

# UNDERSTANDING VIDEO GAMES

## THE ESSENTIAL INTRODUCTION

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## 9 SERIOUS GAMES—WHEN ENTERTAINMENT IS NOT ENOUGH

ADVERTAINMENT/POLITICAL GAMES/TRADITIONAL GAMES FOR SERIOUS PURPOSES/CATEGORIZING EDUCATIONAL COMPUTER GAMES/THE RATIONALE BEHIND EDUTAINMENT/THE INSTRUCTIONAL APPROACH TO EDUTAINMENT/THE MODERN APPROACH TO THE EDUCATIONAL USE OF COMPUTER GAMES/THE EDUCATIONAL EFFECTIVENESS OF VIDEO GAMES/FINAL REMARKS

Can you name the seven wonders of the ancient world? If so, perhaps you are a trivia buff, or a world traveler. Or perhaps you are among the millions of people who have played *Civilization*, leading an entire people to glory and world domination. In this groundbreaking game, the player must develop a civilization of her choice, starting anywhere from a band of early American settlers to a modern nation spanning entire continents. Along the way, the player must absorb a wide range of historical knowledge while combining an understanding of geography, economics, and cultural history to adapt and prosper.

This chapter deals with one of the most nebulous and contested issues in the game world: the value of it all. We know that games serve, first and foremost, to entertain. As we contemplate the moneymaking juggernaut that is the gaming industry, it would be foolish to argue that anything is as important—read: profitable—as entertainment, although the other uses of games are growing these years. But beyond fun, what do players take away from video games? Not on a cultural level, but in terms of getting influenced on an individual level. Do players learn from video games, and if so, what do they learn? Is a video game capable of imprinting the Nike logo on a player's retina like in the ambitious Nike soccer game *Secret Tournament* developed for the World Cup in 2002? In the game you step into the shoes of world-class soccer players and have to survive a two a side soccer game staged in a cage. Could players be persuaded to join a political organization that advocated its message through video games like in the game *Ethnic Cleansing* where Jews, Mexicans and other ethnicities are offered as the only true enemies in an otherwise classical style first-person shooter game? However distasteful, the message is clear, and converting impressionable teenagers to a racist agenda is the clear goal. Can players learn about European history by playing *Europa Universalis* where through trade, diplomacy, colonization and war you have to carve out a place for your medieval nation?

Above are only a few of the titles and basic questions gathered under the umbrella term **serious games**. The term serious games was coined by the American academic Clark Abt in 1968, and was the title of his influential book.<sup>1</sup> Today, the label refers to a broad swathe of video games produced, marketed, or used for purposes other than pure entertainment; these include, but are not limited to, educational computer games, **edutainment** and **advertainment** (terms we'll define below), and also health games and political games. As we'll see, serious games span a wide area, and the games in question need not be originally conceived as "serious." In theory, any video game can be perceived as a serious game depending on its actual use and the player's perception of the game experience.

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The breadth of what constitutes a serious game entails that very different research traditions and approaches converge on this topic. Early examples of research interest in serious video games are the work of psychologist Patricia Greenfield (1984) with her book *Mind and Media* that deal with the influence of among other things how computer games influence individuals' development; Thomas Malone (1980; 1987a; 1987b) with his work on motivation, education and video games; and psychologists Geoffrey and Elizabeth Loftus with *Mind at Play* (1983) on the cognitive learning gains from video games. In recent years interest has increased, with academic contributions from the fields of literacy with the work of James Paul Gee (2003) on basic learning principles of mainstream entertainment games, and socio-cultural theory by Kurt Squire (2004a) on the implications of actually using mainstream entertainment games in real classrooms. But in general it has been the discipline of education that has tried to understand educational use of games for example the work of Angela McFarlane et al. (2002), Marc Prensky (2001), John Kirriemuir (2002) and Simon Egenfeldt-Nielsen (2005).<sup>2</sup>

Before turning to educational games that dominate the field of serious games, it is worth examining other upcoming serious games areas like advertainment and political games. The research on these types of games is still very limited but this is changing.

#### ADVERTAINMENT

Advertainment is a fusion of advertising and entertainment, and refers to video games used for marketing purposes. Advertainment has grown considerably since its origins in the mid-1990s, led by an increasing interest from major companies around the world. Such growth has been facilitated by an abundance of new software, including Shockwave, Flash and Director, which require much less technical knowledge than earlier gaming tools that was mostly built in-house by game companies with limited documentation. The World Wide Web now means that anyone with a web page can "publish" a game, thus circumventing the traditional channels for reaching the game audience. Global brands in particular have been eager to produce advertainment titles, to attract traffic to their websites and increase brand awareness: a small sampling of recent games includes *The Beast*, developed for the Steven Spielberg movie *AI*, *Nokia Game* a returning game for Nokia, *Nike Goal* for Nike, and *Stolichnaya* produced for the vodka company of the same name.

Companies like these especially appreciate the active participation required to play these games; while playing, we are relentlessly exposed to the companies' products—which are incorporated into the gameplay in more or less creative ways. While playing an advertainment title, in other words, we are literally helping to build the company's brand in our own and others' consciousness.<sup>3</sup> Gardner stresses the difference between integral games and giveaway games, which refers to a classic problem in using video games for serious purposes. Some serious games will not really integrate the message they want to get across with the gameplay. These are called the *giveaways* whereas the *integral games* integrate the message in the gameplay. Integral games are usually more difficult and expensive to develop, but also result in a stronger impression and user experience.

There is limited research into advertainment but it is considered one of the best means to draw visitors to web sites. And by making these interactive commercials fun for the consumer, these games facilitate exposure to the brand that can last a lot longer

than a typical commercial. The global companies with leading online presence—like Lego, Nike, Disney, and Coca-Cola—continue to harness the potential of video games because they seem to work. Companies often keep the results to themselves but Toyota's *Adrenaline* racing game from 2000 was found to increase brand awareness considerably among consumers. According to company's own survey Toyota went from a number six ranking among major car brands to number two a mere three months after game launch.<sup>4</sup> Full-fledged video games are also increasingly considered a medium for mainstream advertising. And not just to reach reclusive adolescent boys but increasingly as a more mainstream advertising tool.

As video games reach a broader audience, product placement becomes a more appealing option for a wider variety of global brands. Product placement differs significantly from traditional advertainment games as product placements can in principle be implemented in any computer game, and not a specifically developed game as such. Though product placement began in racing and other sports games, as well as games that featured virtual worlds, today we encounter product placement in virtually any genre. We see product placement even in the abstract *Super Monkey Ball*, a game, which bears no resemblance to the world, we live in. The player picks up bananas labeled with the Dole brand name. The launch of *Super Monkey Ball* became part of a cross promotion with Dole to introduce a "luxury banana" in Japan.

Although a game may seem to feature product placement, that need not, of course, be the case. To increase realism, many video games try to model the game environment as closely as possible to the real world, leading to incidental product placement. Still, the last five years have seen an increased amount of actual product placement where companies are paying game publishers rather than the other way around. Product placement is also beginning to mature, as new companies now specialize in product placement and offer what they refer to as "dynamic implementation" of an ad product, which can be inserted and continuously updated across a number of titles that all have online access.<sup>5</sup>

Most advertainment is simply an extended version of product placement. However, sometimes advertainment *does* try to actually use video games to create a different advertising experience. One example is the home design game for high schools by the organization for interior architects. The intention behind this game was to bring new, talented people into the business by letting students experience what it is like to work as an interior architect. This provides a truly different user experience from other commercials by bringing users into the actual product, and letting them become part of it. The same is the case in the area of political games, where organizations attempt to bring users closer to their agenda, and participate in universes reflecting their world view.

## POLITICAL GAMES

Political games are generally more ambitious in their game design than the advertainment titles we saw above, but also aim to affect the player through (more or less) hidden messages.<sup>6</sup> Some significant early attempts of constructing video games with a political agenda were *Nuclear War*, *Balance of Power*, *Hidden Agenda*, and the neo-Nazi game *Purging Germany*. All of these games tried to set a political agenda, and could in some sense be called educational; however their goals were quite special. Some served more as comic strips or propaganda leaflets than real games. They wanted to present a specific message, and this message had strong political undertones. In

*Nuclear War*, for example, the inevitable destructive consequences of nuclear war were caricatured in "Spitting Image" style, which is a cartoonist's caricature of world leaders. The subversive use of video games has always been present within game culture, but became less of a factor as the industry matured commercially during the 1990s.

However, political games have made a comeback in gaming subculture since the terrorist attacks on September 11, 2001. Many of these games have paralleled the fight on terrorism, and serve as part of an ideological crusade against Osama Bin Laden in particular. The subgenre is still emerging and research is quite limited, although news articles have hailed political games as "the next big thing," especially in connection with the 2004 U.S. presidential election.<sup>7</sup> Some recent well-known examples of using video games for political agitation are: *September 12th*, *Ethnic Cleansing*, *Michael Jackson Baby Game*, *Kaboom Kabul*, and *The Howard Dean Game for Iowa*.

*September 12th*, serves as a good example of this recent crop. In this simple, single-screen game, the player overlooks a village filled with both terrorists and civilians. The player's only option is to fire missiles to kill the terrorists or do nothing; the firing of the missile will inevitably result in civilian casualties. The deaths of innocent victims will draw mourners, who will also be drawn towards terrorism; the player watches as almost the entire village population become terrorists. The player cannot win the game, and does not get any points. All he can do is observe, and become more frustrated in his powerlessness. Circulated on the web in 2003 by Gonzalo Frasca, developer of the game and game researcher, *September 12th* is barely a game, but its criticism of the war on terror is clear.

One of the most discussed examples of political games is *Special Force*. Developed in 2003 by Hezbollah, the political party, social institution and/or terrorist group based in Lebanon depending on your source and outlook on the world, the player is set in the middle of the resistance against Israel in southern Lebanon. The goal—hinted at by the website's claim that the game includes "all that an anxious persons dreams of in order to participate in facing the Zionist enemy"—is to influence public opinion against the Israeli occupation.

These examples fit the informal definition of political games presented by Karlsson who writes that a political game

... wants to communicate a specific message or perception of the world. Play becomes secondary. This does not mean that the gameplay necessarily lacks in any way. America's Army is hugely popular because of excellent gameplay, but play is still instrumental as regards to the U.S. Army's overriding goal.<sup>8</sup>

The game Karlsson refers to is one of the most successful efforts at political gaming, although some will deny its political connotations. Available free on its own homepage, it is explicitly offered as a promotional tool to "inspire" young men and women to join the U.S. army. However, its popularity has been a huge surprise for many, and some speculate partly in jest that without the game the United States would not have been able to continue the war in Iraq due to the lack of recruits.

Political games often overlap with the category usually referred to as news-gaming. At [www.newsgaming.com](http://www.newsgaming.com), for instance, game designers try to illustrate conflicts in the current public debate—like airport security—through video games. Most controversial is Kurna Reality Games that develops episodic games allowing players to "Play

accurate re-creations of real war events weeks after they occur." Here, players are able to play recent newsworthy event like the Iraq invasion or the Afghan fighting on their computers while receiving news analyses and video material. The games are built up as a classical first-person shooter. A more subtle and serious attempt of developing episodic games about current news is the collaboration between Persuasive Games and the *New York Times*. The popularity of this broad category of political games implies that at least some gamers do not mind a heavy-handed message as long as its delivered with something they can play.

Having covered the smaller areas of serious games we turn to educational computer games that are the main driver of games with an agenda beyond entertainment. This area has a long history, but before turning to the educational use of computer games it is important to consider the kinship with traditional, non-electronic games.

### TRADITIONAL GAMES FOR SERIOUS PURPOSES

The serious games "movement" was born in the late 1950s with non-electronic, pen-and-paper and board games, although the term serious games was coined later. By the 1970s educational games had exploded in popularity, and were becoming an important pedagogical tool, especially for teaching in American businesses and the military. Then and now, the games used in such settings have primarily been simulations—which as we saw in Chapter 4, aim at precisely replicating a real-world event, from landing a plane to implementing city taxes—rather than the more broader category of fictional games including action, adventure and strategy where the replication of the real world can be less strict. One of the first educational non-electronic games, for example, was *Inter-Nation Simulation* from 1958, used in high school social studies classes to teach about international relations. Here, players control one of up to seven hypothetical nations, and need to negotiate with the other, nations in order to solve problems ranging from minor international crises to nuclear war. Another simulation, this one aimed at eleven-year-olds, was *The Sumerian Game* from 1961, where players learned about economic factors in Mesopotamia around 3500 B.C.

Since these initial efforts, the creation and use of these non-electronic—or "traditional"—games has been relatively stable. They were always quite popular with some teachers but never became a core feature of the educational system. Along with their popularity, research into the educational use of these traditional games is now well established in its own right, with peer-reviewed journals, well-known researchers, and substantial research topics. Over the last fifty years, researchers have addressed topics from the learning outcome of traditional games to the practical barriers of using such games. The majority of these findings have a bearing on the educational use of video games. Below we present the most important implications, with brief discussions of the key topics relevant to video games: effectiveness, motivation, debriefing, and the influence of teachers and setting.<sup>9</sup>

The number of studies on the effectiveness of traditional games in education is quite high, spanning more than thirty years of research, and offers good directions. The findings so far suggest that games are a viable alternative to traditional teaching, and provide approximately the same learning outcome—that is, a student has the same chance of learning a piece of material using a game than he does through another way of learning. Games cannot be said to be more effective than other teaching forms, although most studies have offered evidence of better retention over time. Students tend to subjectively rate their learning outcome higher when they

use games, and to prefer gaming to other teaching methods. Thus, for good or bad, even though we cannot objectively measure an increased learning outcome, students often feel they have learned more. Indeed, the preference of students for games fits well with the increased motivation consistently found when examining the educational use of games.<sup>10</sup>

The effectiveness of traditional games relies heavily on how exactly they are used in a teaching environment. Debriefing—the process of reflection after the game has finished—is especially important. Researchers have found that students can make wrong assumptions based on their game experiences.<sup>11</sup> Therefore debriefing is of paramount importance, as the teacher needs to take time to correct any mistakes, clarify misconceptions and expand on the game experiences.<sup>12</sup>

The role of teachers and the setting for educational games have caused a number of problems in these studies. The school setting—with its physical limits in terms of classroom size and logistical limits in terms of available time for teaching—is not very appropriate for using games. In addition, most teachers have little experience using games, and this jeopardizes the learning experience. The teacher's theories of learning—not to mention their opinions about the value of alternative teaching strategies—may also hinder the effectiveness of games.<sup>13</sup> As we can see, the research into traditional games has addressed some of the tough questions of the proper role of games in education. Such research shows no sign of abating, as the use of games in education continues to grow these years. And now, more and more of these educational games are electronic. As we turn to video games, the thirty years of research into traditional games offers interesting insights in relation to games, and these are useful when we engage with video games. Especially, in more recent research on the educational use of computer games that challenge the dominance of edutainment, we see that a lot of the above ideas from traditional games make a comeback.

It is important to understand that there are different kinds of educational computer games, although the term edutainment is usually used as an all-encompassing term for educational computer games and the use of computer games for education.

#### CATEGORIZING EDUCATIONAL COMPUTER GAMES

An important distinction when determining the educational use of video games is the different game titles used. The first, most obvious category is commercial educational video games, often known as edutainment. Edutainment focuses on teaching the player certain specific skills: mostly algebra, spelling, problem solving, and other basic skills. Edutainment titles include *Pajama Sam*, *Castle of Dr. Brain* and *Mathblaster*. In *Mathblaster*, the player must shoot down the right answer to an arithmetical problem to progress in the game; with any luck, the player hopefully learns basic math along the way. Many of the edutainment games are consciously devised to mirror “normal” video games, in order to make them more appealing. However, usually it is a quite dated gameplay and graphics that are implemented. Edutainment titles have a strong educational component but often do not reflect the strong engagement present in commercial titles.<sup>14</sup>

The second category comprises commercial entertainment titles used fairly haphazardly for education. These rarely focus exclusively on one topic and on basic skills. Commercial entertainment video games in this category include *SimCity* and *Civilization*, titles used by several schools. In the game *SimCity* exemplary for

commercial games with educational potential you have to plan and run a small city developing it from a hole in the ground to a bustling metropolis. In order to build a metropolis you have to understand a lot of the basic principles of urban planning like zoning, sewage, land prices, pollution, crime and unemployment. The educational goals of commercial video games are mostly indirect rather than direct, goals that can lead to a skewed focus in the learning process. However, their strength is that the motivational part is well documented through success on the commercial entertainment market. When commercial games like *SimCity* get it right they are an unbeatable educational experience.

The third category is research-based educational video games; these often challenge the existing formula of edutainment (e.g. Hancock and Osterweil, 1996; Malone and Lepper, 1987a). Edutainment originating from research often presents new approaches and has strong documentation for learning outcomes. However, these titles often lack the budgets and technical quality to compete with the more commercial titles. They make a greater impact only if published on the commercial market with some modifications. Exemplary titles are *Oregon Trail*, *Logical Journey of the Zoombinis*, *Phoenix Quest* and *Global Conflicts: Palestine*. In *Global Conflicts: Palestine* you play a journalist arriving in Jerusalem. You have to write stories and in the process find sources, information and recognize different perspectives and agendas to get the right story. The research-based educational computer games are still far between but show that there is a way to combine to strength of commercial entertainment games with education without necessarily limiting oneself to edutainment. Even though we find different expressions of educational computer games, edutainment has come to dominate the area with a very particular approach, which we shall describe below as problematic and limiting.

#### THE RATIONALE BEHIND EDUTAINMENT

According to legend, founder of Electronic Arts Trip Hawkins in 1984, coined the term "edutainment," to refer to any electronic games that use entertainment in the service of education. The label was used with great success for the top-seller *Seven Cities of Gold* about the Spanish colonization of Latin America in the sixteenth century.

While edutainment in the public refers broadly to any electronic use of entertainment for educational purposes, it is manifested in a variety of ways depending on your learning approach. Historically, edutainment started out in the United States in the 1970s as a very fragmented field with different developers picking their own favorite theory from the major learning approaches (behaviorism, cognitivism and constructivism). Early on edutainment drew strongly on existing traditions within educational media, but it became even more marked in the early 1980s. By the 1980s, edutainment basically relied on the learning principles of behaviorism, articulated first by John Watson in 1919. Today, we still have edutainment titles that are similar to the ones in the 1970s and 1980s. The behaviorist approach cares less about the actual connection between the game and the learning experience; the game often simply serves as a reward for learning. This baggage strongly shapes the way video games are developed and used for education even today. So although edutainment does not have to be behaviorist it is often so today, which has increasingly led researchers of educational use of games to look at using commercial computer games. Here they rely on the lessons learned from non-electronic games and simulations, where for example debriefing is critical. Indeed

the limited research on commercial computer games finds very similar results to the extensive research on traditional, non-electronic games discussed previously in this chapter.<sup>15</sup>

So while edutainment started as a serious attempt to create video games that could teach children various subjects it was quickly marred. The reliance on behaviorism resulted in games that relied heavily on simple game mechanics, quite traditional learning principles to the detriment of researchers and many parents.<sup>16</sup> Today edutainment tend to focus on simple game structures, which provide a limited learning experience for younger children because edutainment feed the player information, rather than encouraging curiosity and exploration.

We must also acknowledge that edutainment has, from the very start, primarily been driven by business interests. This pedagogically mostly unambitious perspective has arguably undermined the market by producing a long string of low-quality games that simply aren't very engaging to play.<sup>17</sup> The edutainment category also includes a number of titles with questionable educational content, developed by opportunists seeing a chance to capitalize on parents' hopes for such games. These are often found attached to a license like Disney or Garfield that have fielded some of the more spurious of many examples, as the games focus on the same basic games that offer little that is new in the way of teaching math and spelling that remain among the most popular topics.<sup>18</sup>

The formula settled on by most edutainment titles in the 1980s that are still with us today can be defined by the following characteristics:

- *Little intrinsic motivation:* edutainment relies on extrinsic motivation—the promise of rewards—rather than intrinsic motivation arising from the game activity per se. Extrinsic motivation is not related to the game but consists of arbitrary rewards, like getting points for completing a level; intrinsic motivation, on the other hand, might be a feeling of mastery from completing a level. It is considered more pedagogically valuable because research shows that this leads to stronger learning experiences (especially in Malone's research that we will discuss a bit later). Where intrinsic motivation is in short supply for edutainment, it is evident when we look at the educational use of commercial video games. Intrinsic motivation is also quite strong in the research-based educational computer games, although with large variations.
- *No integrated learning experience:* usually edutainment is unable to integrate the experience of playing with the experience of learning, so the latter is subordinated beneath the more palpable experience of play. The player will often concentrate on playing the game rather than learning from the game. This problem is most evident in entertainment computer games used for educational use, where the entertainment experiences are not necessarily closely related to any accidental learning contents, skills or competences. The research-based titles often excel in this area, as they are capable of finding unique game mechanics that work as significant learning activities.
- *Drill-and-practice learning:* the learning principles in edutainment are inspired by drill-and-practice thinking rather than understanding. Games encourage the player to memorize the answers—for example, that two plus two equals four—but don't necessary teach the underlying rules that make this true. Again, we will see that research-based games and entertainment computer games used in

education rely on quite different learning principles. Here we find that discovery, exploration, problem solving and experience-based learning are much more appropriate for describing the game and learning experience.

- **Simple gameplay:** most edutainment titles contain simple gameplay, often from classic arcade titles or a simple adventure game with a world you can move around in. The simple gameplay can be effective, especially for younger and less avid game players. However, increasingly, we need to deliver more advanced and innovative game experiences to be able to keep educational games engaging and motivating compared to the rapid developing entertainment titles. Especially, entertainment computer games are of course quite strong when it comes to developing new formats.
- **No teacher presence:** edutainment hardly demands anything of teachers or parents; it assume that students can simply be put in front of a given game title, and through gameplay alone will learn the given content or skills. This is a very problematic assertion given recent research for example by Egenfeldt-Nielsen (2005) and Squire (2004a). In the research on educational use of *Civilization III* and *Europa Universalis II* in high schools the teacher is crucial to facilitating students' appreciation of key experiences in the game and expand these experiences beyond the game world.

It is a common problem in edutainment that the video games and the educational material used is completely separated. In the commercially successful edutainment title *Chefren's Pyramid* the player might read something about the pyramids, and then play a bit of *backgammon*. This hardly facilitates a meaningful learning experience. A way to overcome this would be for games to implicitly use educational material as part of the basic conflict (or goal) of the game, as suggested by Malone (1980). Or in technical terms, the game's victory conditions would require the desired learning outcome, so the player would have to utilize the desired knowledge in order to win. For instance, gaining geographical knowledge in *Civilization* is crucial to take full advantage of the map and the historical development of a certain region is beneficial in *Europa Universalis II*. Whether you get this information before, during or after playing the game is not important. However, it is important that you will actually need educationally relevant contents, skills or attitudes to succeed in the game, because you will then find it relevant and meaningful while playing the game, and worth "holding" onto. However, often a fruitful connection between educational content and the basic game structure remains difficult to construct. The simple structure of video games limits the amount of material one can include and this material must be integrated with the core game activities. Otherwise the player risks only learning one thing, namely to play the game.

Consequently, the attitude among educators, researchers, and game developers towards edutainment titles is often one of deep skepticism. The game design, the learning principles, and the graphics are all criticized heavily by both children and parents.<sup>19</sup> Practically none of the current edutainment titles are built on research that verifies their educational benefits.

However, the ghettoized position of edutainment games may be changing. An understanding is emerging among developers, educators and researchers that to make successful edutainment games one may have to turn to be inspired more closely by the commercial games industry. The minimal success of edutainment

titles over the last ten years implies that children are unlikely to be attracted to discount games. The game titles which dominate the entertainment games sales charts are not discount products, but rather state-of-the-art in all areas, from programming to visualizing to animating (not to mention marketing!).<sup>20</sup>

### THE INSTRUCTIONAL APPROACH TO EDUTAINMENT

The principles of behaviorism continue to influence edutainment, but other theories are influential concerning educational computer games. The growing importance of cognitivism during the late 1980s supplemented with behaviorism leads to what we can refer to as the "instructional approach." This approach attempts to describe how video games can best affect the player and how to deal with various obstacles to learning. The main learning principles within the instructional approach come from the laws of exercise and effect developed within a behaviorist framework. The law of exercise says that repetition is crucial to learning something which is surely true for learning a number of basic skills like reading, writing and spelling. The law of effect states that we can strengthen a response by providing a reward.<sup>21</sup> These basic principles have been expanded within the field of cognitive theory, which has articulated a number of potential obstacles to learning—limits like attention, processing speed, interfaces, and motivation.

During the 1980s, the cognitive theorist Thomas Malone elaborates on the instructional approach, and stresses that to be effective the gameplay and educational content must be integrated. Malone identifies a number of factors relevant to designing educational video games, and especially stresses the need for intrinsic motivation in a game. In 1987, Malone and Mark Lepper (1987a, 1987b) write arguably the most influential papers in the research on educational video games. However, much of Malone's work does not have a lasting effect on the development of edutainment. They list the elements needed to achieve intrinsic motivation in a game, which is one of the shortcomings of edutainment, but crucial to achieve strong educational computer games that are comparable to entertainment computer games:

- **Fantasy:** the game activity can increase intrinsic motivation by using fantasies as a part of the game universe. All entertainment games rely heavily on building fantasies for players to explore and educational games should be similar rather than be abstract and distant games like finding the missing letters in a word and getting points for that. A fantasy can be internal or external to the game. In a missing letters game you can easily provide an external fantasy that you need to find the letter to free the princess. However, an internal fantasy is more motivating but it also requires that the fantasy is tied more closely to the actual gameplay and not merely an *ad hoc* story. This is almost impossible to accomplish in an abstract game.
- **Control:** the player gains the overall feeling of being the controlling party while playing. The sense of feeling in control is present in most entertainment games, and many fans of the bestseller *Grand Theft Auto* series describe the control and freedom as the defining element of the series. All games have a sense of control given their interactive nature, but the degree of control can vary widely. Basically, as Raph Koster (2004) would say, games are about verbs not nouns, things you can do, and many educational computer games are just way more limiting than their entertainment counterparts.<sup>22</sup>

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are just way more

- **Challenge:** the activity should be of the appropriate level of difficulty for the player to be pushed to the limit of his or her capacity. Here again we see that most entertainment games do this extraordinarily well, whereas many educational computer games have to rely on the lowest common denominator among players. They make it too easy (or sometimes too hard). Indeed, balancing a game is always a very hard assignment.
- **Curiosity:** the information in the game should be complex and unknown to encourage exploration and re-organization of the information. So games must always have more to show whether literally in the exploration of a visual universe, conversations or events in role-playing games or in strategy games' relationships between variables and the dynamics of the underlying system. Here entertainment games are also ahead of educational computer games as they provide more areas to explore and reconcile, whereas many educational computer games (especially edutainment) make the mistake of serving information well chewed and ordered to the player.

Over the years, the above principles served as guidelines to many researchers and some game designers. It seems, however, that although the contribution is important their focus is too narrow on the game structure itself. The principles leave little room for the social dynamics around the game and learning experience, which we will explore further a bit later in this chapter. Although later revisions of Malone and Lepper's work tried to integrate the collaboration around video games, the context around the game is arguably downplayed in this framework. The instructional approach still influences the majority of edutainment titles out there, although the principles are not applied to their fullest extent.

#### THE MODERN APPROACH TO THE EDUCATIONAL USE OF COMPUTER GAMES

The last decade's criticism of edutainment has largely emerged from constructionist circles. Constructivism is particularly critical of the industry's reliance on behaviorism and cognitive learning theory. Constructivist theorists stress different elements such as the player's freedom to explore the game universe and the process of constructing knowledge in a meaningful and personal way. For some constructionist thinkers, video games hold fantastic promise; they make it possible for the learners to approach a subject in an active way and construct their own representations. In an ideal game, constructivists argue, the learning experience of the students draws on different perspectives, gives rise to a variety of actions, and offers a fuller understanding of the given topic.

For these thinkers, the main focus is the actual construction process of knowledge facilitated by interaction with the game; as a consequence, constructivist-based research has focused on open-ended games, on students making their own simple games and on so-called microworlds. A microworld is a simulation of a system—anything from small universe with laws of physics to a city with basic urban planning actions—which is simplified and constructed so that a player can work with the system's concrete objects. When players interact with objects in a video game, they are learning about the properties of these objects, their connections and applications. In a constructionist perspective, this is an optimal way to learn.<sup>23</sup>

From the behaviorist perspective, the challenge of educational video games is transmitting information from the video game to the player. The context of this

information is irrelevant, and the transmission of content relies on conditioning and reinforcement (much like “drill-and-practice”). From a constructivist position, the transmission of information is not sufficient for a successful educational experience. Players must actively engage in a video game and construct their own knowledge using the artifacts of the game world.

Among the most noticeable early constructivist contributions within this field, the work by Yasmin Kafai remains central. In the mid-1990s, Kafai researched how to use the actual game design process as a new way for students to engage with a subject. Seymour Papert, often seen as the father of constructivism, inspired Kafai’s work. Kafai envisioned children not just as players of games, but as the actual designers of these games hereby turning children into producers of knowledge and in a very concrete way let them play with knowledge.<sup>24</sup>

Today the socio-cultural approach is becoming a stronger alternative within the educational use of computer games, and is championed by James Paul Gee, David Williamson Schaffer and Kurt Squire in particular. In a socio-cultural perspective, video games are tools for constructing viable learning experiences. Games mediate discussion, reflection, and analysis. The video game experience is facilitated by the surrounding classroom culture and the student’s identity. This approach is argued to be very useful for understanding video games that are surrounded by strong social networks, which facilitate the learning experience.<sup>25</sup> Here, the content of a video game is less significant than its way of initiating new explorations and journeys into knowledge.

Gee (2003) has given the strongest account of the area and presents five main areas of interest concerning video games for educational purposes. He does not see these as limited to school settings but as intrinsic qualities found in video games:

- *Semiotic domains*: like other activities in life, video games are a semiotic domain—a realm of signs and symbols—that one slowly learns to interpret. The player learns to make sense of and navigate through a video game, and in doing so is pointed to other interesting domains, like science and history.
- *Learning and identity*: when the student is involved with the material, video games give new opportunities for learning experiences. Namely, video games are quite good at creating agency and identification: they develop the player’s sense of control and encourage the player to identify with other people. Both of these spark critical thinking and deepen the learning experience.
- *Situated meaning and learning*: video games are well suited for new forms of learning where the player is situated in the domain and understands it from the inside. Players can interact with the game world through probing, can choose different ways to learn, and can see a topic in its larger context.
- *Telling and doing*: games can amplify the important elements in an area to facilitate easier understanding, and represent subsets of domains enabling the player to practice in a safe environment with constant feedback. Games also lend themselves well to transferring between domains, so that you can apply facts you learned about astronomy in a video game to real-life stargazing. This is due to the fact that games are virtual worlds with meaningful, concrete and rich audiovisual learning experiences rather than abstract bits of concepts put together in a textbook.

- *Cultural models*: the content in games represents ways of perceiving the world, and uses a lot of information implicit in the game universes. This content also has bearing on other domains of life, and can be both good and bad depending on your values and norms.

Gee's contribution is currently one of the strongest, but also symptomatic of the area's broader problems: he does not engage with earlier research on traditional games, or with other findings within educational computer games research. This weakens his claims, and increases the fragmentation of the field.

Though each theory offers its own problems, the field of educational use of computer games has made great strides in the last two decades, and offers a host of engaging research. Let us now turn our attention to four of the foundational issues facing the field today.

### Learning vs. playing

The recent research on the educational use of video games is concerned with a series of basic problems. Some researchers question the viability of packaging education as fun. They fear that using video games for learning sends the implicit message that learning is not necessarily hard work, but must always be fun.<sup>26</sup> However, this problem seems to spring more from these researchers' beliefs on education, as they are not supported by any direct studies.

But a related, and more crucial, issue is the potentially inherent contradiction between learning and playing. Researchers increasingly suggest that a student should clearly see that a particular game is about learning a specific topic and appreciate the expected result. Without explicitly framing the experience as educational, the goals and rules in play take over. The play and learning clash is evident when the game goals work against the learning goals. This is all too often the case as much educational use of video games relies on commercial titles, and many edutainment titles split the game and learning parts.<sup>27</sup>

Another problem between playing and learning relates to students' interest and engagement, which will vary considerably between lessons. Students see the experiences with games as a playful, voluntary activity, an activity that they control. Within a game the player remains in control, very different from the more explicit demands that traditional classroom learning makes on a student. The player feels that the control should not be tainted by outside interference, but may also criticize the lack of direct educational interventions. On one hand, player control is a critical characteristic in video games stressed by all researchers, but it is also a fact that many studies show the benefit of carefully guiding, supporting, scaffolding, introducing and debriefing the player after the video game experience. This guiding is actually part of most game cultures but becomes problematic in school settings. The lack of a firm setting confuses students that are uncertain of the expectations when playing and learning. Ultimately, students are unsure whether to approach the video game as play or learning.<sup>28</sup>

Indeed, sometimes the playful approach may ruin the educational experience. On a very basic level, relying on games means that some students will not trust the experience, while others may trust it too much. Research indicates that when students experience a contrast between their own knowledge and information presented in the game, they stick with their own knowledge.<sup>29</sup> Other studies indicate that students sometimes have a blind belief in the game.<sup>30</sup> Neither approach

is very beneficial. Blind belief is a poor starting point for critical reflection and complete denial is similarly problematic.

### Drill-and-practice vs. microworlds

Today, most researchers seem to shy away from a narrow focus on drill-and-practice games found in behaviorist edutainment; but many designers still indirectly assume that parts of the game have drill-and-practice elements that can transfer facts and support development of different skills. In fact, research indicates that drill-and-practice can be useful, but works best in combination with other teaching forms.<sup>31</sup> Maria Klawe (1998) stresses that video games should be used for math activities that are otherwise hard to introduce in a classroom while specifically pointing to the limitations of drill-and-practice.

Most of the early mathematical video games focused on drill and practice of simple number operations and concepts. Such games are easy to develop. Moreover, playing such games are an effective and motivating method of increasing fluency for many students. However, drill and practice is only one of many components of mathematics learning and can be achieved via a variety of non computer-based methods.<sup>32</sup>

The preference for drill-and-practice is understandable: it replicates the rote repetition that is the basic part of many traditional classrooms, and thus must feel familiar to many designers; and furthermore, drill-and-practice games are easy to develop compared to the design challenges facing other types of titles. Microworlds, for example, have proven significantly harder to design than classic drill-and-practice games.<sup>33</sup>

In Microworlds the player is confronted with a virtual world that contain a condensed version of the most important variables and characteristics of a given domain. This could be a physics environment where you explore the different mechanics and interrelationships between atoms by constructing strings of molecules. It could also be a simulation of Williamsburg in colonial times where you get a look into the important elements of everyday life, interactions and routines.

### Immersion vs. transfer

In discussing the challenges of the game design process, Klawe (1998) raises some of the central problems with educational video games. Most of her conclusions are backed up by an earlier study by Kamran Sedighian and Andishe Sedighian (1996), the researchers responsible for the Super Tangram component of *E-Gems* series of educational titles. Klawe points out that the immersive effect of video games lead to a lack of awareness of the mathematical structures and concepts integrated in the video game. This results in a weak transfer of game experience to other contexts. Students may learn some content or skills in the game universe and apply them in the game context, but most games are not constructed in a way to make the knowledge accessible in other contexts. In an earlier study, Klawe and Eileen Phillips (1995) found that when students wrote down math problems on paper simultaneous with playing a math video game, they were more successful in transferring the video game skills to other classroom practice. The engagement with paper and pencil, these researchers found, forces the students to construct the knowledge actively.

The transfer of knowledge seems to represent a double bind. On one hand, many researchers assume that the learning experience must be undetectable by children—that an educational video game should resemble a traditional video game. It should not give itself away as children will then shy away from the educational title.<sup>34</sup> On the other hand, it seems that if the players are not aware that the learning elements, the learning experience—and especially the student's ability to transfer the information elsewhere—will be undermined. The transfer of game skills to other contexts has to be made explicit (and here, as we'll see below, the teacher can play a crucial role).

### Teacher intervention

Contemporary research consistently shows that teachers play an important role in facilitating learning with video games: teachers steer the use of a game in the right direction, and provide an effective debriefing that can catch misperceptions and important differences in students' experiences while playing. Many edutainment titles adhering to behaviorism neglect the teacher's role, and assume that no outside intervention is necessary for learning. In more recent titles that are designed with a constructivist approach (although far between), the teacher is made essential.

Many researchers argue that video games should not be thought of as explicitly educational, but as tools, which provide opportunities for interested teachers. Thus, the teacher's role is imperative to create the learning experience. This is especially true regarding commercial entertainment titles which find their way into educational settings—like *The Sims* and *Civilization*—which have not been developed with curriculum explicitly in mind.<sup>35</sup>

### THE EDUCATIONAL EFFECTIVENESS OF VIDEO GAMES

The question that continues to haunt the educational use of games is whether it is really worth the trouble. The research findings regarding the effectiveness of video games for educational use are still sparse but at least thirty studies address the issue directly.<sup>36</sup> So far, one thing seems relatively clear: just as we saw earlier with the use of traditional games, players seem to learn the same things when using video games as when taught by other methods, although a student's retention may be better with the former. Also, motivation, relevance and engagement are stronger when using computer games in education compared to traditional teaching. An example is a 2005 quasi-experimental study of *Europa Universalis II* in a high school history class. On a multiple-choice exam of European history from 1500 to 1700 given immediately after the course ended, the students who used the video game had lower scores than the group who had learned via a traditional classes and case studies. However, when the students took a similar test five months later, the scores of the two groups were equal.<sup>37</sup> This study also revealed that students found the computer game to be more engaging and motivating, although not all found it to contain relevant historical information. However, the question of relevance seemed tied to specific issues in this empirical study.

One problem with the research is that most studies are content with proving that it is possible to learn from video games. Few have the opportunity and persistence to actually compare video games with traditional teaching methods. From several decades of theoretical speculation and practical research it seems obvious that we can learn something from video games, but the questions are *what* and *how*,

and whether it is different from what we learn with traditional teaching methods. These questions still remain largely unanswered, although there is support for better retention and higher motivation when using games compared to more traditional teaching forms.

Some small-scale qualitative studies have failed to find educational effects of video games, and question the general merits of the educational use of video games. These researchers point out that the content in video games is understood and mediated in the game context in ways that are not appropriate for education. The risk is for example present in *Civilization*, where a player may understand the building of the the Hanging Gardens of Babylon, one of the seven wonders of the ancient world as nothing more than providing a reward of one extra happy face. This is hardly an adequate description of their historical and cultural significance. Others have also found mixed evidence for the effectiveness of video games.<sup>38</sup>

A fundamental difficulty of our assessment of games is that defining "educational effectiveness" is incredibly difficult. Measuring the learning outcome of a given activity is never easy, but video games make such quantification even harder. We also need to acknowledge that different kinds of computer games aspire to different forms of knowledge that is not easy to measure. Some of these knowledge forms will largely go unnoticed if we rely on, for example, simple multiple choice tests. Computer games are dynamic systems and each player will have a different experience.

In the ambitious educational strategy game *Making History: The Calm and The Storm* by Muzzy Lane, one student may not acquire the information about the Japanese occupation of Manchuria in 1931, whereas another player will get this information. This makes it very hard to compare learning outcomes between students and classes, and also causes concern for teachers. What is one to measure, and will students learn the right things? To some degree, this problem stems from a narrow focus on education as knowledge acquisition. Let's see what happens when we expand our search to include the "softer"—but no less valuable—cognitive skills.

### Cognitive learning outcomes

Some researchers have argued that we should not look for a direct relationship between game playing and the assimilation of specific knowledge; instead, they have suggested that video games could improve general cognitive skills. Over the last twenty years, eye-hand coordination, spatial ability, and problem-solving have received a lot of attention.

Starting in early 1980s researchers attempted to connect eye-hand coordination and game play,<sup>39</sup> but with disappointing results. This limited number of studies all found that there do not seem to be any differences between non-players and players in respect to eye-hand coordination, although anecdotal evidence remained popular in and outside research circles.<sup>40</sup>

The area of spatial ability is more thoroughly researched than the question of eye-hand coordination, and positive effects of game play have been found both on a long-term basis<sup>41</sup> and in terms of short-term improvement.<sup>42</sup> After playing video games, subjects were able to perceive more quickly the construction of objects in 2D/3D space. A major controversy in research on educational video games revolved around the question of whether one can transfer skills learned in video games to other areas. Although the area of spatial skills gives some indications of

transfer there are severe methodological problems. A frequent source of error in the studies on spatial ability is the measurement methods. The test of spatial skills is conducted on a computer screen, the native platform for video games. Hence, the test is administered in an environment favoring the video game players. The favorable results for the video games group may therefore be a consequence of familiarity with the test platform rather than improved spatial ability.

The third and final cognitive area—problem-solving in relation to computer games—has received the most research over the past thirty years. Problem-solving is often linked to adventure games, a game genre popular among teachers, journalists, parents, players, and researchers alike.<sup>43</sup>

Most of these studies have methodological problems of their own—particularly in the testing methods used to measure problem-solving—but the conclusions of the most ambitious studies are consistent: problem-solving skills can be improved by playing one game and then transferred to another video game. They also found that general problem-solving skills are a predictor of performance in video games, which implies that video games may potentially be used to test a subject's existing problem-solving skills.<sup>44</sup> However, the studies did not find that real problem-solving will be improved by playing computer games.

The results of this research to date are mixed, but lend some support to the belief that video games influence cognitive skills (although, we should note, often not significantly more than other activities like making a small puzzle). However, all of these studies are hindered by the difficulty of documenting the transfer of skills obtained in a video game to other areas of life. Still, we believe that edutainment would benefit from broadening its definition of effectiveness in education. If we focus not just on the acquisition of specific facts, but consider the many skills required to play games, then perhaps we can more adequately understand the variety of benefits that might come from play.

#### FINAL REMARKS

There are positive research results on the benefits of educational use of computer games, but it still seems that the real breakthrough is some years away, when it is known that the majority of teachers use computer games in an educational setting.

Unfortunately many publishers and developers within the area are stuck with the edutainment formula that provides much low hanging fruit, but also has a lot of limitations as described above. This far from implies that these games do not work, but rather that there is much room for further improvement.

The barriers blocking the educational use of video games seem to be numerous. Research on edutainment has provided little clear direction where the field should head. Taken as a whole, the results of these studies suggest that students can acquire knowledge from a video game, but that this acquisition may not be any more effective than a teacher's presentation, or reading a textbook. Furthermore, it is evident that edutainment is at a dead end where the formula remains unchanged. We, therefore have to look to the use of commercial computer games and research-based educational computer games to find new ways for the area.

We must also acknowledge that contemporary education may simply be a poor fit for video games. The foundations of primary and secondary education today—lesson plans and strictly divided subjects—hardly facilitate the use of video games. To this we can add the clash between game expectations and school expectations on the part of both students and teachers. Many teachers are curious about games,

but with their strong pop culture connotations it is also easy distrust their educational benefits—few teachers will accept that killing monsters can be educational, and in the eyes of many non-gamers, killing monsters is what most games are all about.

Some researchers have argued that we should be careful about investing large sums of money into expensive educational video games before we have evidence that they are worth the investment.<sup>45</sup> On the other hand, it is very hard to actually gain the necessary experience to develop effective titles without experimental use and research. Though to date it is still difficult to prove conclusively that serious games are worth the investment, it would be premature to dismiss the potential of educational video games.

The market is seeing more ambitious attempts like *Making History: The Calm and The Storm* and *Global Conflicts: Palestine*, where video games are integrated more deeply into current educational praxis. The new momentum in research circles towards what video games entail educationally is beginning to give way to a better appreciation of their real potential.