided into static and dynamic models

(Boohan, 1994, 49, see also Ogborn & Miller, 1994, 34). In a static model, “initial values are given to the variables and the outputs are calculated” while in a dynamic model the values that were calculated are “fed back into the relationships so that the behavior of the system is modeled over time” (Boohan, 1994c, 49). A semi-quantitative model “involves thinking about systems in terms of the rough and ready size of things and directions of effects” (Bliss, 1994, 117), while qualitative modeling as the name implies, “aims to develop a reasoning systems that mimic or reflect human understanding, without the use of mathematics” (Tompsett, 1994, 145). Qualitative modeling can be further broken down into two types; “expert systems that solve problems concerned with planning, diagnosis or advice; and event-based simulations where the events depend on the decisions made by the user, rules, or probabilities” (Cox and Webb, 1994, 191). The focus of this categorization of simulations is on their construction rather then their intended outcome. Any of the types defined by Mellar and Bliss could produce the outcomes of Yildiz and Alkins.

4.2.1 ***Computer Simulations***

Where does ***Call to Power II*** fit into these classification schemes? While simulations can be found in several media as Widdison et al (1998) indicate, what is of primary importance in this study are those which are classified as computer simulations. A computer simulation can be defined as “any software application that provides access to a model of a theoretical or physical system” (Thomas, Schnurr, & Tomes, 1998, 65). Widdison et al contend that there are two important types of computer simulations, dependent upon how the computer is used (Widdison, Aikenhead &Allen, 1998). The first simply uses the computer as a passive conduit “between two or more human players” (Widdison, Aikenhead &Allen, 1998). This use of computers, they posit, makes the simulation essentially the same as other media such as drama or simulations that use table top gaming equipment (Widdison, Aikenhead &Allen, 1998). However, they do not offer an explanation as to why there is not a difference between computers used as a passive conduit for simulations and table top simulations. In making this statement without supporting evidence, Widdison et al. are ignoring a large portion of the research concerning computer-mediated communication. As a result this contention would have to be investigated further, as the mediation of the computer could make simulations operated between two people over a tabletop, between two people through an email program or on through the internet, markedly different.

The second type of computer use in simulations involves simulations in which the computer "provides the environment in which the action takes place and also simulations where the computer plays one or more of the players and/or takes in the role of judge or umpire" (Widdison, Aikenhead & Allen, 1998). It is this second type, they contend, that can properly be labeled computer simulations (Widdison, Aikenhead & Allen, 1998). The distinction between computer simulations and other categories of simulation is an important one, as computers are often seen to possess advantages in simulating over other media. ***Call to Power II*** clearly fits into Widdison et al's second category of the computer acting as player, judge or umpire.

4.3 ***Simulations as Constructionist Learning Environments***

There have been many claims made about the educational power and potential of a special type of modeling environment, known as a microworld (see Lawler, 1997). While microworlds can be found or constructed anywhere (a sandbox is often cited as an example) microworlds are most often associated with computers. On the surface a microworld and a simulation, such as the game being studied here, appear to be very similar. Is there a difference between the two? If there is no difference between the two, then can the claims made for the educational power of microworlds be made for simulations? Considering microworlds, such as Logo and simulations such as ***Call to Power*** II as the same type of learning environment would allow for the consideration of this game as a constructionist environment.

4.3.1 *Microworlds*

The most widely studied and best known microworld is Logo (in this case, the term Logo is referring to the turtle graphics program and not the computer language Logo used to construct this and other microworlds), which was developed to help children learn high level mathematics concepts using turtle graphics, an icon or robot that responds to commands programmed by the player. The turtle responds to the commands by drawing shapes.

Logo is a microworld because it is “a lucid representation of the major objects and relations of some domain of experience as understood by experts in the area” (Lawler, 1997, 52) (a definition that appears to match closely with those previously given for a simulation). It is also a program Papert refers to “as an object to think with” (Papert, 1984, 23), an object “in which there is an intersection of cultural presence, embedded knowledge and the possibility for personal identification” (Ibid, 11).

The Logo microworld reflects Papert’s desire for a real world object to manipulate, in this case a screen or floor turtle, because “children learn more quickly when they have real world objects to play with as they learn” (Pesce, 2000, 88). This real world object would allow the abstract world of mathematics to be concretized, “it tries to establish a firm connection between personal activity and the creation of formal knowledge” (Papert, 1984, 58).

Logo is, however, more than just a microworld. It is, as Papert states, “a programming language plus a philosophy of education” (Papert, 1999, VII). This philosophy is “most often categorized as ‘constructivism’ or ‘discovery learning’” (Papert, 1999, VII). It is this notion of discovery learning that is most often associated with the use of microworlds as educational tools. It is the contention that children learn by discovery that is the basis for constructionism.

4.3.2 ***Constructionism***

Constructivism comes directly from Piaget, whom Papert credits on many occasions as his influence for his work with children and computers (Papert, 1999). The notion that microworlds provide the ideal space for the building of Piaget’s knowledge structures is essentially what separates constructivism from Papert's theory, constructionism.

As Papert and Harel state, constructionism shares the belief that knowledge is constructed “irrespective of the circumstances of learning” but believes that it “happens especially felicitously in the context where the learner is consciously engaged in constructing a public entity” (Papert and Harel, 1991). The construction of knowledge should therefore take place while working with “concrete material rather than abstract proposition” (Papert and Harel, 1991). A microworld then, can provide these concrete materials and facilitate this construction. While Piaget did examine how knowledge development was “affected by the nature of the idea, by the context (both physical and social)” (Lawler, 1985, 72), he did not judge traditional instruction in a negative way. Papert, on the other hand, sees computer microworlds as being the ideal environment for the construction of knowledge, or Piagetian learning, arguing against traditional classroom instruction or instructionism. Papert and Harel make the claim that the use of microworlds is “better for everyone than the prevalent “instructionist” modes practiced in schools” and allows for “the full range of intellectual styles and preferences to each find a point of equilibrium” (Papert and Harel, 1991). Constructionism is a better way to build Piaget’s knowledge structures than instructionism, based on the notion that concrete objects manipulated in a microworld will allow for quicker adaptation and assimilation than the passive absorption of abstract knowledge (Papert, 1984, 49-50). Papert claims that microworlds such as Logo facilitate this adaptation and assimilation and most importantly allow for the transfer of this knowledge to other subjects.

Papert, when discussing the Logo program, indicates that microworlds are programs constructed “each with its own set of assumptions and constraints” (Papert, 1984, 117). This definition has influenced all subsequent definitions and designs of programs calling themselves microworlds (Edwards, 1995, 130).

4.3.3 ***Microworlds Vs Simulations***

Rieber, like Papert and Lawler, constitutes a microworld as “a small but complete, version of some domain of interest” (Rieber, 1996a, 46). Rieber goes on to state that “people do not merely study a domain in a microworld, they ‘live’ the domain” (Rieber, 1996a, 46), referring to the supposed identification by the player with the objects that are manipulated. Again, on the surface, Rieber’s definition of a microworld, like Papert’s and Lawler’s, appears to be similar to the definition of a simulation, they are both models of a system, with the educational intention placed on learning that model. However, Rieber contends microworlds and simulations are different in two areas.

The first difference is that “a microworld presents the learner with a simple case of the domain” (Rieber, 1996a, 46). However, this difference may not be significant, since as has been previously indicated, a simulation must be a scaled down version of the domain it is modeling. The second difference between microworlds and simulations postulated by Rieber is that the microworld “must match the learner’s cognitive and affective state” (Rieber, 1996a, 46). In other words, the user should know how to use the microworld without training and the microworld itself must be open to a wide range of abilities and interests (Rieber, 1996a, 46). Rieber goes on to contend that it is the user that decides whether what they are using is a microworld or not, “since successful microworlds rely on and build on an individuals natural tendencies towards learning”

(Rieber, 1996a, 46). If the microworld matches the user's "cognitive and affective state" and is easy for them to use, then it can be considered a microworld for that user. The microworld then, must be open for the user to take any direction that they please, to "become active, active constructing architects of their own learning" (Papert, 1984, 122).

This is in contrast, Rieber believes, to simulations that are "determined by the content or domain it seeks to model and is usually judged on the basis of its fidelity to the domain" (Rieber, 1996a, 46). What can be formulated from this is that microworlds are open worlds, lacking content and context, while simulations are more directional in the pathway that the user is allowed to follow. However where the line is drawn between open directionless microworld and closed directional simulation appears to be one of convenience to the researcher.

DiSessa takes a similar approach to Rieber when defining microworlds, explaining that they are a "genre of computational document aimed at embedding important ideas in a form that students can readily explore", the best microworlds being those that "have an easy-to-understand set of operations that students can use to engage tasks of value to them and in doing so, they come to understand powerful underlying principles" (diSessa, 2000, 47). Again, like Papert and Rieber, the emphasis is placed on the need for the learner to access easily the operations of the program, and the exploratory, open nature of the world, but again the outcomes proposed are the same as those for an educational simulation. Papert, Rieber and diSessa emphasize the openness of microworlds, and the notion that the underlying principles of a microworld are accessible through its use, while in contrast, simulations are defined as systems that are less open to exploration. In other words "microworlds differ from simulations in that they present the user with a simple domain that can be reshaped by the user to explore complex ideas" (Amory et al, 1998).

Pea also posits a distinction between the two domains, defining a microworld as “a structured environment that allows the learner to explore and manipulate a rule-governed universe, subject to specific assumptions and constraints that serves as an analogical representation of some aspects of the natural world” (Pea, 1987, 137). In this definition we see, as Edwards (1995) contends, one indication of how microworlds and simulations, whilst being very similar, can be distinguished. Edwards reserves the term simulations “for environments which represent elements of the ‘natural’ world” (Edwards, 1995, 139). Edwards herself does not see this distinction as an essential one (Edwards, 1995, 139). In both a simulation and a microworld, the user is exploring a space or rule governed universe. The user is confined to that space or world, and that space is a representation of something outside of itself, however loosely. The difference as indicated by all these definitions is in the amount of directionality or openness for exploration that is allowed in that world.

This distinction is also illustrated by Bliss who differentiates between two types of learning activities in modeling. The first type, expressive activity, is where “the students are creating their own models” (Bliss, 1994b, 30). This is indicative of the previously examined notion of a microworld, because the user is allowed to freely navigate in the space and build there according to its rules. The second type of activity, exploratory, takes place when students are “working with someone else’s model” (Bliss, 1994b, 30) and the student may be exploring ideas that could be “quite different from the learner’s ideas” (Mellar and Bliss, 1994, 3). This second type of activity is indicative of simulations, in that the student is only allowed to explore, not build. However, by indicating that the student may develop ideas that could be very different from the model maker’s ideas, exploratory activity is indicative of constructionist microworld learning. Bliss goes on to place microworlds and some simulations in the exploratory category. This would appear to support the notion that one distinction between microworlds and simulations is one of intentionality, the activity it is used for. While defining microworlds as a “space where learners are provided with a collection of ‘objects’ that have specific behaviours which allow the learners to explore a given set of concepts or phenomena”, she does not mark out the difference between these microworlds and simulations (Bliss, 1994c, 128), perhaps because the distinction is one of intention, dependent on how the model is used.

It would appear then that the distinction between a microworld and a simulation is dependent on the level of analysis. How open does the model have to be to be open? The underlying model, if the user has direct control of it, or builds it, may be considered a microworld. Hiding the model behind a scenario or instructional overlay that prevents direct access to the model would constitute it as a simulation. This does not necessarily mean that the simulation is not open to exploration. As Bliss indicates, simulations can be very open to exploration. It may simply be, then, a case of how the model is used.   If, for example, Rieber’s reasoning is followed, the level of analysis is left up to the user of the microworld/simulation. If the user constitutes the model as a microworld, where they are actively constructing new knowledge, then the model is a microworld. While for some researchers the distinction is a necessary one, for others who are working at a different level of analysis, the distinction is unimportant and the terms (microworld and simulation) are interchangeable, simply because they appear to share the same goals and orientation; an exploratory environment. Olson (1988), for example, simply states that microworlds are computer environments for “exploring ideas and stimulating higher order thinking”, and uses the term microworld and simulation interchangeably throughout his research into microworld use in the school classroom (Olson, 1988, 6). If the two terms are interchangeable then one can consider a simulation a constructionist learning environment. In this case then, ***Call to Power II*** can be constituted as a microworld, with its users constructing knowledge.

4.3.4 ***Claims to Learning with a Simulation/Microworld***

The literature associated with simulations contains many claims of educational advantage for simulations in general and specifically for computer simulations (Widdison et al, 1998). Widdison et al postulate several advantages for the use of simulations in education, which include placing what is being learned in the world beyond the classroom without harming or impacting that world, and allowing for controlled experimentation (Widdison et al, 1998). They go on to make specific claims for computer simulations including the ability to model very complex situations, providing a highly motivational environment and "producing rich and absorbing scenarios" (Widdison et al, 1998). Thomas, Schnurr and Tomes echo some of these claims but place them more directly in line with constructionist ideas. They suggest that simulations allow "'learning by doing'" and help "students to form concepts through experience" (Thomas et al, 1998, 65). They go on to state that simulations "provide an exploratory environment", provide "direct access to the object domain" and "allow students to form hypotheses and test them" (Thomas et al, 1998, 65). This is in line with Papert's claims that knowledge constructed in a microworld is transferable to other subjects. The knowledge is built because the microworld allows access to the underlying principles, or a domain of knowledge.

This same argument of transfer and access to the underlying model is seen in other research on the use of computer simulations. Hennessy and O'Shea indicate that the goal of simulations "is to achieve a mapping from objects and operations in that world to the learner's existing concepts so that s/he can appropriate and internalize the concepts modeled by the system" (Hennessy and O'Shea, 1993, 126). Not only then is internalization of the simulation's model proposed as a benefit, the externalization of the user's thoughts, their own internal models is also identified as an advantage. That is to say "interactive simulations are particularly useful because they require users to make explicit their implicit reasoning" (Hennessy and O'Shea, 1993, 126). If one accepts that "people's mental models are often incomplete, unstable, nebulous, easily confused with one another, and not always able to 'run' in dealing with a task" (Bliss, 1994b, 32), then the benefit of a simulation to change this is clear. However, Bliss is more cautious suggesting that "interacting with a model in a computer which is clearly structured and runnable provides at least the possibility of clarification and crystallization of ideas" (Bliss, 1994b, 32).

Stead places a caveat on the educational benefits of simulations by stating that only users with background knowledge in the simulation's domain will be able to "derive educational benefit from building on it through the simulation" (Stead, 1990, 107). Lacking this knowledge the user "may be forced to operate a simulation like an arcade game, simply entering decisions with no understanding of the process at work" (Stead, 1990, 107). This statement places games and computer game play in a negative light. However, contrary to Stead's statement, the arguments for constructionist learning in simulations are also made for simulations that are more overtly embedded in the area of computer games and gaming.

Friedman (1995), commenting on computer game simulations, such as ***SimCity*** and ***Civilization***, states that "a computer game is a process of demystification: One succeeds by discovering how the software is put together" (Friedman, 1995, 82). By playing the game, the user will discover the underlying principles used to make the model. The moment when the player has the model figured out, when its inner working become transparent, is the point at which they will lose interest in the simulation (Friedman, 1995, 82). Provenzo (1991) also makes the argument for computers games as teaching machines "that instruct the player using them in the rules of a game as it is being played" (Provenzo, 34) and thus makes the argument that they are microworlds (Provenzo, 47). Turkle (1984) also appears to make a connection between computer game play and access to the model by stating that playing the game is "a process of deciphering the logic of the game, of understanding the intent of the game's designer" (Turkle as quoted by Provenzo, 1991, 34).

How much access to the underlying principles of the model does the player have? Does the player ever truly understand the model? Friedman appears to be arguing for complete access to the model through trial and error play (Friedman, 1995, 82). However, Turkle (1995) indicates that while this may have been possible with early video games, it is not necessary the case with newer more complex games (Turkle, 1995, 67). Referring to computers in general, Turkle states that

> In a culture of simulation, when people say that something is transparent, they mean that they can easily see how to make it work. They don't necessarily mean that they know why it is working in terms of any underlying process (Turkle, 1995, 42).

This also applies to simulation games such as ***Simlife*** where one user "is able to act on a vague intuitive sense of what will work even when he doesn't have a verifiable model of the rules underneath the game's behavior" (Turkle, 1995, 69). The game player doesn't need to have access to or even think about the model in order to play the game. While they do learn something from the process of playing the game, it may not be the underlying model of the game, only an intuitive sense of how to navigate or play the simulation.

As they are cited frequently in this paper, it needs to be kept in mind that neither Turkle, Friedman, Provenzo, nor Murray privilege the reader to their methodology in the particular works cited. This may be the result of the particular audience that the authors were targeting in these works. While they do provided data to support their claims, they do not inform the reader as to how that data was generated. The empirical setting is not firmly established leaving the analysis generated open to discussion.

4.4 ***Play and Computer Games***

The most important aspect of learning with a simulation appears to be the idea of constructing knowledge about a 'real world' system though playing with a model based on that system. Often the constructionist/constructivist environments are seen as playful environments, where knowledge is acquired through the act of play (Amory et al, 1998). Pesce (2000) positions Piaget's constructivism (in the process aligning it directly with Papert's constructionism) with play by stating that:

> Piaget proposed that children are constantly exploring the world with their senses, and that their interactions with the world help them to formulate theories to explain the activity of the world. At every step along the way, the child applies its growing base of logical thoughts. Testing them for truth, amending them as new experiences force a reconsideration of their understanding. Their play in the world is actually an advanced experiment in the behaviour of the world, and every interaction leaves the child with a broader and more complete sense of the real. (Pesce, 2000, 54).

Pesce is positioning play as a positive and necessary aspect of a child's development and learning. Children are active constructors of their own knowledge through the act of play. Children need play to reduce the "complex universe of human culture into forms that a child can grasp" (Pesce, 2000, 4), to help guide them into culture and "determine their likes and dislikes, their social skills and even their choice of careers" (Pesce, 2000, 34).

Winnicott (1971) places this same emphasis on play and culture stating that "cultural experience begins with creative living manifested in play" (Winnicott, 1971, 100). In this case, culture is "inherited tradition…the common pool of humanity" (Winnicott, 1971, 99). This access to cultural experience is accomplished with what Winnicott terms as "transitional objects…objects and phenomena from external reality" brought into a play space as substitutes for real things (Winnicott, 1971, 51). As Murray (1997) sees it, "all sustained make-believe experiences, from children's play to Shakespearean theatre evoke the same magical feelings as a baby’s first teddy bear because they are all “transitional objects”” (99-100). All this lends support to the argument that play is an important and necessary aspect of education, and the objects that are played with act as models for the ‘real world’.

Play is still perceived, however, to have negative connotations as is it is “traditionally viewed as only applying to young children”, too easy an activity and while “work is respectable, play is not” (Rieber, 1996a, 43). Furthermore “another misconception is that the activity of play is irrelevant or inconsequential to either formal or informal learning” (Rieber, 1996a, 43). Computer game playing is often regarded as one of the most negative types of play. However, computer game playing is increasingly the leisure activity of choice for children, and needs to be considered closely. As Tapscott (1998) sees it, the computer itself is just a very expensive toy, a toy that can be used in a wide variety of play (Tapscott, 1998, 159), one example being the playing of computer games.

4.4.1 ***Computer Games***

It can be contended that much of the cultural experience and socialization gained from play is now taking place through the playing of computer games (at least for males), in the United Kingdom and other western countries (Cassell and Jenkins, 1998, 10). In Britain alone, 40 million computer games were sold last year and those children who play them spend an average of 45 minutes per day at this activity (Travis, 2001, 5). Computer game play is therefore a major pastime for a large number of children and increasingly adults (Travis, 2001, 5).

Provenzo (1991) believes that “video games represent an important type of socially coded goods around which cultural allegiances can be developed” and that such games become “culturally and socially appropriated…taking on symbolic value among their users” (Provenzo, 1991, 14). This is reflected in the community that has grown around the players of video games, and the amount of related merchandising and media associated with popular games. Perhaps most importantly, because the games themselves are “important social and cultural statements”, they provide insight into the culture that produced them (Provenzo, 1991, 22). Games and toys “not only help to form the imaginations of our children, but also reflect the cultural imagination back upon us” (Pesce, 2000, 4). This cultural reflection, marked by the increased popularity of video games, may indicate, as Turkle (1995) contends, that “we are moving towards a culture of simulation in which people are increasingly comfortable with substituting representations of reality for the real” (Turkle, 1995, 23). Computer games themselves allow for culture of simulation to be constructed (Turkle, 1995, 67).

Perhaps though, games and toys do not reflect society or culture as much as they mold them. This argument is best illustrated in regard to examinations of gender differences in computer game play. An examination of gender differences and its relationship to these games needs to be undertaken since only males were observed for this study and computer games are seen as almost an exclusively masculine domain.

4.4.2 Gender and Computer Game Play

Although an increasing number of females are now playing video games, for the most part the games are still seen as a male domain (Sunnen, 2000, 11-12). With “80% of game playing among nine- to fifteen-year-olds” done by boys (Subrahmanyam and Greenfield, 1998, 47), and video game magazine readership 90% male (Subrahmanyam and Greenfield, 1998, 48), it is easy to see why computer games are seen as masculine. Even when games are specifically aimed at girls, they have not succeeded in the market place (Subrahmanyam and Greenfield, 1998, 48). However, based on games that have been popular with girls, such as ***Barbie Fashion Designer***, an understanding of what makes games appealing to males and females can be established. Research suggests that “not only do girls prefer less violence, but they also prefer different kinds of games, game characters and game worlds" (Subrahmanyam and Greenfield, 1998, 48). Cassell and Jenkins (1998) contend that this difference is not biologically determined but a construction of culture. They state that the "binary opposition between masculine and feminine is a purely cultural construct" that changes with time, culture and context (Cassell and Jenkins, 1998, 6). This contrasts with the view that games show us the structures of culture. Rather than the games and toys of a culture showing us the differences between male and female likes and dislikes, the games and toys construct these differences.

Whether computer games are reflecting culture or building culture and thus showing gender preferences or building them, differences are potentially present and need to be taken into consideration, given the empirical nature of this study. Boys were exclusively sampled for the empirical work.

4.4.3 The Appeal of Computer/Video Games

Greenfield (1984) explains the appeal of video games by, amongst other things, their visual dynamism, personal involvement or control, discernable goal, audio effects, and speed (Greenfield, 1984, 90-91). Murray (1998) also identifies similar criteria as appealing aspects of games, and digital environments in general (Murray, 1997, 71). Murray sets out four essential properties of digital environments: they are procedural, participatory, spatial, and encyclopedic, the first two deal with the interactive nature of digital environments and the last two with its ability to be immersive (1997, 71). These properties also give insight into the appeal that computer games have for their users.

Digital environments are procedural in that they are governed by a set of rules (Murray, 1997, 71). It is these rules and their relationship to a recognizable "interpretation of the world" that determines the success of the digital environment (1998, 73). These rules also relate to the goal of the game. It has been proposed that the more specific the goal of the game, the more popular the game becomes (Provenzo, 1991, 39). Games with easy to follow rules and clear goals can therefore be seen to be more appealing.

However, the appeal of the procedural environment is also dependent on the user's ability to have those rules respond to their input (Murray, 1997, 74). In other words the digital environment must be participatory. The procedural and participatory nature of digital environments allows for interaction and navigation. It is this navigation that gives rise to the computer's ability to create a space (Murray, 1997, 80). While other media, such as books and films, can portray a space "only digital environments can present space that we can move through" (Murray, 1997, 79). This is not dependent on the environment's ability to represent the space in a graphical form, but dependent on the interactive nature of the environment (Murray, 1997, 80). The user creates a space by interacting with the rules of the game.

The final characteristic of digital environments is their ability to deal with vast amounts of information. This encyclopedic quality has the "potential to offer a wealth of detail, to represent the world with both scope and particularity" (Murray, 1997, 84). However, this encyclopedic quality can also be a disadvantage, Murray believes, especially in relation to simulation games. In simulations such as ***Simcity*** and ***Sid Meier's Civilization*** "the authority bestowed by the computer environment" is used to make the games "seem more encyclopedically inclusive than they really are" (Murray, 1997, 89). In doing so they can hide the assumptions behind the game from the user.

> In an interactive medium the interpretive framework is embedded in the rules by which the system works and in the way in which participation is shaped. But the encyclopedic capacity of the computer can distract us from asking why things work the way they do and why we are being asked to play one role rather than another (Murray, 1997, 89).

The game's underlying model can get lost in the vastness of the game environment. This statement appears to contradict Friedman's view that access to the games underlying model is obtained through playing the game (Friedman, 1995, 82). The appeal of the computer game medium will be touched on and examined in more detail in relation to the analysis of the data obtained regarding ***Call to Power II.***

5. Simulation Use in History Education

Call to Power II, by making statements about history and using associated images on it's packaging, is placing itself into a relationship with the historical past, even before the game is actually played (Appendix A). Images, such as the Egyptian pyramids found on the packaging, have an immediate association with history and ancient cultures. Notions of history are found throughout the game environment. Each advance the player's culture can make is listed in a menu that allows access to the historical facts associated with that advance. With ***Call to Power II*** so clearly connected to history it is necessary to examine how simulations are used in historical education.

The most widely used piece of technology in history education is the video recorder, with over 90% of history teachers using it on a regular basis in their classroom (Haydn, 2000, 99). However, the use of computers in history education has not been so widely embraced, with three times more teachers preferring video recorders in their classrooms to computers (Haydn, 2000, 99). The most likely reason for this lack of use is lack of time for the teacher to develop ways of using the computer in the history classroom. (Haydn, 2000, 100). The result is that ICT use in history education is not widespread.

When computers are used in history, simulations are often cited as an ideal use of the technology. The National Council for Educational Technology indicates "the use of computer simulation introduces new activities to the history classroom, enhancing both teaching and learning" (NCET, 1989, v). Simulations do this by requiring the pupil "to examine issues from the perspective of a participant…in order to explain how it was in the past" (NCET, 1989, 1), as well as requiring them to identify changes and trends, and "examine the impact of variables and thus model the situations" (NCET, 1995, 1). In doing so, simulations "support the development of pupils' understanding of the past itself and of the process of determining what the past was" (NCET, 1989, 1). Additionally simulations are recommended for "their ability to act as a focus and a catalyst" and build skills in "researching, arranging and interpreting facts" (MEP, 1986, 8). Simulations classified as games can be used to "teach children about the nature of cause" (Francis, 1983, 7), what needs to happen in order for something else to happen. However, the issue of winning the game may, even if the game is firmly set in historical context, inhibit historical learning (Francis, 1983, 7).

It may not be the type of software used that is of importance to history education so much as how it is used, or how it forces the user to use it. Haydn (2000) believes that there are two important principles to follow in using ICT in history education.

> The first is that pupils must be asked to do something with the information they are presented with, rather than simply being provided with access to an increased volume of historical information. The second is that there should be some valid historical purpose to the activities that pupils are engaged in, rather than meretricious comprehension, matching and representation exercises (Haydn, 2000, 105).

This can be accomplished by

> Asking students to make connections and demonstrate understandings with other areas or aspects or historical information, or presenting them with a choice between two or more alternatives and asking them to make intelligent choices between them, based on the principles underpinning history as a discipline (Haydn, 2000, 105).

Clearly then, the use of ICT in history needs to focus on what the computer program is asking the user to do with the information that is presented to them.

6. Methodology Considerations

6.1 Empirical setting

This dissertation study can best be constituted as an ethnographic study into computer game play and its relationship to notions of learning and schooling. For this reason the main portion of this study was conducted at a state secondary school in southeast London, in an attempt to observe and record students using ***Call to Power II***. The all boys' school is made up of 900 pupils aged 11 to 18. It is worth noting that 42% of students speak English as a second language. All the students observed for this study fall into this category. Additionally, 50% of the students qualify for free school meals and 20% are identified as having special educational needs.

While this research, as it stands, could have been done outside of the school setting, the use of games as educational tools and their perception in the school environment was of interest. Additionally the game's connection to history, as a subject of study, was of interest, again lending support to the use of this particular empirical setting. This is not to say that questions or statements arising from this study are limited to the school educational setting. However, the makeup of the sample of students used for the study may have limiting effects on any generalizations reached.

The school was chosen because of its status as a specialist technology school. As noted in the school brochure, the school has "been noted as a centre of excellence in ICT", with technology permeating every aspect of the curriculum[1]. All classrooms contain networked PCs for student use as well as access to portable computers and separate computer labs. This not only allowed for easy access to the computer equipment necessary to conduct the research, but also made the school of interest as technology is incorporated across all subject areas, including History.

Based on information provided by the Head of the History department, computers are primarily used in the history class to allow students access to data base information, and for the use of presentation and publishing tools, such as ***Microsoft Power Point***. Primarily then, it can be said that the students use ICT in History for the handling and interpretation of information through databases and the presentation of information for assessment purposes though software packages. Interestingly, while History classes participate in simulations or role-plays in the classroom, they do not use computer based simulations.

This use of computers in history is interesting in light of Haydn's statements concerning how ICT is generally used in history education. This school would appear to fall outside the norm for ICT use in the history classroom. This may affect the outcomes of this study, in that students have had experience in the use of computer programs aimed at history learning.

Three 13 year-old students volunteered to participate in the research. While additional students wished to participate, several factors limited the numbers. Firstly, only I was available to observe the students using ***Call to Power II***, this therefore necessitated a small sample owing to the difficulty of observing more than one group at a time. Additionally, however, the study was limited by school policy, and technical considerations. The school has a 'no game' policy on all the PCs. This made it difficult to load and access ***Call to Power II*** on the school machines, as it was necessary to use the Head of ICT's code to gain access to the hard drive. This was done to limit the student's access to the game and limit the number of computers the game was placed on. While the school was willing to allow the game to be loaded on additional computers, they were however hesitant to do so. This appears to reflect Rieber's statements that game play in an educational setting is often viewed negatively.

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[1] This information is derived from the prospectus of the school used in the empirical study.

These technical considerations also necessitated the move out of the history classroom originally chosen for the study, and into one of the school's computer labs. This location change altered the empirical setting considerably. The computer lab also seems to function as a lounge/lunchroom for ICT teachers, and given that the study was limited to the students' lunch time, the room was occupied by 5 to 6 teachers eating lunch and working at computers. While this did not have any noticeable effect on the subjects' behaviour, this, along with my presence as an observer, needs to be taken in to account when examining the data collected. The presence of teachers and myself may have altered the level of motivation the students displayed towards playing the game.

6.2 The Sample

The issue of sample selection also needs to be taken into account. The three students observed for the study could best be considered as what Brown and Dowling (1998) constitute as an opportunity sample, in that they were not selected, they were used because they volunteered and made themselves available (p. 30). This lack of selection of course introduces variables into the study that need to be addressed, as they may affect any generalizations that can be made. Primarily, this raises the issue of these students as motivated computer game players. All confessed to being very interested in computer games, all spending considerable free time playing these games. Less active game players may have reacted differently to the game environment.

Additionally all the students involved were friends, which may have contributed to them volunteering in the first place. All had worked together in groups before. This may have allowed them to easily fall into roles within the group, such as Sam taking on the role as the reader, which allowed the others to ignore the written portion of the game.

6.3 Data Collection

Data for this study was collected by direct observation of the students playing ***Call to Power II***, followed by interviews about their experiences with the game. These observations took place over a period of four consecutive days, during the students' lunch period. Additionally the students spent one hour under observation playing the game after school on the third day of the study. In total, the time spent observing the students play was limited to approximately 4 hours. This limited exposure to and observation of the students with the game, needs to be considered closely as ***Call to Power II*** can take upwards of 20 hours to 'win' a game. In essence then, the research subjects had very limited exposure to a rather large and long game. This may have a significant limiting effect on the generalizations that can be made from the analysis of the data collected.

The interview was conducted in an attempt to have an unstructured conversation with the students about their experiences with the game. Areas of interest to discuss were developed during the observations, but the questions were not determined before the interview. However the interview can be seen as not entirely successful. As this was my first attempt at interviewing (the study was not piloted) the questions were very leading, indeed test like in their intention. From this the students may have been trying to give the ***correct*** answer. This calls into question the usefulness of their responses for analysis.

The fact that the boys were interviewed together may have affected their answers. They appeared to be unwilling to commit themselves to a definitive answer until another makes an indication of where they are committing themselves. The nature of the questions also may limit how much can be interpreted from them.

The final issue to be raised about the sample is the gender of the students. If gender is classified as a biological difference, then as previously stated, there is a perceived difference in how men and women play games and the type of games they prefer to play. The students' approach to playing the game may have been influenced by their gender.

6.4 The Game

As the accompanying 92-page player's manual indicates, ***Call to Power II*** can be viewed as a very complicated game (Activision, 2000). The player is required to keep track of a large number of variables that have a direct effect on the outcome of the game. Determining what the player's cities build, controlling the movement of military and other units, keeping your people happy, setting wages and working hours, monitoring/controlling pollution levels and regulating trade are just a few of the aspects of the game environment that need the player's attention. As the game progresses and presumably the player's empire grows, the more attention these aspects of the game require.

The limited space available here makes it difficult to give a complete account of all the aspects and functions that influence game play. However in order to contextualize the data collected through observation of the game play, it is important to highlight some of the broader areas of the game environment, their functions and interactions.

6.4.1 Getting started

To begin ***Call to Power II*** the player is required to pick from a list of forty-one "ancient and modern nationalities" (Activision, 2000, 4), the Roman Empire being the default choice. This is the group the player will lead and control. The game has predetermined names for the leader of this civilization, depending on the sex, male or female, that the player chooses to assume. For example, if the player chooses the Roman Empire as the civilization they wish to control, then the name Julius Caesar appears in the name box. The player then has the option to change this name to anything they wish. If they choose to change their name, then the game will address them, in text boxes, with this new title, at various stages of the game. The player also has the option to change the sex of the civilization leader they are playing. For example, if the player chooses the Hebrew civilization to play, the male leader is David, while the female leader is Golda Meir.[2]

The player next has the option of choosing the number of computer opponents that they wish to compete against, the maximum number being 7. They do not, however, have the option of picking the civilizations that these opponents will represent, the game determines this, and appears to pick from a select few each time. These include American, Scottish, Irish, English, Native American, German, French, and Japanese civilizations. The player has the option to set certain parameters for the game including the skill level, from beginner to impossible, and the shape of the world, doughnut shaped or earth shaped. The player also has the option of customizing the map that they are playing on. They can adjust the size as well as the physical makeup of the terrain. The general humidity, temperature, variety of terrain types (desert, jungles, etc.) amount of land area compared to ocean, the expanse of continents compared to islands, and the number of goods available for commerce, can all be modified.

Two final adjustments can be made before playing the game. The first is a choice to turn the Pollution variable off, thus eliminating pollution as a factor in the game. This will have profound effects on the game as global warming and ozone depletion will not occur, and the activities that cause them will be of less concern while building your civilization (Activision, 2000, 8,16). The second variable that can be turned off is the Bloodlust option, which “determines your options for winning the game” (Activision, 2000, 8). When this option is turned off, the player has four ways to win the game “Conquest, High Score, World Peace (Diplomatic), and the Science Fiction victories” (Activision, 2000, 8). The Conquest victory, as the name implies, requires the player to eliminate all the other civilizations from the map (Activision, 2000, 16), while the High Score victory requires the player to have the highest score, based on their performance as a

[2] These historical figures are hardly comparable.

leader, by AD 2300 when the game ends (Activision, 2000, 16). Diplomatic victory is achieved "by engaging your neighbours in diplomacy" with the goal of "forging a permanent alliance with every nation in the world" (Activision, 2000, 16). The Science Fiction victory involves the player in the building of the Gaia Controller. It is "a device that makes a limitless supply of energy" in doing so it "opens the door to a true world utopia, free from want, conflict, scarcity, and strife" (Activision, 2000, 16).

6.4.2 Beginning and Movement

After the player has set the above parameters and launched the game, the player is presented with a screen that is mostly black, except for a small portion, which surrounds the player's settler units. The game automatically presents the player with two settler units at the start of the game. It is these units, when given the command to 'settle', which will form the cities of the player's empire. These units, and all subsequent units that are built, can also act as explorers. As the player's units travel around the game world, areas that were black become visible. This reveals the "terrain, resources, and information critical to your survival and growth" (Activision, 2000, 3). After a unit moves out of an area, a grey shroud appears over that area. While the land is visible is the greyed-out area, any changes that happen there are not known until that area is visited again by one of the player's units, or permanently occupied in some way, such as by founding a city. To move units the player clicks and drags them with the mouse. The type of unit and the terrain it is moving through determines the amount of space that the unit moves in a turn.

This exploration of the game map is presented as one of the seven goals of the game, growth in area and population, building within the cities and their surroundings, conflict management, scientific discoveries, trade within and between other empires, and diplomacy with computer opponents being the others (Activision, 2000, 3). To accomplish these goals, and therefore achieve one of the four victories, "a successful leader must effectively manage three primary resources, food, production and commerce" (Activision, 2000, 3). Successful food management allows for growth and empire expansion. Production allows for exploration, building within the cities, and therefore growth of the cities, and the ability to engage in and manage conflicts with other empires. Commerce through trade funds the production of new units, buildings, wonders, and scientific discoveries.

6.4.3 The Technology Tree

The Technology Tree is the representation of all the innovations that are potentially available for the player to discover during the game. The player's manual describes the Technology Tree as "a complex web of scientific and cultural advances that builds upon itself, mirroring the complex and non-linear progression of human achievement throughout the ages" (Activision, 2000, 64). It is accessible in two forms; one form is available within the game itself, in the form of a game section called the Great Library. The second comes in the form of a poster provided with the game literature.

The Technology Tree is constructed as a flow chart. Along vertical axes are listed the categories that all innovations are divided into: construction, engineering, sea faring, aerospace, military, economics, physical sciences, cultural advancement, environmental sciences, energy science, medicine, government and education. The horizontal axis is divided into the ages that the player's civilization may advance through: ancient renaissance, modern, genetic, diamond. The innovations themselves are interconnected along these axes. For example religion, drama, philosophy, theology and fascism, are all located linearly in the cultural advancement category. In order to move from religion to drama the player must first have discovered writing, which is in the government and education group. In order to then move from drama to philosophy, trade, which is located in the economics category, is a prerequisite. However in order to discover trade, the player's civilization must have first discovered agriculture, which is located in the military group. The discovery of agriculture not only allows for the discovery of trade it also allows to the player to build certain units, city improvements, tile or map improvements, or wonders of the world. In this case the player will now be able to place farms around their cities and build granaries within the city. Both of these will allow more people in the city to be fed and allow the city to grow.

The Technology Tree then is an arrangement of numerous innovations in 12 groups through 5 time periods. All the innovations are connected in a complex web of prerequisite innovations. The game provides some help in navigating this web by providing the poster, also by allowing the player to establish a research goal. For example, if the player wishes to be able to build a nuclear submarine unit, they first must develop the nuclear power innovation, which is an energy science innovation in the genetic age. The user selects this as their goal; the game then informs them of which innovations they must achieve in order to reach this goal. If the user sticks to this path through the web, they will skip other innovations that are not necessary to achieve this goal, and could accomplish this goal very early in the game, before the genetic age. This would give the player an advantage in terms of nuclear capability over the other players. However the computer opponents may have chosen different paths through the Technology Tree, giving them advantages in other areas. The game manual indicates, “history is littered with the unfortunate consequences of nations ill equipped to resist the imperialistic overtures of a more scientifically advanced nation” (Activision, 2000, 64). It is this that the player must try to avoid.

One item on the Technology Tree is the ‘Wonders of the World’. When the player discovers certain innovations, their civilization can then begin work on completing one of these. The wonders bring benefits only to the civilization that completes them. For example, it is possible to complete the building of the (Egyptian) pyramids. This wonder then brings tourism to the host empire, which in turn generates gold. This gold then can be used to complete other improvements or units.

7. Data and Analysis

7.1 Call to Power II as a Simulation

The formulation of the Technology Tree lends evidence to the argument that the simulation, ***Call to Power II***, constructs history as a series of cause and effect relationships, that is with one event leading to others. Within ***Call to Power II***, the 'causation' web constructed by the game is evident through the Technology Tree. The player is invited to move through this web of cause and effect relationships, innovating to achieve pre-determined goals. Notably, contrary to the claim of the game that this web represents 'a complex web of scientific and cultural advances that builds upon itself, mirroring the complex and non-linear progression of human achievement throughout the ages" (Activision, 2000, 64), the very notion of one innovation leading (irreversibly) to another in a related sphere is a reflection of the game's interpretation of history as a linear process. Most significantly, player's civilizations can never regress; they are 'restricted' to going forward. A civilization may stagnate and fail to advance, but it will not lose or reverse the progress it has made through the player's actions.[3] Focusing on a particular strand may enable the player to develop innovations before they actually occurred in history. This allows the players to construct ***what if?*** scenarios. For example, what if your civilization develops the nuclear submarine in the Renaissance? How will that alter history?

Speculations about the causes of important historical events, such as the game constructs, are reflected in academic historical literature. For example, Kershaw (1998), investigating the rise of Hitler, postulates that

[3] This misses a fundamental characteristic of the historical process. Belief in 'the march of progress' towards the modern age is a gross simplification of the past.

> The First World War made Hitler possible. Without the experience of war, the humiliation of defeat, and the upheaval of revolution, the failed artist and social dropout would not have discovered what to do with his life by entering politics and finding his métier as a propagandist and beerhall demagogue. And without the trauma of war, defeat and revolution, without the political radicalisation of German society that this trauma brought about, the demagogue would have been without an audience for his raucous, hate-filled message. The legacy of the lost war provided the conditions in which the paths of the German people began to cross. Without the war, a Hitler on the chancellor's seat that had been occupied by Bismarck would have been unthinkable (Kershaw, 1998, 73).

It can be argued that Kershaw is doing two things in this quotation. First he is speculating that the First World War was a prerequisite event for the rise of Hitler to take place. Kershaw's explanation could be constructed as a flow chart similar to the Technology Tree, with all the strands of causation prior to and post WWI flowing together to point to Hitler. Secondly, Kershaw appears to be inviting the reader to speculate upon what would have happened if these causal conditions had not been met. Would Hitler have been brought to power in Germany? If not, how might the last 60 years of history have been different? Similar questions may be being asked by the ***Call to Power II*** model. It is inviting the player to change history by experimenting with the parameters of the model. The statements on the game packaging evidence this.

> What if the Ancient Egyptians had worshipped the god of commerce? What if the world leaders left global warming unchecked? What if Japan hadn't bombed Pearl Harbor? What if the Aztecs had invaded Spain? What if you led the world? (Activision, 2000.)

7.2 Call to Power II and its Relation to History

The first issue to be addressed in relation to the data collected from the observations and interviews with the students and my own experience with the game is the accessibility to the model of history that the game is based upon. In general terms, this model represents history as a linear process always leading to progression and improvement. The accessibility of the model is, in turn, connected to the issue of the game playing experience. What did the students do while playing the game and why?

History, as a concept, was not discussed with the students before or during the study. Nor was their personal interpretation or understanding of history established before they played the game. Only during the interview was the term history used or discussed. However, the students were given the packaging for the game and the player's manual. Both of these texts make reference to history and its association with the game.

When asked if the game did give them the power to change history, as the packaging for the game claims, one student stated that, "We didn't change anything". Another, however, felt that they could change history because "We can choose what could be built or what shouldn't be". When asked directly whether ***Call to Power II*** was a game about history the following responses were given. The interviewer is indicated by the letter Q.

Q. Is it a history game?
Sam. Not really
Ruman. Sort of.
Q. What do you mean sort of?
Ruman. I don't know, you could build the pyramids, that sounds like history.
Q. The pyramids come from history therefore it is a history game?
Ruman. Sort of.
Sam. Yah it is.

It can be argued from the answers of the students, that it was only upon questioning after play that they made any association between the game and history. This association seems tentative and unsure. One student, Ruman, makes a connection between history and the pyramids, but only to the extent that the pyramids are part of a personal 'history' category. When questioned further about the game's portrayal of history the students responded as follows. The questions were used to elicit the students' ideas about how history works as a process.

Q. Is that how history works?
Ruman. I don't know.
Carl. Yah sort of.

Q. Ok, how does history work then?
Sam. It's like whatever happens… I don't know.
Q. What did you say before about connections?
Sam. Well it's like a chain…
Q. Is this game asking you to look at how history changes if inventions…
Sam. Yah, it's like you can change the past, make things your own way.
Carl. Make things better.
Sam. Or worse.

This line of questioning can be seen as leading (see methodology), and must be treated with caution. It is therefore not at all clear whether any of the students saw the game as constructing a chain of events or causes. They may simply be trying to answer the question correctly, as if it were a test question. This creates the strong possibility that the students did not associate ***Call to Power II*** with any notion of history until asked explicitly to do so through focused questioning.

This contrasts to my own experience with the game. I could clearly see the connection between the game and history. Through my playing with the game and examination of the material provided, I constructed an interpretation of the model. Additionally, it could be argued that I learned about history from the game, through accessing the History tab of Great Library menu within the game, an optional section that was not used by the students. The game provides this area to allow the player to place the innovations "in their proper historical perspective" (Activision, 2000, 70). The reasons the students may have ignored this section will be touched upon later, the important point here is that the students ignored a large section of the game devoted to factual history.

The Great Library contains a section (menu) called History for each objective or innovation that a civilization can accomplish. For example, one of the wonders that can be built during game play is the Gutenberg Bible. By accessing the history section the player is presented in part with the following information.

> The Gutenberg Bible, also known as the Mazarin Bible and the 42 Line Bible, was the first volume known to have been printed with movable metal type. A Latin edition of the Bible, it was printed some time between 1450 and 1456 in Mainz, Germany. Although

> German bibliographers claim that it was printed by Gutenberg, the edition may have been finished and perfected by Peter Schöffer, Gutenberg's assistant and Johann Fust, a wealthy financier who acquired Gutenberg's share of the business in a lawsuit. Regardless of its exact origins, the Gutenberg Bible was one of the first religious texts mass produced by machine. (Activision, 2000)

This can be seen as a concise factual account of the Gutenberg Bible. If accessed by the player, as I did when playing, it could have the potential to provide the user with an opportunity to learn history, (or at least what the game's manufacturers consider the important facts of history). However, there is no need to access this information at any time during the game for any reason. The player's manual indicates that the history is provided "because ***Call to Power II*** is a game largely based on actual human history", therefore "it can be enlightening and enriching to learn about the history behind the advances, wonders, units, improvements and governments." (Activison, 2000, 70). Enlightening but not necessary. It does not affect game play in a positive or negative way if the history behind the innovation is known to the player. I only accessed this information because I was looking at this game for its potential as a pedagogic tool, in order for me to complete the game there would be little reason for me to have done so.

This is evidenced by the students' success, limited by the time available, in navigating the game without entering this area. They did, however, use the other resources of the Great Library, namely the Game Play section. This section presents information as to how the unit or innovation will benefit or hinder the player's civilization. For example, the students set the ***Cannon Making*** innovation as a goal. The Game Play section offered this information on cannon making.

> In the same way that the discovery of gunpowder revolutionized infantry combat, cannon making revolutionized siege combat. The bombard capability of the cannon unit makes it ideal for attacking cities from a distance (Activision, 2000).

While it could be argued that this is offering some historical information, what is more important in the text is what the unit will allow the player to do in the game. In this case, it allows the player to attack other civilizations from a distance. This is a significant advantage in terms of game play, allowing the player to destroy all the units' stationed in an opponent's city. When these units are all destroyed, the player can take the city without losing any of their own units.

The students used the Game Play section of the Great Library in an effort to decide what research goals they should set. These research goals relate to the Technology Tree. This concerted attempt to pick the right goals to aim for was especially evident the second time they played.   The first attempt saw the students attempting to work their way through the various menus (city manager menu, great library, build menu), but with little success, in terms of achieving the game's goals.

The students attempted to make their cities build nothing but military units, and focused on the cannon as their main goal. They also took any units the cities produced and used them to explore the map. The result was that their citizens became very unhappy because they lacked any city improvements or protection. They then struggled to make their citizens happier. This led to speculation as to which items, if built, would make them happy.[4]

In the students' first attempt at playing the game, they lost one of their cities to an invading army. Rather than continue, they decided to start over. This second attempt saw them spending more time in the Great Library. Again they picked the cannon as the research goal, however in planning their cities they spent more time attempting to make their citizens happy. To do this, they left units behind to guard the cities, as well as placing innovations that increase happiness, such as shrines and

[4] At one point the Slaver unit was mooted as a way to increase happiness. This unit will travel to rival cities and steal citizens from that population, to make slaves for your cites. It does not increase happiness in anyway.

arenas, in the build queue.   When asked about this changed approach in the post task interview, the students offered the following explanation:

Q. Ok so how was it different? (When game was started over)
Sam. Guarded our city and put people in there…
Ruman. Built things
Sam. ...and built ships… you weren't there when we built ships (said to Ruman) and we um… made friends with other civilizations and …
Carl. Being cool to some but they rejected us.
Ruman. And we beat them up.
Sam. No we requested them, requested some of their map and they gave us…
Carl. And we got more money and build more…
Sam. We just played a bit smarter.
Q. I noticed you planned a lot more, you were picking… because when you first started playing, you lined up, cause in the… you pick what you are going to build, right? And you… when you first started you picked nothing but troops.   Archers, archers, archers, warriors, warriors, warriors….
(All laughing)
Q. 100 of those and then… but the second time you played what did you do differently there?
Sam. We built things for the people so they stay happy and survive. I mean like the first time they weren't happy so um it dangerously….
Ruman. We built things we needed the most first.
Sam. Yah, and then the troops…
Carl. The warriors.
Q. What happened when the people were not happy?
Ruman. They wouldn't make fields or anything.
Sam. They weren't building anything.
Q. They refused to work for you didn't they?
Sam. Yah.
Q. The game kept flashing up messages, all the time. Telling you oh you should do this, oh you should do that.   What did you think of those?
Ruman. Couldn't be bothered to read anything.

From this it can be argued that the students demonstrate learning in regards to how the game is played. They clearly show that they are working to correct the mistakes made during the first attempt to play the game, namely they are attempting to make the people happier, a condition that must be met in order for them to build the units that they wish to build. While this could be argued to be learning about how the game is played (an issue that will be examined later), it does not indicate that anything related to history is being learned.

Ruman's comment, that he "couldn't be bothered to read anything", is important, as it touches upon another way in which the game uses, or disseminates historical information, as well as important information concerning game play. Periodically the game forces some information, some of it arguably historical, onto the player through messages that appear in text boxes over the game interface. These messages can be in the form of tutorials on game play and/or messages regarding the actions of the computer generated opponents. Additionally the messages can contain information about the historical connections between the actions of the player in the game.

For example to begin the game the following message is flashed up.

> Welcome! In Call to Power II, you will have the opportunity to create the most powerful, most advanced, or most peaceful empire in recorded history. In establishing your empire, you will build cities to control the land, raise armies to explore and conquer, and interact with other nations (Activision, 2000).

While this tutorial message is dealing with the goals of the game, other messages deal more directly with game play options. For instance messages will offer tips on troop deployment, city management, and overall empire management. Some of these messages, while dispensing tips for game play, still make reference to history, through the use of quotations that can be attributed to historical figures.

> “Ask not what your country can do for you…ask what you can do for your country”. The production of your nation depends on the length of the workday. Long workdays make for more productive cities. However, shorter workdays make people very happy (Activision, 2000).

The quote is recognizably that of John F. Kennedy, although the game does not attribute it to him. Importantly, it is a highly recognizable quote, connected to important information about the cause and effect relationship of some of the simulation’s parameters, an understanding of which may be important for success in the game. Similarly, when important accomplishments are made by the player, such as the building of a ***Wonder*** the game opens a box in which a brief animated movie is played. While these movies are interesting in their use of historical imagery, such as Egyptians shaping and moving the stones to construct the pyramids, at this point what is of more interest is the accompanying text.

> Gutenberg's printing press made possible the mass production of literature and religious works. Religious leaders were better able to spread doctrines, making multiple copies of their tomes faster and cheaper then the traditional method of having monks transcribe works painstakingly by hand. An empire with Gutenberg's bible is a more religious empire, and therefore happier. The citizens resist conversion from foreign clerics (Activision, 2000).

Again it shows the use of historical factual information (at least how the game constructs it) with important information for game play. In this case, the citizens of your civilization will be happier and resist rival civilizations' attempts to convert them. Here a cause and effect relationship is developed between religion and happiness, with the Gutenberg Bible providing happiness for the empire. This is important information in terms of the game play, again indicating parameters in the simulation that the player has direct control over. If the player manages to build this wonder before their computer opponents, then they will increase the overall happiness of their empire, allowing them to produce other innovations and units faster.

The information, both game play and historical, was ignored for the most part by the students. Although they read it at the beginning when they first encountered the tutorial windows, they gradually began to ignore them, closing them as soon as the window opened. When questioned about this in the interview, it appears that they felt the information was getting in the way of game play.

Ruman. I couldn't be bothered to read anything.
Q. You couldn't be bothered to read anything?
Ruman. I let Sam do it.
Q. Well what about you though? Were you reading it?
Sam. He was.
Ruman. Some of them.
Q. But you started, everybody started… you all started reading them, then you started to click them away, get rid of that. "That's bothering me." Why?
Ruman. Couldn't be bothered with it.
Carl. Maybe you don't know how to get here or something like that.
Sam. You are right in the middle of doing something, and then that comes up…

Ruman. It's bad news.
Sam. It should be like something at the bottom that flashes, there's this message, then you can click on it whenever you want.
Ruman. Yah but it never says anything good; it always says bad things about us.
Q. What did the messages say?
Carl. To find something…
Sam. About other people were completing or something, ramia or something.
Carl. Rimaia?
Ruman. Ramayana.
Carl. Oh.
Sam. This wonder of the world, and that completed and…
Q. What did the wonders of the world give you?
Sam. Happiness and money, like the pyramids

Several potential reasons for the messages being ignored can be gleaned from these responses. One student complained that the messages only concerned bad news. This is in reference to the warning messages that appeared as their civilizations became increasingly unhappy. The reason these may have been ignored, as one of the students implies, is that they didn't know how to fix the problem. Without knowing how to fix the problems, and with the message continuing to appear every turn because it has not been fixed, they become an annoyance and are ignored. Likewise, the messages concerning the progress of other civilizations began to be ignored by the students. These messages concern the wonders of the world. When a rival begins to build a wonder the game lets the player know, presumably so they can then begin building it. In this case the message was that Brian Boru of the Irish was working on the Ramayana. Similar messages also occur when a rival civilization is nearly complete with a wonder. Once a rival completes a wonder, no other civilization may build it. The text boxes act as an impetus for you to complete the wonder quickly, so you maintain an advantage over your rivals.

It is clear that the students, one in particular, understood the benefits of completing the wonders. However, the messages concerning them were an irritant that interrupted game play, particularly those messages that warned them about competing civilizations. Deleting them may however have been detrimental to their initial attempts at navigating the game space, as evidenced by their starting over. They did learn how to play the game, as evidenced by their subsequent success. Of course once again the short amount of time that they were observed playing the game needs to be taken into consideration. Although they initially seemed successful when they started playing the second time, this may not have continued as the game takes several more hours to complete. However, given that they appeared to be making sense of the game play, it may be assumed that their success would have continued given more time. Importantly, they appear to be learning through a trial and error process rather than from the messages given by the game or from the player's manual, which they briefly examined, and then ignored.

I learned to play the game in a similar manner. While I did examine all the messages in more detail than the students did, I was doing so for the purposes of this study. It did not alter the trial and error manner in which I learnt to be successful in the game.

A possible conclusion that can be drawn from the game-playing pattern of the students and my own experience with the game is that while ***Call to Power II*** is a game thoroughly connected to a notion of history there is no reason to use or learn that historical information. The students did not make the connection to history or demonstrate any understanding of how history is constructed in the simulation's model. One student did indicate an understanding of an interpretation of the historical model used by the game, but his explanation of the model was in part a result of responding to leading questions, leaving any conclusions problematic. The students did not noticeably leave the game knowing any more factual historical information, even though the game offers opportunities to review large amounts of this information. The results then, do not appear to support the notion that the underlying model was accessible to the students, at least in terms of the historical material. However, the students' success with the simulation may indicate that they are developing an understanding of the simulation's model in terms of the cause and effect relationships that affect the success of their civilization. Why then did they fail to acquire the historical model from the simulation? Why use history as the basis for the game, if it not necessary to learn it to play the game?

To examine why the history provided by the model was not acquired by the students, it is convenient to examine ***Call to Power II*** in comparison to Logo. This comparison is justified by the previously established connection between the educational intentions of microworlds, such as Logo and simulations, namely the claim that, through their use, the learner will gain an understanding of the model. Through this, they will gain an understanding of the subject or system upon which the model is based. This comparison is also convenient given the extensive literature associated with Logo as a tool for learning.

Papert's book ***Mindstorms (1984)*** was the work that set out most of the goals and ideas associated with the Logo learning environment. In it, he states that the turtle graphics of Logo are, "easily learnable and an effective carrier of very general mathematical ideas" because it is a program designed for children to make sense of maths (Papert, 1984, 63). Thus Logo teaches children mathematical ideas as well as mathematical knowledge, or knowledge about learning, with the most important mathematic principle being: "make sense of what you want to learn" (Papert, 1984, 63). It is Papert's assertion that the ability to make sense of Logo will help students make sense of maths outside of Logo, because turtle geometry "opens the door to an intuitive grasp of calculus, physics and mathematical modelling as it is used in the biological and social sciences" (Papert, 1984, 68). This is a significant claim for one program to make, but larger claims are made for Logo as a developer of problem solving skills. Beyond maths and specific mathematical content, it is also the contention of Logo enthusiasts that use of the program will lead to the acquisition of problem solving skills that will be applicable to all problems faced in and outside of the education environment (Boecker, Eden and Fischer, 1991, ix,). Papert provides evidence to support his claim. However, this evidence is anecdotal in nature, and as critics have pointed out, most support that Logo "can teach mathematical concepts, alleviate a fear of maths, provide an environment in which children feel in control and can succeed…and in general teach children how to learn" comes from "observation of positive student reactions to Logo rather than from empirical research" (Horner and Maddux, 1985, 45). It is necessary then to look at other research to try to establish these pedagogic claims and examine their connection to ***Call to Power II***.

There are no such direct claims for ***Call to Power II***, the literature accompanying the game only makes an association between the game and history. Nowhere are claims made that the user will be learning history, only changing it. The implication is, however, that in order to change it or manipulate it, the player must learn or know something about it first. Given that ***Call to Power II*** is a simulation, the same learning potential that is argued for simulations and microworlds should be present.

It could also be argued that the potential for the development of problem solving skills could also be present. The assertion that Logo allows for the development of problem solving skills is based in part on the notion of program debugging (Bass, 1985, 110). Through debugging, the child can make sense of Logo, and thus make sense of maths in general because "in debugging one must first understand how something came to be that way" in order to able to correct the problem (Bass, 1985, 110). As children build programs with Logo, they encounter systems they construct that do not function as they had anticipated. In order to fix these problems, the child must identify the bug in the program and make the appropriate corrections. These problem-solving skills become part of the stock of powerful ideas that are built in microworlds that can be applied to different situations (Lawler, 1997,51). It could be argued that the same will take place with ***Call to Power II***. In this case, the debugging is not of the programs the students are building, but in terms of building a successful empire, the trial and error process of navigating the simulation.

Lawler, who studied his own children's use of Logo, contends that, children after playing in these microworlds will better understand "what's what…whether they face problems in a more formal environment or solve problems of their own posing" (Lawler, 1997, 51). Lawler bases his arguments on observations of his children using knowledge structures that he credits to the use of Logo in situations outside the program. One example he provides of this is his observations of his son Robby using stepping variables while playing a geometric paper game (Lawler, 1997, 75). Lawler states that his son's approach to the game, to step the variable by which he means "the development of the decision to apply a systematic mental procedure for isolating and incrementally changing one of several variables"(Lawler, 1997, 64), came directly from his child's use of a similar approach to changing the shape of his Logo creations (Lawler, 1997, 70). He suggests that his son was applying a mathematical concept developed in Logo, and also employed his debugging skills to explain why an expected shape in the paper failed to appear. Beyond maths, Lawler offers the example of his daughter's use of a Logo based reading program. In this case his daughter Peggy uses a simple microworld to learn her ABC's and then begins to apply the knowledge structures she develops to books (Lawler, 1997, 23-24).

Resnick and Ocko's research into the use of LEGO/Logo, a program combining the programming structure of Logo and building a robot with LEGO bricks, showed that students could learn mathematical and scientific concepts through the use of the program (Resnick and Ocko, 1988). Again they produce evidence that students, when presented with the opportunity to design their own worlds, will transfer what they learn in these worlds to other situations. Like Lawler's work, this case study lends credibility to Papert's claims for knowledge's transferability from Logo worlds to other situations. They also lend support for Logo's use as a method to encourage problem solving, through program debugging. Two questions arise out of these empirical studies, one concerning the role of the teacher and the other concerning the nature of the knowledge that the students appear to construct.

Is the knowledge constructed by Lawler's children and Resnick and Ocko's students the formal academic knowledge that Papert appears to be claiming can be constructed? Laurillard believes that the use of Logo and other microworlds does not build academic knowledge, but experiential knowledge (Laurillard, 1993, 143). The user develops an intuitive sense of how the microworld operates. This appears to contradict Papert's ideas that microworlds will bypass the long route into the formal knowledge that they are based on (Papert, 1984, 124). Instead of accessing the formal mathematics of geometry through non-mathematic means, like Turtle Geometry, the user is simply experiencing it in another form (Laurillard, 1993, 143). The implication is that the same is occurring in ***Call to Power II***. The students are simply acquiring an intuitive sense of how to navigate through the simulation. Evidence for anything beyond this intuitive understanding is not present in either the observations or interviews of the students. It could, of course, be that the wrong approach was taken in the interview to find evidence of this. However based upon what was asked and observed, evidence indicates only intuitive learning of how to win the game. Laurillard still sees this experiential/intuitive knowledge as valuable and as a potential way to build the academic knowledge that Papert seeks (Laurillard, 1993, 144).

This intuitive learning seems to contradict Friedman's assertions regarding computer games, specifically his assertions made for the learning potential of Simcity. If the player is only accessing the model in an intuitive/experiential sense, such as Turkle and Laurillard suggest, then they may not get an explicit understanding of the model. Even through repeated and extended play, the player may never acquire the principles of the model. While the amount of time spent on the game by the students limits the applicability of this assertion, my own experience with the game would appear to support it. While I do feel I gained more in terms of the historical connection and the historical model, I do not feel, even after several repeated and extended plays, that I have more than an intuitive feel for the actual model used to simulate the game environment. I do feel in more a positive position to make a guess as to its nature, which is more than I would say for the students based on my observations. This difference may lie in the approach we took to the game. I played the game with the ***intention*** of learning the model, and examining it in terms of its use as a historical teaching tool. The students had no such intentions; they approached it as a game to be played.

Therefore whether or not the knowledge constructed should be considered experiential or academic, the question as to how much or how little instruction is needed to construct it, or move from one to the other as Laurillard suggests, is still present. Lawler at times appears to be guiding his children rather closely. He appears to act less as a facilitator and more as an instructor, in order for his subjects to make connections between Logo worlds and other worlds (Lawler, 1997, 58). What needs to be examined then in these cases is the role of the teacher/researcher, as other research has shown this may be the critical element as to whether the transfer of knowledge claimed for Logo takes place. If a case can be established for Logo, then such transfer of knowledge may apply to ***Call to Power II*** as well.

Littlefield, Delclos and Bransford studied two groups of students that encountered Logo through two different teaching strategies, the first an unstructured discovery learning environment, where the teacher's role was to "observe and answer questions" and a structured environment where "the teacher's role was to ensure that the students worked on the assigned task and to answer questions" (Kinzer, Littlefield, Delclos and Bransford, 1985, 35). The conclusion of the researchers was that there was little difference between the two methods of instruction, in so as far the acquisition of knowledge specific to Logo is concerned. They did, however, indicate that they felt that their observation technique might have been at fault, as it is difficult to observe learning in a Logo classroom in a traditional sense (ibid, 42). This is commonly cited as a difficulty in the examination of open learning environments (Martin, 1986, 12). Similarly, a study by Horner and Maddux found that the results of their investigation did not support the conclusion “that instruction in Logo will positively affect problem solving ability, produce more internal locus of control, produce more positive attitudes toward mathematics, or increase the ability to recognize the size of geometric angles” (Horner and Maddux 1985,53). They were using a pre and post-test procedure to assess learning. They explained the student’s relatively poor performance with reference to the length of the time spent working with the program by the students (which may not have been sufficient), to post-test apathy (Ibid. 50). Most significantly, they indicate that their study may not have been “structured so that students could generalize what they learned with Logo” (ibid, 51). In other words the students didn’t receive instruction as to what they were learning, resulting in a failure for the students to make the connection between what they learned in Logo and the maths on the tests. Without the teacher indicating that they were learning maths, the students failed to learn maths (Clements, 1985, 68).

This is very similar to the observations made in regards to ***Call to Power II***. Because the students were not told of the connection between history and the game, they did not make the connection. Again it points to the potential need for a source of direction or authority in order for learning to take place in these environments.

7.3 ***Why use history?***

If the player is not required to learn the history embedded in the game, then why make the connection to history at all? One possible explanation is that history provides a convenient entry point into the game narrative for the player. The pyramids are recognizable objects. Ruman associated them with history when questioned, but most importantly he recognized them, he knew what they were. The same is true of the other objects in the game. The cannons are recognizable objects. The player immediately knows what to do with them; cannons are used to fire cannon balls at the enemy. If a different object was used, the player may eventually discover through investigation what purpose it serves, without the game having to interrupt in order to explain the purpose of the object. Despite the fact that the game uses known historical entities, some interruptions of the game-play did take place to the annoyance of the students, who, as previously indicated, saw this as a disruption to their goal of winning the game. These interruptions were designed, in some cases, to introduce factual historical details to the player.

In an examination of the early computer text game ***Zork***, Murray (1997) postulates that use of a Dungeons and Dragons[5] type setting provides an easy entry point for the players. This is a world with which they are familiar and therefore would know the appropriate actions to take in order to navigate this world. This fantasy environment "provided the interactor with a familiar role and made it possible for the programmers to anticipate the interactor's behavior" (Murray, 1997, 79). The same may be true of ***Call to Power II***. The use of history provides the player with situations and objects that they are familiar with, giving them an intuitive sense of how to navigate in this world. From this it can be argued that ***Call to Power II*** is not a game about history at all, but a game that uses history as a familiar entry point for the player.

Evidence for this perspective can be found in the way the game uses historical objects and concepts. Communism, which could be seen as a key to understanding the history of the 20th Century, is defined by the game manual as a type of government that "affords high productivity and is well-suited to medium sized empires wanting to build up their cities and military" (Activision, 2000, 53). It further states, "communist empires tend to have poor economies in comparison to others, but are excellent at

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[5] Dungeons and Dragons is a role playing game set in a fantasy land populated by mythical creatures and monsters. The players usually assume the roles of heroes and participate in quests.

waging war" (Activision, 2000, 53). While this research is not an attempt to judge the historical content of the game, it is difficult to accept this statement as a serious attempt to make an historical judgment about the character, impact or validity of this form of government. Instead the use of 'communism' in this capacity may be interpreted as a convenient and highly recognizable label for a parameter that influences game play. By implementing a communist government the player will see their military preparedness increase and their economies suffer. This will affect how they can interact within the game environment, but the type of government could have been called something else. Communism is simply a recognizable label to the player.

Call to Power II could have been constructed without reference to history at all. Another recognizable sets of icons and ideas could have provided the entry point for the game narrative. ***Sid Meier's Alfa Centauri*** is an example of a game with essentially the same goals, to build the most powerful civilization. However, in this game, the narrative takes place in the future on a newly discovered planet, the player's civilization must compete with the computers to colonize the planet's surface. Instead of history acting as the interactor, science fiction is the used to give the access to the range of actions available in the simulation. The use of science fiction is also present in ***Call to Power II***, when the civilization advances to a point beyond the present day. This serves to illustrate that other interactors could have been used to accomplish the same game playing experience; history in this case provides a readily accessible block of familiar objects, an entry point into the game's story line.

If history is simply used as a recognizable set of objects to supply and entry point into the game into the narrative, it further explains why the students did not acquire insight into the game's historical model. The game does not require the player to learn the history, or how it is

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The game environment is set and controlled by another player call the Dungeon Master. While computer game versions exist, Murray is referring to the original tabletop version of the game.

constructed by the simulation, but simple recognize its association to history.

7.4 ***Narrative***

While the use of history may have provided an entry point for the students into the narrative, the narrative itself may have limited the immersive power of the game environment and therefore limited the learning potential of that environment.

An explanation for the lack of learning that took place when the students played ***Call to Power II*** may lie in the narrative structure of the game itself. As previously stated in the methodological section, the students were experienced, if not eager game players. Ruman seemed the most enthusiastic about computer games of the three, indicating that he played up to eight hours a day if given the opportunity. It was therefore surprising that the students, especially Ruman, seemed less than enthusiastic about the game while being observed playing it. Their willingness to give up their lunchtime, in order to participate in the study, lends evidence to their enthusiasm for computer game playing. It was therefore surprising when they didn't find this particular game engaging. They did indicate that they would continue playing the game, but it appeared to be a less than enthusiastic endorsement.

Ruman in particular complained about the lack of a goal in the game, he didn't feel that there was one, or at least not a compelling one. In contrast to this he cited his favourite game ***Final Fantasy 9***. This is a popular role-playing game (RPG) series, both for the computer and video game console. When asked about the differences between ***Call to Power II*** and ***Final Fantasy 9*** Ruman and the other students responded with the following;

Ruman. Not with Final Fantasy it's different
Q. Why is it different then..?
Ruman. Because you have loads of missions to do, when you lose you're not going to do this thing all over again, it's different
Q. But once you solve a mission… how long does that take for one mission to solve?

Ruman. Depends what kind of mission it is
Q. Just give me an estimate
Ruman. Um…
Carl. Twenty minutes
Ruman. Yah around twenty or thirty minutes
Q. About twenty or thirty minutes, so after you're done with one mission, why don't you just stop then?
Ruman. I know but you get new mission
Sam. Its like…. Its like you want to play it
Carl. Yah you want to play it (said at same time as S)
Sam. It's like you're addicted to it
Ruman. It's a good game; there are many games like that, lots of them
Sam. You want to see what happens next.
Q. You what to see what happens next.
Sam. Yah
Q. So you just want to keep playing and once you solve one mission you just got to do the next one.
Sam. Yah
Ruman. Yah

Ruman's comments indicate the compelling power of ***Final Fantasy 9***, particularly the need to continue playing in order to see what happens next in the game. Murray sees this as the immersive power of a narrative environment (Murray, 1997, 98). Clearly the students did not achieve this immersion. This may have been because as the following illustrates, they failed to identify with the goals of the game.

Q. What was the goal of the game? You were saying that it didn't really have a goal.
Ruman. It only had one goal, and there are a million in other games like RPG's
Q. So final fantasy has a million goals?
Ruman. Yah it goes like from on to another like that
Sam. And missions
Q. And this game didn't have any goals, or just had one goal.
Ruman. Yah
Q. What was the one goal than?
Sam. Complete the map, find the civilizations and...
Carl. Build more cities and all that
Ruman. Kill everyone, and be the last one there
Sam. No um...
Carl. What happened to that Caesar?
Sam… make the people happy, give them all you want, all they want.
Q. Aren't those little… each new discovery, isn't that a goal? You guys built a ship, if you would have kept going you could have built cannons, if you would have kept going you would have had airplanes and then eventually you would have had...
Sam. Genetic um…
Q. Genetic engineering, then computers
Sam. Cloning...
Q. Aren't those goals?
Sam. Yah
Carl. Yah
Ruman. You didn't exactly have to do it though. You didn't have to do it though, if you didn't want to.
Q. You didn't have to do it.
Sam. No you could build another one, build something else
Q. You could just pick any goal….

Ruman. That's what we did last time remember… that's how we got the cannon
Q. So you would rather have the game telling you what to do?
Ruman. Yah except Sam could read it
Q. What do you think Sam, would you like the game to just tell you what to do?
Sam. Well yah, but…
Ruman. Boring
Sam. (Unintelligible) right, you can choose what you want but it will help you with it, tell you, tell you what
Ruman. Give you advice
Sam. Yah things like that
Ruman. It just said your people are unhappy, do something.

While they could see the overall goal of the game, it appears that it was too distant. The intermediate steps towards that goal, that I found compelling, were not of great interest to the students. The reasons why the goals were of little interest to the students may lie in two areas that Murray identifies. The first is that the game lacks an avatar with which to identify with (Murray, 1997, 113). An avatar acts as a threshold maker, like the transitional objects of Winnicott, a way to enter the simulation, an entity to control. While the game does provide the units, that can be manipulated, this does not appear to satisfy the needs of the students. This may be the result of their comparison of this game to ***Final Fantasy*** and other role playing games, where the player invests effort into the creation of their screen character. In the case of ***Call to Power II*** the player is investing in the creation of an empire, with more control than any one emperor would actually have. Murray likens the control in such simulations, for example ***Simcity, Sid Meier's Civilization***, to that of a god "than to any real-life political leader" (Murray, 1997, 88), a god that does not have a screen presence. This may then limit the immersive qualities of the game environment; there is not a second self that the player can identify with in the game.

Related to the immersive power of the game environment is that which Murray terms as agency, "the satisfying power to take meaningful action and see the results of our decisions and choices" (Murray, 1997, 126). While the player does see the results of some of their actions, agency in ***Call to Power II*** is limited. While the player can see aspects of their empire change with their actions, such as roads being constructed between cities and the icons representing the cities changing as the cities grow. They do not see into their cities. The result is they do not see the shrines, arenas, stock exchanges, or wonders that they made their various cities build. This contrasts to other simulations like ***Simcity***, where the player sees all that they have constructed. This is also in contrast to the first person shooter games[6], such as ***Half-life***, where the player's actions result in significant changes to the game world. Bombs are set off to remove walls, buttons are pressed to open doors, and wooden crates are smashed during fire fights, leaving blood, bullet holes and destroyed equipment behind.

This frustration with the lack of agency was expressed in the interview in relation to the pyramids. The students compared ***Call to Power II*** with a similar game, ***Age of Empires***. Again this illustrates the effects the game's narrative structure may have had on the experience of playing, and therefore its potential as a learning environment.

Ruman. When you build something you see it
Q. When you build something you see it? You would rather... You would like to see the things you build?
Ruman. Yah, like the barracks and stuff
Q. But don't you. Oh you mean like pyramids and that sort of thing.
Ruman. Yah
Sam. Yah
Carl. Yah
Q. You get to see the units you build, like the archers you build
Ruman. But its different, when you build like a wonder like the pyramids…
Sam. You get to see people
Ruman. You have to keep it on because people like come to destroy it. So you have to keep it for like 3000 years.

The final factor associated with the game narrative that may have limited the involvement of the students and therefore the learning, is the encyclopedic nature of simulation games. Murray contends that "simulations like these take advantage of the authority bestowed by the computer environment to seem more encyclopedically inclusive than they really are" (Murray, 1997, 89). While the game environment may feel

[6] This refers to the position that the player's avatar occupies in the game. In a first person game the player is positioned as if looking out of the avatars eyes into the game world. The result is that they only see the hands, or weapon that the avatar is holding. A third person perspective interface has the player assuming a position just behind the avatar, allowing the player to the entire game character, although in games such as Tomb Raider that use this format, the player generally just see the back of their character.

open to the choices of the player, the player is actually constrained within the parameters of the simulation model. The data collected here does not imply that the students felt they could do anything they wished within the simulation. But the encyclopedic environment can distract the user from the asking questions as to the nature of the model. In this case the large game world in which the player interacts may hide the model from the player. Murray contends that multiple plays will be needed in order to discern the patterns in the game and through this the assumptions, in this case about history, that were used to construct the model (Murray, 1997, 90).

There is no evidence from this study to support the notion that a more immersive environment would have led to greater access to the historical model, resulting in new knowledge about history, nor is there evidence about whether multiple plays would have given further access to the model. The data does however raise these issues, by showing the students apparent lack of interest in the game. It is equally important to note that Murray does not provide extensive empirical evidence to support her views on the narrative environment, only anecdotal references.

8. Conclusion

This study began as an exploration of computer game environments. As it proceeded, the link between computer game simulations and microworlds such as Logo became apparent and became a useful starting point through which learning activities in computer games could be assessed. From the observations and interviews with this very small sample, it is apparent that the students did not learn the underlying model of the chosen simulation. The player was not required to access the model's structure in order to play the game. They instead navigated it only by feel. This may be the result of the study being carried out in an open environment. The students may have accessed the historical model if they had been told to do so before they began playing.

Games that claim to represent a historical model are not necessarily appropriate teaching and learning tools for school history. Simulations appear to be of little educational value if the model cannot be accessed. This argues for close teacher direction if the use of simulations in history is to be educationally valid in terms of measurable ‘knowledge’ outcomes. From this research, computer games in general do not appear to offer a pedagogic environment. The focus for the player is to play and win the game-the research subjects were concerned to know ‘how to win’. The notion of learning whilst playing was never explicit or implicit in anything the students said.

How would the students have reacted to a more instructionist approach to the use of ***Call to Power II***? While additional research would be necessary to generate data to examine this question, it is possible to make some speculations. Computer games are ultimately disposable objects. New games and new additions to old games hit the retail shelves at a rapid pace. It is a rare game player who doesn’t pick up a copy of the next ‘greatest game ever’. Fans of the original ***Call to Power*** would quickly buy part two. Often web sites devoted to discussing a new game appear even before that game is available to purchase. This builds up the excitement surrounding the game and makes it even more desirable. Old games are quickly abandoned for the new. It is therefore rare that games are played the multiple times that it may take to go beyond the intuitive navigation that was perceived to be taking place in this study. Games are disposable; in this research the historical facts embedded in the game were even more disposable, what remains is the navigational skills, which will be used in the next game.

There are those who take a keen interest in one game and continue playing it long after others have moved on to newer ones. They can be seen as the ‘nerds’, sticking with an unpopular game when the trendy players have left. It may be these game players who have the best chance of gaining an understanding of the system of the simulation. They achieve this, not through playing the game, but through direct access and manipulation of the model, the computer program itself. This is manipulation of the model's programming, producing new scenarios, levels or objects with in the game, for others to play with. A recent example of this is the game ***No One Lives Forever***, a first person game similar to ***Half life.*** The producers of the game, after the game had been on the market for six months, released the game's source code. This often happens when newer games have entered the market. The old game is no longer a viable product, but interest can be maintained for future additions, by giving the fans who have stuck with it power over the model. The source code is the language that built the model. With it, the faithful can build upon the game. This can be seen as a recontextualization of the simulation, from a game into a different activity altogether, using the programming language to build their own version of the game for others to explore.

This same recontextualization may take place if the students are asked to approach the game with the intention of learning history. ***Call to Power II*** would cease being a game and would become a school lesson. This could change the way the students engage with the text, by asking them to go beyond the surface navigation that they associate with games. It may be this 'play by feel' nature of computer games that makes them enjoyable. Any attempt to make the students learn the history may break the fantasy that the narrative has built.

This line of thought can be expanded into other areas by examining Logo. Unlike ***Call to Power II***, Logo is designed for learning. But if students approach Logo as a game, then imposing a direction or learning goal would recontextualize it as a school lesson. Just like computer games, there is no reason for the student to learn maths to play in the Logo world. Imposing the requirement to learn maths could change the "carefree spirit" with which Papert suggests students approach Logo (Papert, 1984, 42). The game environment is what matters, changing that environment changes what will take place when the student uses it.

Additional exploration into how girls would have approached this game would be interesting and useful. It would be difficult to suggest that girls would have had the same reactions as the males in this study, given what has been previously noted as differences in game design preference between males and females. An exploration of how students who are not avid gamers would react to this game environment would also be useful in furthering this research. While the self-reporting that the students made about their game playing may be unreliable, especially as they were asked in a group (they may have been trying to outdo one another), all students who took part in this study were game players. Had they not been, their style of game play may have been different. The ease with which they were able to navigate the surface of the simulation may not have been present.

It would be interesting to examine what would have happened if the students had been given more time on the game. Due to time constraints, the students did not progress very far into the game's narrative. Given more time, the students may have felt more comfortable with examining other area of the game, such as the historical content in the Great Library.

Given that computer game playing is an increasingly popular leisure activity and that so called 'edutainment' games are prevalent in schools and widely available in the market place, a more sophisticated examination of what students are learning in these environments is essential. This study has focused on a game that does not explicitly proclaim itself to be a learning tool. However, the research tentatively suggests that game play can serve, not as a learning tool, but as a distraction from learning. Models do not need to be understood to be successfully manipulated in the game environment. Computer games are not necessarily the easy route to the knowledge embedded in simulation models.

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