2013

Design Better Games! Flow, Motivation, & Fun

Guerrero, Michael; Murphy, Curtiss; Chertoff, Dustin; Moffitt, Kerry

(Excerpted with permission, from the Design and Development of Training Games: Practical Guidelines from a Multi-Disciplinary Perspective, by Cambridge University Press, 2013)

Chapter 5

DESIGN BETTER GAMES! FLOW, MOTIVATION, & FUN

Curtiss Murphy[1], Dustin Chertoff[2], Michael Guerrero[3], Kerry Moffitt[4],

Abstract: In a 2010 Ted conference, Ali Car-Chellman offered this criticism of our industry: "Most of the educational games that are out there today are really flash-cards. They are glorified drill-and-practice. They don't have the depth and rich narrative that really engaging video games have" (Car-Chellman, 2010). She concludes with this challenge: "We need to design better games." This chapter will address her challenge.

In this chapter, we will explore Flow, Motivation, and Fun. We will dissect how the entertainment industry creates really engaging video games. We will unravel the science of why people become engaged and learn guidelines that promote flow. We will explore how motivation works and what fun really means. Throughout the chapter, we will highlight some of the best examples and most effective techniques. By the end, you will know how to use flow, motivation, and fun to design better games.

Key words: Games; Learning Games; Game Design; Flow, Motivation; Fun; Learning.

1. INTRODUCTION

In a 2010 Ted conference, Ali Car-Chellman offered this harsh criticism: "Most of the educational games that are out there today are really flash-cards. They are glorified drill-and-practice. They don't have the depth and rich narrative that really engaging video games have" (Car-Chellman, 2010). She concludes with this challenge: "We need to design better games." This chapter will address her challenge.

We already know that games can be used to teach many things. Sailors in the US Navy play the Damage Control Trainer as part of their boot camp training. Marines use games and virtual environments to train convoy operations (Hussain et al., 2009). In healthcare, you see games used to improve physical fitness, aid diabetics, and improve the lives of asthmatics (Baranowski et al., 2008). But, what makes these games work?

In this chapter, we will explore flow, motivation, and fun. We will dissect how the entertainment industry creates really engaging video games. We will unravel the science of why people become engaged and learn guidelines that promote flow. We will explore how motivation works and what fun really means. Throughout the chapter, we will highlight some of the best examples and most effective techniques. By the end, you will know how to use flow, motivation, and fun to design better games.

2. FLOW

Sometimes, an activity captures our attention so completely that the rest of the world seems to disappear. We become so totally engaged in what we're doing that time becomes distorted, somehow it seems to both slow down and to fly by unnoticed. In such a state, we perform better, forget ourselves, and become one with what we're doing. This state is known as "flow" and it perfectly captures the fundamental appeal of games (Murphy, 2011). This section explains the scientific importance of flow and how it applies to games.

2.1 Introduction to Flow

Psychologist Mihaly Csikszentmihalyi spent more than 25 years researching human performance and the nature of optimal experience (Csikszentmihalyi, 1990, 1997). He initially noticed this phenomenon while studying top athletes, who would often describe record-breaking performances as being "almost effortless." He later realized that his theories applied to almost any human activity, from factory work to works of art, from the simplest of activities such as reading, to the masterful actions of a surgeon. He studied children and adults in dozens of countries, beginners and experts, east and west, rich and poor. After this research, he concludes that there are certain conditions that promote a level of optimal experience, known as "flow." In such a state, people become highly focused, become less aware of themselves, experience an altered sense of time, and feel fully in control of their actions.

Csikszentmihalyi describes flow as "the state in which people are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it" (Csikszentmihalyi, 1990, p4). Others have described it as "the ultimate in harnessing the emotions in the service of performing and learning" (Goleman, 1995, p.90). The state of flow induces feelings of fun, pleasure, and enjoyment and leads to lasting memories. In addition, "the flow experience acts as a magnet for learning - that is, for developing new levels of challenges and skills" (Csikszentmihalyi, 1997, p33).

As Csikszentmihalyi (1990) describes, there are seven core components of flow (summarized in Table 2.1). These components can be broken into two categories: conditions and characteristics. Conditions are the prerequisites of flow and characteristics are what happen while you're in flow.

Conditions of Flow	**Explanation**
Clear tasks	People understand the task they must complete
Feedback	People receive clear and immediate feedback showing what succeeds and what fails
Concentration/focus	People are not distracted and can fully attend to the task
An attainable, balanced goal	Goal is challenging and within their abilities to complete
Characteristics of Flow	**Explanation**
Control	People believe their actions have direct impact on tasks and that they can influence the outcome
Diminished awareness of self	Complete focus on the task leaves little room for self-consciousness or doubt. Often described as becoming a part of the activity.
Altered sense of time	Perception of time is distorted. Seconds can feel like minutes, minutes like hours. Yet, time also passes by quickly, unnoticed.

Table 5.1 – Conditions and Characteristics of Flow

The conditions are the pre-requirements and the characteristics are the benefits. In order to put flow in our games, we need to ensure the conditions exist, so let's take a look at them. The first condition states that the activity must have clear objectives. The person needs to understand what they are trying to accomplish. The second condition states that the activity must provide a lot of feedback about progress. Feedback is usually immediate – part of their moment-to-moment actions and behaviors. The third condition says the person must be allowed to concentrate on the task without distractions.

That leaves one condition left: the need for an attainable, balanced goal. This condition requires that the tasks must be simultaneously challenging and achievable. A task that is not challenging (or that requires excessive time to accomplish) becomes boring and we lose interest. On the other hand, if the task is too hard, we become frustrated and anxious, and once again, we lose interest. Everything hinges on the balance between the difficulty of the task and our skill. Further, since a person's skills will improve over time, the challenge needs to increase along with the improving skills. This is referred to as the flow channel (Murphy, 2011). It is shown in figure 2.1 (based on a diagram from Csikszentmihalyi, 1990, p 74).

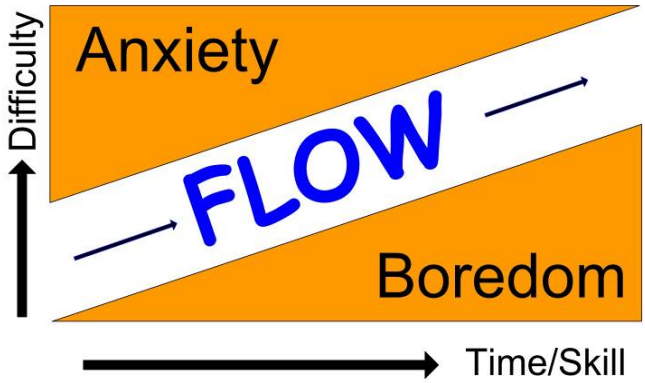

Figure 5.1 - Flow – Balance of Difficulty vs. Time/Skill

Csikszentmihalyi repeatedly emphasizes this relationship. He asserts that maintaining this balance is one of the most critical prerequisites for flow and is important for both motivation and learning.

> It is this dynamic feature that explains why flow activities lead to growth and discovery. One cannot enjoy doing the same thing at the same level for long. We grow either bored or frustrated; and then the desire to enjoy ourselves again pushes us to stretch our skills, or to discover new opportunities for using them (Csikszentmihalyi, 1990, p.75).

2.2 Flow in Games

The intense feelings of engagement, discovery, and learning we experience during flow are a core part of the appeal of games and are hugely important for game design (Murphy, 2011). As long as the conditions are met and the challenge is balanced against skill and time, players can experience flow in the first few moments of playing a game or hundreds of hours later, as an expert. As game designers, the question is not whether flow is important, but rather, how long you can keep your players in flow (Chen, 2007).

This fundamental realization has significant implications. As Chen explains, "Flow explains why people prefer certain games more than other games and how they become addicted towards these games. If a game meets all the core elements of Flow, any content could become rewarding, any premise might become engaging" (Chen, 2007, p. 9).

There are lots of successful games that validate this claim. Consider the Sims™. In the Sims™, you control virtual characters that look and act a lot like normal people. The gameplay often involves making your 'sims' perform a variety of ordinary tasks such as doing dishes, taking out the trash, bathing, and going to work. However, the game is well designed – it keeps players in a state of flow for long periods of time. In other words, it meets the requirements of flow because its "goals are clear, feedback relevant, and challenges and skills are in balance" (Csikszentmihalyi, 1997, p. 31). Despite the rather mundane mechanics, the Sims™ elegant use of flow helped it to become one of the most successful game series of all times.

To promote flow as a game designer, you should constantly be aware of the following:

1. **Use clear tasks** – present clear, non-confusing tasks to the player.
2. **Provide feedback** – provide simple, direct feedback as players make progress.
3. **Balance challenge with player skill and time** - give tasks that are challenging, but accomplishable and not overly long; scale the difficulty to match growth in player skill.
4. **Minimize distractions** – avoid elements that direct attention away from the tasks.

This rest of this section will expand on these aspects of game design and provide practical steps for creating flow in learning games.

2.3 Use Clear Tasks

The first requirement of flow is the need for clear tasks. The player needs a tangible goal(s) in order to achieve flow. The goal can be almost anything, but it needs to have a specific ending. As an example, consider the following task: dig a hole. It's a simple task, but it is not very clear. How deep are you supposed to dig? What are you looking for? Should the hole be round or square? What's the purpose of the hole? Compare that to this task: use a spade to dig a 4-6" hole for each flower bulb. The tasks are similar, but the second is much clearer – it specifies exactly what to do.

Games use tasks extensively (Rouse, 2004; Schell, 2005). We propose that there are three types of tasks that games routinely offer. The first type is **explicit tasks**. These come in an infinite variety and include ideas such as: beat the boss mob on the next level; achieve max level of cooking skill; collect 100 coins; match 5 colors together; build 10 houses for your town; or make 20 friends. Explicit tasks are usually dictated to the player as part of the gameplay and interface. Games often use terms like quests, objectives, goals, missions, directives, and of course, tasks.

The second type is **implicit tasks**. These are tasks that the game implicitly expects of the player but that are not explicitly dictated by the game interface. This includes ideas such as: try to stay alive as long as possible; earn as many points as you can; collect as many things as possible; maximize all of your character's skills; or find all the secret areas. Implicit tasks are sometimes optional, but they are still a primary part of the game in some way. Games will often provide an interface to help the player gauge or track their progress on implicit tasks. For instance, they might show a player: how long they've survived; the number of waves completed; how they rate on a high-score list; or how many secrets they've found.

The third type is **player-driven tasks**. These are self-directed goals that the player creates for themselves, during their experience. They are neither explicitly directed by the game, nor implicitly expected of the player. Player-driven tasks are limited only by the creativity of the player and the sophistication of the game mechanics. Game designers consider this an important design consideration that is worth striving for (Schell, 2005). After all, if a player is evolving their own goals, then they are clearly enjoying the game and will play longer. Koster (2005) expands upon this concept by adding the idea of **emergent gameplay**. This is where the game provides a simple set of mechanics that interact

together to create a complex system. Emergent gameplay enables the widest range of player experiences – experiences that even the designers may not have expected.

Minecraft™ is a wonderful example of a game that uses player-driven tasks. It is an internet phenomenon that has sold over 10 million copies, won numerous awards, and was one of the few games selected for the Smithsonian Museum's Art of Video Games (Choney, 2011). In Minecraft™, the player is dropped into a world of simplistic looking blocks (see Figure 2.2). Players have two primary mechanics: move around and destroy the world by clicking on the blocks. When destroyed, each block leaves behind resources that can be harvested and used to build new things. Players can create simplistic tools such as picks and axes or complex objects such as beds and electrical circuits. The game offers little guidance on what you should do. In fact, there are no explicit tasks at all. However, once darkness descents upon the land, the monsters come out and usually kill the player. After respawning in the light of day, the player will discover the games only implicit goal - stay alive.

Minecraft™ is an example of a sand-box type of game. Figure 2.2 shows a scene where the player has decided to craft their own beach town. There is a town hall, a set of apartments in the mountain wall, an enormous central fountain, swimming pool, sugar farm, and a little smiley-face meditation garden. All of this was created without any explicit or implicit tasks. The mechanics allow players to destroy, harvest, and build almost anything they can imagine: floating castles of glass, rivers of lava, railroad roller coasters, death traps, or functioning musical instruments. Alternately, players can build nothing at all. Their goal may be to wander around exploring the limitless landscape. Minecraft™ demonstrates how games use player-driven tasks and emergent gameplay to create flow.

Figure 5.2 – Player-Driven Tasks in Minecraft™

2.4 Provide Feedback

The second requirement for flow is **feedback** (typically immediate). According to Csikszentmihalyi, feedback is a fundamental requirement for both flow and motivation. Csikszentmihalyi (1990) explains:

> …the kind of feedback we work toward is in and of itself often unimportant: What difference does it make if I hit a tennis ball between the white lines, [or] if I immobilize the enemy king on the chessboard. … What makes this information valuable is the symbolic message it contains: that I have succeeded in my goal. (p57)

He further explains that "almost any kind of feedback can be enjoyable, provided it is logically related to a goal in which one" (p. 57) is invested. In addition to being relevant to flow, feedback is a prominent component of almost all modern learning theories. Studies have shown that frequent feedback is critical for understanding (USDOT, 2008; Bransford et al., 2000) and should be timed appropriately, be meaningful, be stated in positive terms, and help the learner correct their performance (Hayes, 2006).

While much is known about feedback in more traditional learning environments (Mory, 2004; Shute, 2008), there is less confirmed research about the best use of feedback in learning games. Fortunately, the entertainment industry has been using feedback in games for a long time and they are quite adept at it (Schell, 2005; Murphy, 2011). So, let's learn from them.

There are as many ways to provide feedback in games as there are unique tasks that can be performed. For promoting flow, the important thing to remember is that feedback should always be relevant to the task at hand and should be immediate, whenever possible. Feedback is how players perceive progress and it enables them to correlate their actions to outcomes (Csikszentmihalyi, 1990; Murphy, 2011). Below are some guidelines for promoting flow in learning games via good feedback.

1. Simple progress indicators such as task completed messages, completion/failure meters, and level indicators are standard mechanisms for feedback.
2. Changes in the user interface (enabling/disabling actions) and interactions with in-game characters are a great way to provide feedback.
3. Counters (e.g., 5 out of 6), quest progress (e.g., check marks), and other completion marks are important ways to give feedback about current progress.
4. Guidance in response to a player's lack-of-action. This can reduce difficulty and also act as a form of feedback. This can include directing players to "look over go here" or "look at this".
5. Do not use subtle visual changes of text. Even large changes in text can be overlooked if the color or shape does not change. Generally, you should consider using motion (visual or audible) or sharp contrast to direct attention to the feedback. If the player does not notice the feedback, then the feedback did not occur.
6. Natural consequences in response to player actions can be particularly powerful. This means exactly what the name implies and includes things such as watching a fire go out because they use the hose correctly, seeing water stop spraying when a patch is applied, or visualizing the results of a catastrophic failure (Murphy, 2010).
7. Point scoring (e.g., 10,000 points), non-competitive high-scores (e.g., default scores to beat), and performance ratings (e.g., 3 of 4 stars) are standard ways to give feedback on how a player is performing relative to expected norms.
8. Resource indicators should always be used, if the resource is important to the task. Make sure to give clear feedback about increases and decreases of key resources. Consider using scrolling numbers that are centrally located, but non-permanent (e.g., "XP: +10", "Coins: +5").
9. Little badges or semi-permanent icons (e.g., "+8") can be used to provide feedback about progress that is less critical or not time-sensitive.
10. Keep feedback focused on players' progress towards the goals of the game. Feedback about unimportant actions should be minimized – they are a distraction.

As an example of using feedback in learning games, consider the Navy's Damage Control Trainer (DCT). This game showed a 50-80% improvement in an individual's performance in just one hour of game play (Hussain et al., 2009). Figure 2.2 shows one scene where the game is providing multiple forms

of feedback at the same time. As the student interacts with the pipe and patch, the game provides immediate feedback by showing the patch attach to the pipe, by splashing water and changing audio cues when the spray is blocked, and by pushing the patch away when applied incorrectly on top of the rushing water. When the leak is patched correctly, the water flow changes to a drip. At the same time, the interface is also providing more general feedback about time elapsed, suggestions and hints, water flow, available inventory items, and success/failure progress indicators. All of the feedback in this scene focuses on the moment to moment actions of the player. It helps keep players in flow.

Figure 5.3 – Use of Feedback in Navy's Damage Control Trainer

2.5 Minimize Distractions

The third requirement of flow is the need for minimal distractions. The best technique for reducing distractions is the age-old K.I.S.S principle: Keep it Simple, Silly. **Simplicity** is a fundamental quality of effective games, and is one of the things that distinguish games from traditional simulations. Well-designed games encourage flow because they simplify concepts down to goals and rules of action. This eliminates the questions of "what should be done, and how" (Csikszentmihalyi, 1997, p. 29). In other words, games simplify away the complexities of real life so that we are not distracted from the essence of the task.

Consider the act of donning a fire ensemble in real life. This is a fairly complex task. It involves putting on several layers of protective meshes, in the correct order, and attaching them together at various seams. It usually requires two people. However, putting on the suit is just one of many steps required to put out a fire. In the Damage Control Trainer game, the learning objective is for players to understand the big picture of fighting a fire. Therefore, donning the fire ensemble is only a minor goal and the actions reflect this by simplifying the behavior. To don a piece of gear, the player simply clicks the icon for it. When thinking about simplicity, remember this summation from Will Wright, designer of the Sims™, "Your garden is not complete until there's nothing else you can remove" (Peterson, 2012, p. 1).

In games, one of the most common approaches to simplicity is the idea of **transcendence**, which just means that "the player is more powerful in the game world than they are in the real world" (Schell, 2008, p. 272). We often associate this with magical or fantastical abilities, but as we just saw with the Damage Control Trainer, it applies to mundane tasks as well. Consider that games allow players to do things faster, with less red tape, with less outside assistance, with faster learning curves, and in highly unlikely situations. Stated another way, games can make things simpler by abstracting away the extraneous details that would complicate play. As long as simplifying the play is not counter to the learning objectives, using a simplified design is good for learning because it helps to keep the player in flow.

2.5.1 Simpler Interfaces

The best way to make a game simpler is to minimize the interface. A game's interface includes the game mechanics, the way that the user interacts with the game, and the heads up display that shows data. This includes all forms of input (e.g., mouse, keyboard input and touch screens) and whatever is displayed to the user. Fundamentally, the interface is how communication occurs between: the player, the game, and the designer/instructor. The player uses the interface to tell the game what they want to do next. The game uses the interface to communicate what is happening in the game. The designer uses the interface to communicate content and learning material to the player.

Below are a few guidelines that will help to simplify your interfaces and reinforce flow:

1. Make sure the interface provides clear feedback, highlights goals and objectives, and minimizes distractions.
2. Make sure the difficulty of the interface matches the player skill. This means the interface should be extremely simple at the beginning, but can become more complex over time to reflect the player's growing skill.
3. Make the interface easy to read and try to leverage standards used by similar games in the entertainment industry.
4. Avoid things that distract the player. A bad interface hinders flow by drawing a player's attention to irrelevant content. This makes it harder to understand feedback and makes the objectives unclear. Avoid extreme amounts of data or cutesy animations that draw attention to unimportant details.
5. Minimize use of obtuse key or mouse combinations (e.g., Shift+RightMouse+Drag or Alt+F10). A bad interface will not only hinder flow but actively increase the game's difficulty by adding the hidden task of figuring out the interface.
6. Always chose the design option that is simplest from the player's perspective.
7. Minimize the number of ways that users can interact with your game. This affects the unique methods of interaction, not the circumstances or the content of the interaction. Keep the interface familiar and re-use interaction metaphors that you have used before.
8. Play test with target users and make note of any time you see them focused on the interface, rather than the content. Any focus on the interface should be considered a weakness in the design.

Essentially, a good interface will feel invisible to the player, only noticed when they are actively using it. A good interface leaves a player's brain power focused on the task at hand while also guiding their attention to what is important.

2.5.2 Paradox of Choice

As Sid Meier is often quoted, games are just "a series of meaningful choices" (as cited in Koster, 2005, p14). Choices show up almost everywhere in games, from basic mechanics, to items, to avatar appearance. Choices are an important part of games, but, choice has to be balanced with simplicity.

Moderation in all things is a good principle to follow. Let's explore what happens when simplicity is trumped in favor of providing more options.

Barry Schwartz described the **Paradox of Choice** (Schwartz, 2004). After extensive study, he concluded that while having some choice is good, having too many choices can be severely detrimental. The first thing he found is that people facing too many options often suffer from **option paralysis**. This is where people become incapable of making a decision and so chose nothing. This can happen even if all the options have positive outcomes. It can also happen whether the decisions are trivial, like picking a type of jelly, or a major life event, like buying a house. In a nutshell, having too many options makes the task seem more difficult and breaks flow.

Unfortunately, that is not the only problem created by choice. Schwartz also found that people seem to be hard-wired to simplify the decision criteria when faced with too many options. In other words, humans begin to group options into simple categories – in whatever way makes sense at the time. When our brain struggles with too much data, it looks for ways to make the decision easier. The good side is that it makes it possible for us to decide. The bad side is that we are likely to discard criteria that we may have otherwise considered extremely important. The result is that people make worse decisions. In some cases, Schwartz found that the criteria can become so simplified that it essentially becomes a random choice. The simplified criteria also make it harder to correlate cause and effect, which makes the task seem more difficult and disrupts flow.

Finally, Schwartz found that people will be less happy with whatever option they pick and will feel worse. Because there are too many choices, people cannot balance all of the factors, so they simplify. They know something important is being lost in the process and instinctively conclude that whatever they pick is probably not the best choice. This leads to increased regret about the decision they make, whether right or wrong. It also causes anticipation of regret, which is a regret we feel before we even make a decision. Both feelings of regret are distractions that disrupt flow.

This has huge implications for game design. Fortunately, the solutions are pretty straight forward.

1. Remember the age-old axiom, less is more. Since "everything suffers from comparison" (Schwartz, 2006, p. 181), present less things to compare.
2. Sometimes learning games need to teach or test subtle differences in the material, but they shouldn't do it all at once. Break things up.
3. When forcing players to make decisions, limit the number of options and keep them simple.
4. When designing game mechanics, minimize the number of distinct actions a player can take at any one time. Design your interfaces with the minimal number of options required to meet the learning goals. A good rule of thumb is four.
5. Finally, provide a **default** when you can**.** That means showing a default for the choice - something that is in their best interest. The default makes it okay to forgo a decision while still getting a positive outcome. This technique is simple and very effective. When players aren't sure what to pick, the default makes the choice much simpler, reduces the feelings of regret, and minimizes distractions.

Examples of how this works in games are easy to find. Consider that Tiny Wings™ has only one choice – touch the screen now or not. Consider that players in League of Legends™ have only four primary abilities that player's can use for any champion. Consider that in World of Warcraft™, there were originally only nine classes to pick from, where major competitors at the time had 24 or more. Each of these is a wildly successful game where the design benefitted from fewer, more meaningful decisions that led to better flow.

2.5.3 Opportunity Cost

Another aspect of simplicity and decisions is opportunity cost. **Opportunity cost** states that when deciding between options that have value, the cost of the decision includes not just the value of the option, but also the cost of not choosing the other options (Buchanan, 1999). As a practical example, if you chose to vacation in London, you are giving up the options of vacationing in Salt Lake City, Williamsburg, or Disney World. It sounds both silly and obvious, but it has a profound impact on our ability to make decisions.

In general, opportunity cost is associated with decisions that have some sort of permanence or lasting impact. For example, we don't struggle with opportunity cost when selecting a drink from the fridge, because we can just go back and get another one later. However, it's a huge problem when deciding where to vacation or which house to buy. It is also very relevant to the types of choices typically presented in games such as picking a class or assigning stats. Opportunity cost directly affects two of the conditions of flow: minimizing distractions and balancing difficulty with skill. In general, mechanics that suffer from both too many choices (paradox of choice) and choices with lasting consequence (opportunity cost) are almost guaranteed to break flow.

Ignoring paradox of choice or opportunity cost can create moments of extreme anxiety for players. Often, this happens when designers are trying to make a game more fun by allowing players to do lots of different things. The impact on flow is that the task becomes more difficult and the player becomes distracted. This results in a loss of flow. Sometimes a player can be so discouraged that they will stop playing a game all together. At a minimum, they will stall decisions for as long as possible (Schwartz, 2004).

In principle, the solution is simple: a) use fewer options and b) do not present a lot of options that have permanence. **Permanence** is the idea that an option has very long-lasting impact. For instance, the decision of which vacation to take cannot be undone. Once you go to Williamsburg, you can't undo the cost or time. Contrary to what you might expect, Schwartz found that if you are using decisions with permanent impact, it is better not to allow people to change their mind later. If a decision has a huge opportunity cost, and there is some way, however slight, to change your mind, then you will constantly second guess your decision. In other words, if the option is meant to have long-lasting consequences, then once the player has made the decision, make it clear that it is final so they will stop looking backward. Again, in the vacation example, once you land at the Williamsburg airport, you will stop thinking about Disney World. The decision is made and you can't undo it, so there is no reason to think about it anymore.

Unfortunately, minimizing player choice can sometimes go against industry standards, particularly with modern role-playing-games (RPG). The designs seen in the games Fate™ and Titan's Quest™ are good examples of how this typically occurs. In Titan's Quest™, players can allocate points per level into a tiered hierarchy of skills. Each branch of the hierarchy offers significantly different abilities and game play. Similarly, in Fate™, players can allocate points every level, to distribute among 20-30 different skills. In both cases, there are dozens of options, with millions of combinations, and these decisions significantly shape the experience that players will have and the chances for success. Games like Fate™ and Titan's Quest™ offer these types of systems because they want to expand player customization and enhance replay value. Unfortunately, the science of choice shows that this is stressful to players, increases the perceived difficulty of the game experience, and impedes flow. The research on both paradox of choice and opportunity cost would suggest that any value gained was probably overwhelmed by the negative impact of player anxiety, deferred decisions, and decrease of flow.

On the other hand, consider the award winning game, League of Legends™ (LoL). Here, designers also had to contend with a wide array of player options for item and weapon upgrades. Like Fate™ and Titan's Quest™, these decisions can massively impact both the players' experience and their chances of success. To mitigate this problem, LoL used two clever techniques. First, they provide recommended items as shown in Figure 2.6. These recommendations act as default options, which reduce the perceived number of choices and provide an easy out when players attempt to simplify the decision (Schwartz, 2004). The game then evolves in such a way that players can really only afford two or three items at any given time. This further simplifies the decisions. As players learn more about the game, they can bypass the recommendations altogether, but whenever they try a new character, the recommendations are always available as a safety net. Second, LoL items have very little permanence. Items are reset after each game (~30-45 mins). This eliminates almost entirely the problem of opportunity cost and thus reduces anxiety.

Figure 5.4 – Recommendations in LoL Mitigate Opportunity Cost and Paradox of Choice

Despite having hundreds of possible items to pick from, the clever use of default options and lack of permanence effectively mitigates both paradox of choice and opportunity cost in League of Legends™. These types of design decisions led to many awards, and helped League of Legends™ become "one of the year's most successful strategy games" (Johnson 2011, p. 44).

2.6 Balance Challenge with Player Skill

The final pre-requisite of flow is the need to balance difficulty and player skill. To maximize flow, we need to design an experience that rides the knife-edge between too easy and too hard. This is especially tricky in the beginning moments of a game where there is a lot of new material and a wide variety of player skills and knowledge.

2.6.1 Increasingly Difficult

One of the most common techniques is to begin a game with a simplified version of the game play. The game might start out with just a few weapons, actions, or areas to explore. Over time, as the player

gets more skilled, it can open up new features until eventually everything becomes available. Each new addition increases the challenge of the game and helps the game to feel harder. This in turn helps to manage the balance of difficulty versus skill that is critical for flow. Remember that, "enjoyment appears at the boundary between boredom and anxiety, when the challenges are just balanced with the person's capacity to act" (Csikszentmihalyi, 1990, p52).

Unfortunately, this is far from easy to do. After all, learning games also have to convey instructional content, not just the game itself. There is a lot of material to manage which tends to lead to designs that overwhelm new players. The game can easily give too much information and leave players mired in basic tutorials when they are ready to move on. When designing your games, consider the following practical tips:

1. Know your target audience. Find out what knowledge, skills, and experiences they bring to the game.
2. Avoid introducing a lot of skills, abilities, or material at the same time. Break it up and spread it far apart. This is especially problematic at the start of a game, but can just as easily crop up later on.
3. Avoid introducing material that is not relevant to the immediate tasks. Instead, provide just-in-time guidance. In addition, remember that games are often non-linear, which means the guidance needs to reflect their current actions.
4. Avoid the tendency to over-specify. Skip past the minutiae and focus only on what is immediately salient. An overwhelmed player will never enter flow.
5. Try to use design patterns that organically support the balance of challenge vs player skill. For example, consider the time-tested practice of chapter-based level design that starts at a tutorial and works through increasingly challenging missions, requiring the player to build on what they learned in a previous mission.
6. Make sure the chapters are of reasonable length and introduce new skills as a way of increasing difficulty as the player progresses.
7. Add things to the interface over time, as the player becomes more skilled. Start out simple, with minimal information, and add in new data as needed. The interface is a part of the complexity of the game and affects the difficulty.

2.6.2 Dynamic Difficulty Adjustment (DDA)

A number of game companies have attempted to address the balance of difficulty versus skill by implementing **dynamic difficulty adjustment** (DDA). DDA is a programming model that attempts to automatically adjust a game's difficulty to match the player's skill. If the player is struggling, the challenges are made easier; if the player is dominating, the challenges are made more difficult. For instance, opponents can become less numerous or tougher; time criteria may be extended or shortened; or solutions may be made more or less obvious via graphical techniques such as highlights and particles. DDA systems have been implemented in a variety of popular titles. In Left 4 Dead™, Valve created an Artificial Intelligence Director to manage the difficulty of the game as well as how intense the action feels (i.e., emotion). Valve's approach considers the emotional intensity to be another aspect of game difficulty.

A competing argument was proposed by author and game developer, Jenova Chen. He proposed that most DDA systems fail to adequately maintain the characteristic of control that is a part of flow (Chen, 2007). He theorizes that it would be better to give players direct, in-game control over when and how the difficulty is adjusted. As part of his thesis, Chen demonstrated the technique via the game, flOw, shown in Figure 2.4. In the screen shot, the player is flying a creature like an amoeba. By eating other creatures, it can get bigger. If the game is too hard, the player can eat the green blob (shown in the top left corner). If, however, the player wants more challenge, they can eat the little red blob (shown in the top right) to go

to a deeper, harder level. Near the bottom of the screen, you can see a vague ghost outline of the kinds of creatures the player can expect on the next deeper level. This gives the player a strong sense of control over how difficult they want the experience to be. Does that ghosty, swirly creature look like fun or does it look too scary and dangerous?

Chen's appropriately named game won multiple industry awards, became a highly popular PS3 downloadable title, and was recently selected to be part of the Smithsonian Museum's Art of Video Games (Choney, 2011). His research is a practical exploration of flow that has been used successfully in other major titles. For example, Skyrim™ and Elder Scrolls IV: Oblivion™ both provide a difficulty scale that players can adjust at any time, even in the middle of combat. Popular MMOs such as World of Warcraft™ and Everquest™ allow players to select the difficulty of dungeons and missions. Each of these games uses player controlled difficulty to allow the player to manually adjust the difficulty and keep themselves in flow.

Figure 5.5 - flOw With Real-Time User Adjustable Difficulty

2.5.3 Repetition

Repetition is another technique used to balance difficulty. It's a simple concept: use a skill again and again to get better. The correlation between repetition and learning has been well studied (Greene 2009, Hintzman et al,. 1995, Miller et al. 2004). However, as the National Research Council points out, "while time on task is necessary for learning, it is not sufficient for effective learning' (Bransford et al., 2000, p77). It's the old necessary, but not sufficient problem. In a learning game, you need to design repetition so that players get the information they need to improve their performance with each iteration. But, they task must also be designed so that players *want* to repeat the actions to improve their skills, and ultimately, remain in flow.

Plan ahead, knowing that your players will struggle with certain skills. Allow players to fail and give them appropriate feedback, so they can repeat the sequence and improve their play. The play should be

engaging and balanced, so that players will want to repeat the task until they get it right. The following design guidelines can help keep the player in flow and engaged with the learning activity.

1. Design small consequences for failure on necessary, but minor tasks. Most games simply let players try again. Games commonly use this technique to ensure that players have adequately learned necessary skills before progressing to the next level of difficulty, without discouraging them. In essence, "failure is part of the process that leads to success" (Beck and Wade, 2004, p. 134).
2. Give the player enough feedback so they can figure out how to improve their performance the next time. You don't have to give them the answers, just enough hints to point them in the right direction and keep the activity challenging, but still accomplishable.
3. Minimize the use of instant death mechanics. That is, situations where a single mistake results in complete failure. In both entertainment and learning games, we use instant death mechanics to drive home that certain actions should always be avoided. For instance, jumping off of a cliff or causing fellow ship-mates to die. While these lessons are important, too much instant death makes a game feel difficult and unforgiving.
4. Avoid long recoveries after failure. This typically happens in lengthy missions/chapters that don't have partial-recovery points. This leads to long repeats of the easy content that creates boredom and disrupts flow. Try to break missions/chapters into smaller, bite-sized pieces or allow players to re-enter the level at different points.
5. Allow players to skip excessive and meaningless repetition of the same skill. Focus on skills related to the learning objectives, let the player know when they succeeded, and move on.
6. Make the repeated task feel different each time around. This means providing choices, actions, and control so that the player can become engaged in a similar but slightly different experience. Alternately, the next time around, the process should go much faster. This allows them to enjoy the experience of mastery over previously challenging content.
7. Avoid **repetition without learning**. Entertainment games sometimes use repetition to extend hours of play, which is not the goal of learning games. The classic example is the inability to describe the details of a penny (Hintzman et al., 1995). We see thousands of pennies in our lives, but we never learn much about it, nor do we care. That is repetition without learning.

2.6.4 Reflection

Another technique that can help maintain the balance of difficulty versus skill is the use of **reflection**. Reflection is another learning technique, and this time, the studies are very clear. Simply stated, we learn a lot by reflecting upon the outcomes of our own performance and this becomes more effective as our skill and knowledge increase (Bransford et al., 2000). Reflection includes both thinking about and communicating with others about the performance. The tricky part with reflection is not whether it works, but rather, how to create moments of reflection in a game without creating huge breaks in game play.

Reflection can be used in games to help maintain flow as the player becomes more experienced. Remember that in order to maintain flow, the challenges must increase along with the player's skill. They will inevitably rise to a level where the challenge is too hard. Clever use of reflection can help players think about their mistakes and allow them to improve their skills and overcome a previously unsolvable problem. This helps keep them in flow and rewards them with the ability to move on to new content.

One of the most common moments of reflection in games is the score screen, or in military jargon, the debrief. A typical score screen shows which tasks were completed along with overall player statistics. Score screens often provide feedback against a normative value (e.g., 3 of 5 possible stars). Seeing how they did provides an opportunity for players to reflect upon their overall performance, which in turn, leads

to improvements in their behavior. The key to promoting flow is to provide information that is relevant to improving their play. This gives players what they need to try new approaches to improve their skills.

The score screen is not the only way to use reflection in games. In fact, because of its dynamic, nearly instantaneous nature, the game medium has incredible potential. As an example, consider the screen shot of League of Legends™ (LoL) in Figure 2.5. Here, the player has been slain by opponents and must wait 30-60 seconds before respawning and getting back into the action. This cooling off period affords an opportunity for reflection. While dead, players can see a "death recap" that gives immediate feedback on what happened. After they respawn, the players can apply what they have learned by purchasing defensive items or changing tactics with their team. In this instance, the player should realize that most of the damage was from magical sources – little Annie packs a punch! LoL turns an interruption in game play (being dead) into a moment of reflection that helps players improve their performance and maintain flow.

Figure 5.6 – A Moment of Reflection After Death in League of Legends™

3. MOTIVATION

The second major area of this chapter explores **motivation**. Motivation is basically why a person decides to do a particular activity. Motivation comes in all shapes and sizes and applies differently to each person, even for a given activity. Consider the everyday act of brushing your teeth. You might be motivated to avoid cavities, to have fresh breath, to remove a bad taste, or simply because it's part of your routine. The motivation varies from person to person, but the result is the same. Motivation is an extremely powerful force in our lives and is a key part of flow (Csikszentmihalyi, 1990). In this section we will explore ways to motivate players in learning games.

Motivation has been studied extensively and the research clearly shows that it has a huge impact on learning outcomes (Deci, 1995; Pink, 2009; Williams and Williams, 2010). Further, a lack of motivation (e.g. boredom) has been shown to negatively impact a learner's ability to focus attention (Czikszentmihalyi & Czikszentmihalyi, 1992). As one would expect, people divert their attention to other stuff, whether to one's internal thoughts or another task altogether. Motivation can also help a person persevere through difficult challenges or continue on even though the task is boring. Consider also that anxiety and boredom have both been shown to significantly decrease motivation and focus (Lee, 1999; Teachman, 2005). Lee and Teachman studied how anxiety affected the performance of students taking a

test and found that high levels of anxiety had a negative impact on performance, motivation, focus, and the ability to process information. The bottom line is that motivation is a key part of getting our players to focus, process information, maintain flow, and ultimately, learn. It is a critical part of your design.

3.1 Intrinsic and Extrinsic Motivation

Motivation is generally broken up into two types: intrinsic and extrinsic. **Intrinsic motivation** means that the activity is rewarding in and of itself (e.g., we get a feeling of satisfaction or joy that comes from doing the activity). **Extrinsic motivation** exists outside of the person. It usually implies some sort of reward such as money for work or the currently popular in-game achievements. As a blanket rule, activities that are intrinsically rewarding are more motivating than ones that are extrinsically rewarding (Deci, 1995; Pink, 2009). Further, intrinsic rewards are more likely to lead to flow (Csikszentmihalyi,1990).

The difference between intrinsic and extrinsic motivation is pretty straight forward. However, putting it into practice can be tricky. During implementation, the differences become subtle. Fortunately, there are four concepts that game designers can use as guidance; flow, control, baseline rewards, and achievements. These are helpful rules of thumb, rather than guarantees.

3.1.1 Flow

The first concept is **flow**. We've already discussed flow at length and talking about flow as a way to promote intrinsic motivation is sort of a circular argument. After all, flow is intrinsically rewarding by definition (Csikszentmihalyi, 1990) and intrinsically rewarding activities are more likely to lead to flow. However, the fact that flow is so closely associated with intrinsic enjoyment helps to highlight some concrete and practical design tips.

Flow requires four conditions: goals, feedback, balance, and few distractions. So, let's use these conditions to increase motivation. For instance, we can connect the rewards in the game to the goals the player is trying to achieve. Sometimes, players are motivated by the rewards we will give them, and sometimes, they are motivated by the desire to complete a task. By connecting the rewards with the tasks, we are strengthening both types of motivation.

Further, we can use rewards as a form of feedback. The type/amount of reward can be an indicator of the player's performance. For example, when sailors finish a level in the Damage Control Trainer, they are given a rank using the anchor symbol of a Chief. Sailors want to do a good job and they also have strong associations with the rank of Chief, so the reward, ranking, and feedback are all interconnected.

Finally, we can use the rewards to affect the balance of difficulty versus skill. For instance, the rewards can be improvements that make players more powerful and enable them to overcome challenging content. Alternately, the rewards can be new abilities that they need to learn, which increases the difficulty and helps the game keep up with their growing skill.

3.1.2 Control

The second concept is the issue of **control** (Deci,1995). This is when a reward is being used to control a person's behavior. Imagine parents who want a child to do better in a sport, say soccer. The parents may try offering to pay the child for each goal that is scored – an if-then reward. In this example, the money is intended to get the child to try harder (i.e. controlling their behavior). As you might expect, this is a bad idea. The research clearly shows that using rewards as a control mechanism leads to reduced creativity,

increased cheating (and other undesired behavior), and most importantly, reduced performance. In addition, it shifts all of the focus onto the reward and destroys the intrinsic enjoyment of the activity (Deci, 1995).

There is a potential conflict between the discussion of flow and control. Rewards are risky. If used improperly, players will perceive them to be just another attempt to control their behavior. Unfortunately, there is no sure-fire way to avoid this problem. The only thing you can do is to examine your own intentions as a designer. If you are truly not intending for the rewards to act as a control over the player, then you are probably okay. However, if the reward is a form of control, then Deci's research shows that players will perceive it intuitively, no matter how hard you try to disguise it (Deci, 1995).

3.1.3 Baseline Rewards

The third concept is the idea of **baseline rewards** (Pink, 2009). These are extrinsic rewards that are needed to meet minimal expectations. As an example, people go to work and expect to receive a fair compensation. If the baseline reward isn't adequate, then that creates a feeling of being cheated, which acts as a distraction that breaks flow. However, once the baseline reward is reached, then the science shows that additional tangible rewards tend to have a substantial negative effect on intrinsic motivation (Pink, 2009; Deci, 1995).

Thinking about baseline rewards will help us to better understand the right way to use extrinsic motivators. When we examine entertainment games, it is quite clear that they commonly give extrinsic rewards when players accomplish objectives. They do this in all kinds of ways. They might play a visual/auditory reward, show a little movie, award in-game currency, narrate new parts of the story, or grant access to some new content. This is an extremely common practice. Therefore, many players may expect it. Which means that not offering some sort of reward may violate their expectations. This in turn may distract them away from the task and break flow. As a designer, try to ensure you are meeting baseline expectations.

3.1.4 Achievements

With flow, control, and baseline rewards in mind, let's look at the recent trend of achievements in games. Achievements are little side-tasks that are usually unrelated to the primary objectives of the game. Achievements often give some sort of trivial and irrelevant reward for completing them such as a virtual stamp or a point counter (e.g., 13 of 2000 achievement points). However, there are many varieties of achievements. Some achievements are more like goals which means they might be promoting flow, whereas, some are definitely attempts to control the player's behavior, which can interrupt flow.

The use of achievements in games has turned into a rather heated debate (Hecker, 2010). However, we can simplify the argument by considering the three concepts above. If the achievements sync up with the ideas of flow, control, and baseline rewards, then they are probably fine. If not, then what is intended to be a fun and exciting side-track, is probably decreasing enjoyment, reducing flow, and harming intrinsic motivation (Hecker, 2010; Csikszentmihalyi, 1990; Pink, 2009). As a final note, Hecker has proposed that if you still want to use achievements, then you should try to use things that are unexpected, verbal, or that provide informational feedback (Hecker, 2010). Further, unexpected rewards are less likely to be associated with control.

3.2 Engagement and Motivation

One of the positive aspects of flow and motivation is that they create an increased level of engagement. For learning games, this means players are more engaged with the content in the game, which keeps them focused on the material they are trying to learn. This is particularly important because studies show a strong correlation between academic performance and learners that are engaged with their studies (Finn and Rock, 1997; Fredricks et al., 2004). In addition, positive feelings, such as those associated with flow, are known to keep students engaged in learning longer (Bryan and Bryan, 1991; Bryan et al., 1996; Konradt et al., 2003). While it is true that time on task does not necessarily lead to learning, it is also true that the longer students spend with a subject, the more likely they are to excel with it (Dweck, 1996; Duckworth and Seligman, 2005). Basically, the feelings of motivation found in games can be used to keep a player engaged in the activity and thereby increase student performance and knowledge retention (Whitehall & McDonald, 1993; Ricci et al., 1996).

A technique commonly used to increase motivation and engagement is the use of emotional pulls. Emotional pulls are effective because we are emotional beings by nature. Fortunately, there are many, many types of emotions you can leverage including: fear for one's life; the thrill of acting out a fantasy in a virtual world; and burning curiosity about what's around the next corner (Lazzaro, 2004).

When using emotional motivation, always consider the target audience and the domain. For example, the crew of a ship may be particularly sensitive to the dangers of dying at sea; and budding surgeons may be particularly motivated by losing a patient. Emotional experiences can also be used as a powerful form of feedback. For example in the Damage Control Trainer, a critical error can lead to a video showing the death of shipmates as seen in Figure 3.1. In this case, the emotional experience provides both feedback and motivation that leads to increased engagement and flow.

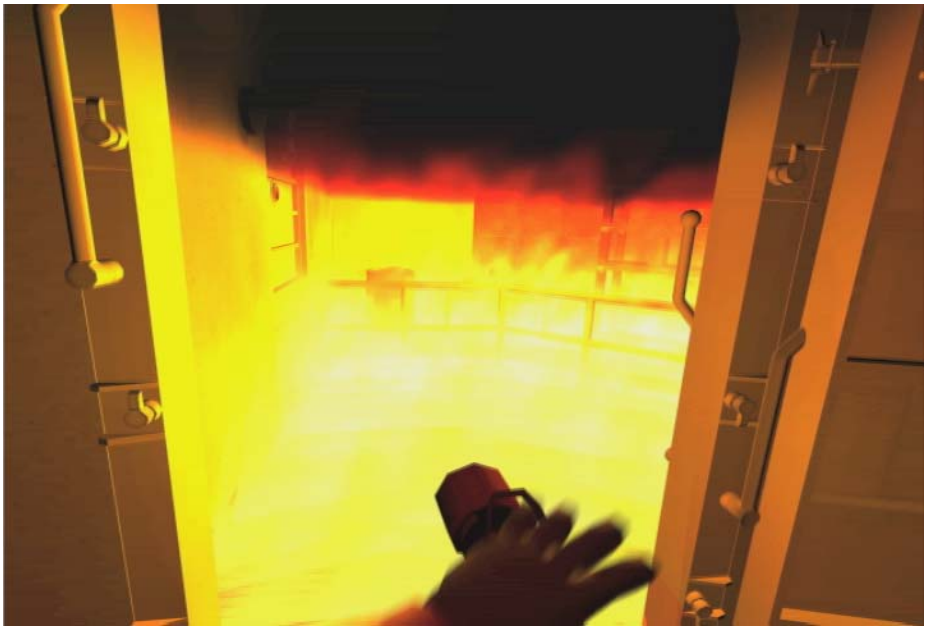

Figure 5.7 - Emotional, Natural Consequences in the Damage Control Trainer

3.3 Principle of Scarcity

Another way to affect motivation is with the **principle of scarcity**. This states that people assign more value to opportunities when they are less available (Cialdini, 2001). In other words, when you have to

trade something in limited supply for something else, it results in an increased perception of value. The principle of scarcity also states that an object of desire that requires effort and sacrifice to attain can be more fulfilling and enjoyable. Clever use of this technique can increase motivation and flow by affecting the perceived value of goals, increasing the person's perseverance, and providing feedback.

3.3.1 Acquiring New Abilities

One way that games motivate players is by making new features available only after they persevere through a significant challenge. Because it requires significant work to earn the feature or item, players will place more value on the result. If the result is something they want, they may also be willing to work longer (i.e., practice more) to overcome the task. The feature may be a new way to interact with the world or a new item that performs actions that were previously unavailable. Sometimes, it can just be a trinket they can display to mark the value of their work. If the reward is a new feature or ability, then this in turn opens up more opportunities and challenges that can be overcome, allowing the process to repeat. This application of scarcity leverages both flow and motivation, which is probably why it is used in thousands of different games.

3.3.2 In-Game Currency

Another way to use scarcity is in-game currency. Typically, a game will reward players with a currency when they tackle various challenges. This currency allows players to purchase things that help them play the game, motivating them to acquire more currency. The Call of Duty: Modern Warfare™ (CoD) series provides a great example of this technique. In the game's multiplayer mode, there are abilities players can obtain such as weapon attachments, never-ending sprint mode, or a parting shot at an opponent. To acquire these abilities, players have to accumulate specific types of currency. In CoD, the various types of currency are linked to the use of specific actions in game. In effect, you have to practice certain skills to earn specific upgrades. The CoD system is an elegant blend of both intrinsic and extrinsic rewards that motivates players to practice specific skills.

3.4 Zeigarnik Effort

The **Zeigarnik effect** is a psychological phenomenon that is used extensively in entertainment games. It states that people remember uncompleted or interrupted tasks better than completed tasks (McKinney, 1935). This significantly increases the drive to complete tasks.

In games, the Zeigarnik effect is typically applied by showing players a visual list of the tasks they have yet to complete. This keeps them motivated to work on those tasks. Feedback on these tasks may be displayed as a percentage of their progress toward a final goal. For instance if a player was tasked with collecting 10 items then as each item is acquired a counter increments and displays their progress. The Zeigarnik effect impacts motivation and when applied correctly, can promote flow by both making the goals more clear and providing feedback on their progress.

Designers should almost always use some variation of this technique. Basically, you are creating a direct tie between goals and feedback that is incredibly motivating. To make the best use of this technique, some care is required. Try to use tasks that focus more heavily on developing the skills of the player (**player skill**) rather than modifying the abilities of the avatar (**avatar skill**). The best way to do this is to make sure the tasks emphasize skills that you want the players to learn. This allows players to achieve real progress by overcoming challenges that focus on the desired learning objectives, instead of just wasting time incrementing virtual pixels. As each small sub-task is achieved, the feedback will then closely relate to the player's skill.

The CoD multiplayer system discussed above is a great example of how to apply this. The CoD currency system shows which tasks you haven't completed yet. Because the tasks stand out as incomplete, the Zeigarnik effect encourages you to finish them. Further, remember that the CoD currency tasks are linked to specific skills that players should be practicing anyway, rather than just virtual avatar skills. The result is that the Zeigarnik effect motivates players to complete the CoD currency tasks, which leads to an improvement of real player skills.

Use of this is extremely common in modern games. However, it is also common to over use it, creating a "get every quest and always click, yes" phenomenon. This may increase motivation but does so in ways that may be unintended or even undesirable for learning games. The player is motivated to complete the task, but may not have any idea what he is completing or why. Blow describes this as the compulsion to spend time increasing avatar skills, instead of real-life player skills (Blow, 2010). In this case, improving flow might not lead to the kinds of learning we want. Design carefully.

3.5 Experiential Design

Experiential design is a design technique that leverages a person's previous experiences to create motivation. The goal of experiential design is to increase motivation by realizing that people carry with them much variability, both in terms of personality and life experience. This variability influences user expectation, motivation, and interpretation of events. As new experiences unfold, people use what they already know to make new decisions and process new information. Our previous experiences can influence our motivation to pursue goals, perhaps based on previous enjoyment and expected rewards (Vroom. 1995) or through the knowledge that some type of fundamental need will be addressed (Ryan & Deci; 2000).

In part, this relies on understanding our audience's previous experiences. While individuals might have individual differences, generally, they have a similar shared experience. Thus, experiential design begins by determining the content of the experience before creating pathways to experience this common content.

The goal is to create a holistic experience which ultimately produces better results for all types of users (Chertoff et al., 2008). Such holistic experiences incorporate five dimensions of the user's prior experience: sensory (i.e., visual artifacts), cognitive (i.e., tasks), affective (i.e., emotional connection), active (i.e., sense of agency), and relational (i.e., social aspects). These five dimensions account for the variability in individual experiences and increase motivation. Researchers found that feelings of flow and presence were greater in environments that made better use of these five dimensions (Chertoff et al., 2010).

Experiential design is often used in massively multiplayer online role-playing games (MMORPG). MMORPGs are large virtual worlds that have vast amounts of content and lore that builds upon itself as the player explores the world. Sensory content is experienced through both visual and audio artifacts. A variety of tasks are presented that provide both short and long-term player goals. As players complete tasks, they begin to associate with the story and narrative, which helps to create an emotional connection to the content. Further, there is the social element of interacting with other players in a virtual space.

Not every player is drawn to a MMORPG for the same reasons. Richard Bartle made an attempt to explore the reasons people play these types of games through four player types: achiever, socializer, explorer, and killer (Bartle, 2003). Socializers play for the varied social opportunities, while achievers

desire to test their ability to complete extremely challenging game content. It is worth noting that this classification is dynamic. Players can move from one type to another depending on what they wish to accomplish at any given time. As a result, it may be worth trying to create content that appeals to each of the four categories. To see how this can be applied, consider the MMORPG Lord of the Rings Online™ (LOTRO™).

LOTRO™ follows players as they experience the world of J.R.R. Tolkien's *The Lord of the Rings*™ in the time period leading up to the War of the Ring. The game is designed to support players that were unfamiliar with the world and also players with extensive knowledge.

The sensory dimension of the game is most important to the explorer. Explorers of Middle-Earth learn what the world looks and feels like. Seeing the ruins of a previous age creates a sense of connection between the game and their past experience with the story through movies and books. For explorers not familiar with the lore, the sense of discovering a location creates a sense of curiosity to find out more. For achievers, socializers, and killers, the sensory content serves as a setting for their preferred activities. For these players, the ruins are the place where they complete a quest, meet with friends, or attack an enemy.

The cognitive dimension of the game is important for all player types as it provides the structure by which activities are performed. For explorer types, this is the reason to travel to new locations. Achievers have a variety of content to tackle. Explorers can appreciate quests that guide them toward new locations. Some quests require additional players to complete, which supports socializers. Meanwhile, killers get satisfaction from the requirement to defeat hordes of enemy monsters. In addition, a player-vs-player game type was included for those killer types that desired socialization.

The affective dimension of the game influences all player types through a particularly in-depth series of quests called the "Epic Quest". This line is more closely connected to the traditional plots of The Lord of the Rings. It provided an opportunity for players to form connections to the main characters, but also make their own decisions. It is primarily through this Epic Quest that players new to the world of Middle-Earth are exposed to the major plot elements found in the books.

The active dimension also influences all player types since the player's experience in the world occurs through an avatar. This avatar has a number of statistics that can be improved and customized in ways that satisfy all four player types. Achievers can level up their avatar and grow more powerful. Killers can focus on growing more powerful through repeated player-vs-player content. Explorers gain experience by finding new locations. Lastly, socializers can measure their character's progress by adding other players to their friend's list or by joining an in-game guild.

The relational dimension is most important to the socializer, but is also important for achievers and killers. Both socializers and killers need other players in the game to stay engaged. Socializers need other players to talk to, while killers need a subject for their player-vs-player combat. Meanwhile, achievers that wish to take on the most complex game content require groups of like-minded players to accomplish those tasks. As a result, heavy achievers are often members of large in-game guilds.

Ultimately, LOTRO allows players of all types to travel through large portions of Middle-Earth based on their individual play style. The game uses experiential design to help players gain a much greater experience of the material. Regardless of player type or prior knowledge, the five dimensions allow players to have incredibly deep engagements with the content – they become one of the unsung heroes of the War of the Ring. All of which motivates them to continue playing.

4. FUN

The last of the major topics is **fun**. Typically, we don't list fun as a requirement when we are designing learning games. After all, it's a nebulous word that is hard to define. However, take a quick look back at the various topics we've discussed as part of flow and motivation. Many of them could just as easily have been categorized under a single heading: fun. After all, engagement, deep involvement, motivation, and being-in-the-zone sound a lot like qualities of fun. Even Csikszentmihalyi routinely uses the word enjoyment when describing flow. So, though it is ambiguous at times, fun is still an important consideration when designing learning games.

4.1 Learning is Fun

Raph Koster presents a compelling argument that games are just teachers and "fun is really just another word for learning" (Koster, 2005, p. 46) He takes that further saying, "a good game is therefore one that teaches everything it has to offer before the player stops playing" (Koster, 2005, p. 46). From his perspective, fun is the positive feedback that our brain gives us for learning and mastering patterns. Fun is a critical part of both motivation and flow. He argues that the opposite of fun is either noise (e.g., patterns that we don't understand) or boredom (e.g., simplistic patterns that have nothing to teach us). Both noise and boredom are destructive to fun, motivation, and flow (Koster, 2005; Csikszentmihalyi, 1990). From his perspective, games are just "iconified representations of human experience that we can practice with and learn patterns from" (Koster, 2005, p 36).

Koster argues that we are all just pattern matchers. Humans are designed to consume vast amounts of information, find the inherent patterns, and apply them to solve problems. This ability is paired with an equally important system that rewards us chemically for finding and applying new patterns. This, in a nutshell, is why we play (Koster, 2005).

4.2 Types of Fun

Nicole Lazarro also explored the meaning of fun. In her various papers on game design, she proposes that there are really four types of fun: easy, hard, serious, and social (Lazzaro, 2004). Lazarro showed that top selling entertainment games typically possess at least three of the four types of fun.

Easy fun is associated with play in real life. It often involves elements of exploration, creativity, or fantasy where goals are often personal and not imposed by predetermined objectives. Easy fun is associated with feelings of curiosity, surprise, wonder, and awe. This is exemplified by the Minecraft™ scene (Figure 2.2), where players acted out their own goals to craft a village and then watched in curiosity as it burned to the ground.

Hard fun is associated with attaining and exercising mastery through goal completion. It involves overcoming obstacles by applying skill and strategy. Ideally the process iterates through cycles where you will experience frustration, triumph, and relief while maintaining the conditions for flow. This type of fun is the one typically associated with learning games, particularly where the goal is to master skills with real world value. This is a major part of role playing and real-time strategy games.

Serious fun describes the enjoyment that players get from the experience itself. It is sometimes referred to as altered states. Serious fun is focused on the emotions that frequently result from repetition, rhythm, or collection such as excitement, zen-like focus, or relaxation. Serious fun is that which promotes mental order over mental chaos. It is a form of play as therapy and is by definition intrinsically motivating

since the experience is pursued for its own sake. This is easily seen in games like Bejewelled™, Tetris ™, and a number of solitaire card games.

Social fun is based on the interactions between people such as communication, cooperation, and competition. It results in feelings of friendship, amusement, bonding, and admiration. Entertainment games have been increasingly designed to create social experiences. Recent trends include multiplayer features, online communities, and the popularity of social networking games. There are other types of social fun such as schadenfreude (gloating over a rival), naches (rewards of mentoring), and fiero (triumph over a difficult task) (Koster, 2005).

Fun can be thought of in terms of both motivation and flow. Therefore, look for ways to include as many types of fun as possible.

1. Invoking serious fun means creating gameplay that the player will value for its own sake (e.g., intrinsically motivating).
2. Easy fun can be integrated by creating opportunities for players to accomplish goals of their own choosing (player-driven tasks) or with creative solutions.
3. Koster argues that "the more formally constructed your game is, the more limited it will be" (Koster, 2005, p38). The idea then is to create simple systems that have complex interactions that lead to emergent gameplay. This often involves exploration and wonder as players discover unexpected game experiences (e.g., easy fun).
4. Hard fun can be created by using clear tasks that focus on completion.
5. Try to allow for easy fun through self-directed exploration. This can help avoid the play-it-once, set-it-aside type of experience.
6. Social fun is particularly useful because there are so many ways to include it. One approach is a multiplayer mode where players can work either cooperatively or competitively in real time. However, this can be tricky in learning environments and has some potential draw backs.
7. Social network games (e.g., Facebook) allow communication, cooperation, and competition to occur asynchronously (Johnson, 2009).
8. Consider using forums, chatting, or email to facilitate social communication. Alternately, news feeds can relay actions of other players or leader boards can show top performers.
9. Consider creating a persistent game state so that players have a chance to impact and interact upon the same world in non-real time.
10. Consider common teaming techniques such as pair playing or mentor based partnerships.
11. For more ideas on social fun, see Koster's presentation at the 2011 Game Developer's Conference (Koster, 2011). He presented an impressive list of forty different mechanics for social fun and argued that games are barely scratching the surface of what is possible.

4.3 Fun in the Rules

Jonathan Blow, creator of the game Braid™, insists that games need to reinvent themselves as a medium in order to live up to their full potential. The crux of Blow's message is that games are an interactive system of rules that can convey content that is independent from linear story elements. In his words: "Any time we set up a system of behavior...that system communicates something to the player" (Blow, 2008). In order to convey meaning most robustly, games ought to be designed so that their meaning (i.e., content) is embedded directly within the fun mechanics of the game. In other words, the fun should relate directly to the learning objectives, not as tangential add-ons.

The game Braid™ is a perfect example of putting the learning content directly into the game mechanics. Braid™ explores the complex nature of time by allowing players to directly manipulate

various aspects of time: faster, slower, backward, and forward. Blow wants players to think about and learn about time in a fundamental way. Figure 4.1 shows a scene where players must manipulate time to solve a puzzle. They must fall into the pit, defeat a monster, get the key, and then reverse time back to before they fell into the pit. In this puzzle, the key is immune to time reversal, and the player will be back on the bridge, but holding the key. In the picture, you can clearly see that there is no way out of the pit. The only solution is for the player to explore, learn about, and apply the complex manipulation of time that is the fundamental concept (i.e., learning objective) of the game. Time is the lesson and is also the core mechanic of the game.

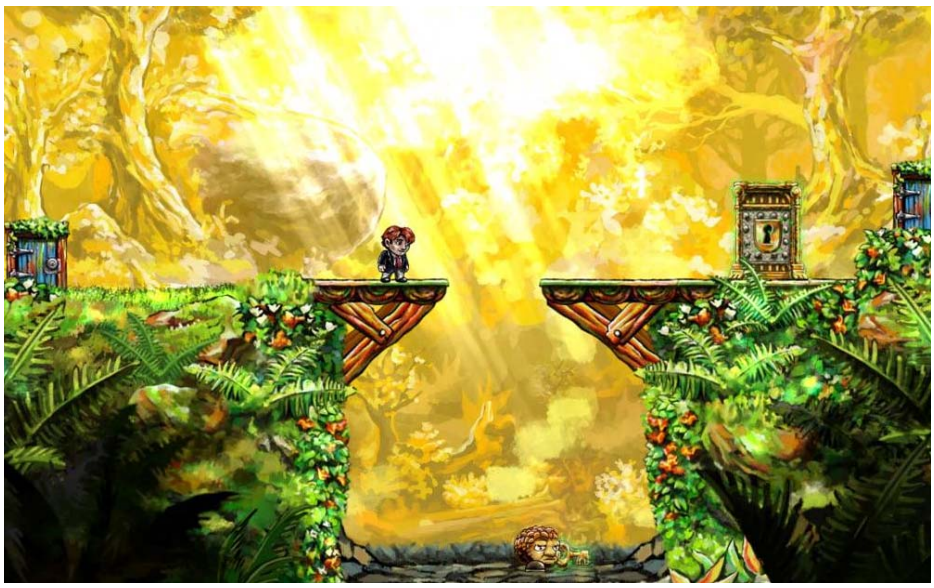

Figure 5.8 – In Braid™, Learning About Time Is Core To The Fun

The application to learning games is clear: make the instructional content a core part of the fun in the game. Make sure the fun is directed at what you want them to learn. As discussed in section 2.2, it doesn't matter whether the base material seems boring or not. The technique applies whether you are talking about the replication of cells, the collision of planets, or battles of the civil war. You can make a compelling game of almost any content (Murphy, 2010; Chen, 2007). The key is to find out what is engaging about the content and identify the patterns that can be mastered. Use those as core elements of the fun in your game. Then, use the techniques of flow and motivation to create a compelling experience that allows players to explore the learning content. As this quote, attributed to Sid Meier, sums up, the goal is to design a "series of interesting and meaningful choices made by the player in pursuit of a clear and compelling goal" (Falstein, 2005, p. 81).

4.4 Presence

Another way to look at player experience is to consider how strongly the player is immersed. When the content and tasks in the game environment support a strong sense of immersion, the player can feel transported into another space. This feeling is often referred to as a sense of **presence**, or being there (Heeter, 1992). Many researchers have studied what causes a person to become and remain present. For example, Witmer and Singer concluded that keeping users deeply involved was very important for maintaining a sense of presence (Witmer & Singer, 1998).

The idea that deep involvement is necessary for presence is supported by recent game studies. Clarke and Duimering noted that gamers often stated a desire for a high-sensory experience, but that such an

experience was irrelevant 'eye-candy' if the game was not enjoyable (Clarke & Duimering, 2006). The authors conclude that the tasks and goals of the game influenced what gamers would perceive. Game tasks that had little or no impact toward completing the overall goal were largely ignored by players. Deeper sensory immersion was dependent on how integrated the sensory aspects of the environment were on goal completion.

It is incumbent upon the designer to create sensory experiences to encourage flow. For example, a first-person shooter that encourages players to take cover amongst debris to avoid enemy fire should provide a better sensory experience than a game that does not. Essentially, sensory content needs a purpose. The purpose for the content ultimately comes from the tasks created by the designer.

One example of a game that combines the sensory experience with relevant game goals is Immune Attack. Immune Attack is a game developed by the Federation of American Scientists to teach high school and college biology students about the human body. In the game, you take control of a nanobot injected into the body of someone with a suffering immune system. Each game task requires you to interact with the various organs and cells found in the body. As a result, player exposure towards the visual and structural representations of cells is highly connected towards successful completion of game goals. It acts to reinforce the notion that the player is vital to the game environment and results in a higher sensory experience through feelings of presence.

5. CONCLUSIONS

Games are not a fringe part of our culture or something that only young people do. They are played by people of all ages. Even the Smithsonian National Museum of Art recognizes that games are a part of the fabric of our society. And, they will become more prevalent, not less. We began this chapter with the harsh criticism of Ali Carr-Chellman, "Most of the educational games that are out there today are really flash-cards. They are glorified drill-and-practice. … We need to design better games" (CarChellman, 2010).

That is our job. And it is not easy. As learning game designers, we are sandwiched between two industries and we contend with the challenges of both. To make matters worse, games are becoming increasingly complex and costly (Murphy, 2005) and learning science continues to evolve (Pink, 2009). Designing a learning game is hard and as Carr-Chellman observed, we haven't done all that well by blindly stumbling along, relying on luck.

To leverage the benefits of games, we need to embrace their strengths. We need to focus on the things that are critical to games: flow, motivation, and fun. Of the three, we believe flow is the most important. After all, flow is the fundamental reason why people play games. In addition to flow, we looked at ways to increase motivation. High motivation is an important aspect of games and it is also strongly linked to learning. Finally, we explored ways to make our games more fun. Together, these three areas show us what we need to design games that both engage and instruct.

Fortunately, you do not need special tools to apply flow, motivation, and fun. Schell suggests a way forward. He guides us to think of game design as both an art and a science (Schell, 2008), which is why this chapter has explored it from both sides. The science side guides us to create games where the goals are clear, the feedback is relevant, and the challenges and skills are in balance. The art side guides us to design a game with flow. The science side validates that we should minimize distractions while encouraging repetition and reflection. The art guides us to use simple interfaces. The science tells us to apply the principle of scarcity and minimize the paradox of choice. The art illustrates the power of

intrinsic rewards and engagement. We need science to apply the Zeigarnik effect. But we need art to ensure we aren't controlling our players with rewards.

Schell's guidance applies equally well to both entertainment games and learning games. We need both art and science to maximize both learning and fun. To answer Car-Chellman's challenge, we need to design games with flow, motivation, and fun.

REFERENCES

Baranowski, T., Buday, Richard, Thompson, Debbe, Baranowski, Janice, (2008), Playing for real: video games and stories for health-related behavior change. Published in *The American Journal of Preventive Medicine*, Volume 31, Issue 1, Jan 2008.

Bartle, R., 2003, *Designing Virtual Worlds,* New Riders, 2003.

Beck, John, Wade, Mitchell, 2004, *Got Game – How the Gamer Generation is Reshaping Business Forever,* Harvard Business School Press, 2004.

Blow, Jonathan, 2008, Montreal International Game Summit, 19 November, 2008. Recording and slides available here: http://braid-game.com/news/?p=385

Blow, Jonathan, 2010, Video games and the human condition, CS Colloquium: Rice University.

Bransford, J., Brown A., and Cocking, R, National Research Council, 2000, *How People Learn: Brain, Mind, Experience, and School*. National Academy Press.

Bryan, T., Bryan, J, 1991. Positive mood and math performance, Journal of Learning Disabilities, 24(8), 490-494.

Bryan, T., Mathur, S., & Sullivan, K, 1996, The impact of positive mood on learning, Learning Disability Quarterly, 19(3), 153-162.

Buchanan, James, 1999, *Cost and Choice: An Inquiry in Economic Theory*. Available in the Collected Works of James M. Buchanan from the Library of Economics and Liberty at http://www.econlib.org.

Carr-Chellman, Ali, 2010, Gaming to re-engage boys in learning, Published Jan 2011, at http://www.ted.com/talks/ali_carr_chellman_gaming_to_re_engage_boys_in_learning.html?hpt=Sbin.

Jenova, Chen, 2007, Flow in games, Master's thesis. Also published in Vol 50, No 4, Communications of the ACM, Apr 2007.

Chertoff, D. B., Schatz, S. L., McDaniel, R., & Bowers, C. A, 2008, Improving presence theory through experiential design, Presence: Teleoperators and Virtual Environments , 17 (4), 405-413.

Chertoff, D. B., Goldiez, B., & LaViola, J. J, 2010, Virtual experience test: a virtual environment evaluation questionnaire, Proceedings of the IEEE Virtual Reality 2010 Conference, (pp. 103-110). Waltham, Massachusetts.

Choney, Susan, 2011, 80 video games head for Smithsonian art exhibit, Article published on MSNBC on May 9, 2011. Available online at http://ingame.msnbc.msn.com/_news/2011/05/09/6613809-80-video-games-head-for-smithsonian-art-exhibit.

Cialdini, Robert, 2001, *Influence: Science and Practice (4th Edition)*, Boston: Allyn & Bacon.

Clarke, D., & Duimering, P. R, 2006, How computer gamers experience the game situation: a behavioral study, ACM Computers in Entertainment , 4 (3), 1-23.

Csikszentmihalyi, Mihaly, 1990, *Flow: The Psychology of Optimal Experience*. Harper Collins.

Csikszentmihalyi, Mihaly, and Csikszentmihalyi, Isabella, 1992. *Optimal Experience: Psychological Studies of Flow in Consciousness,* Cambridge University Press.

Csikszentmihalyi, Mihaly, 1997, *Finding Flow: The Psychology of Engagement with Everyday Life*, Basic Books.

Deci, Edward, 1995, *Why We Do What We Do*. Penguin Group.

Duckworth, A. L. & Seligman, M. P, 2005, Self-discipline outdoes IQ in predicting academic performance of adolescents, Psychological Science, 16(12), 939-944.

Dweck, C.S, 1996, Implicit theories as organizers of goals and behavior, In P.M. Gollwitzer & J.A. Bargh, *The Psychology of Actions: Linking Cognition and Motivation to Behavior* (pp 69-90), New York: Guilford Press.

Falstein, Noah, 2005, Understanding Fun – The Theory of Natural Funativity, published in *Introduction to Game Development* (pp 71-98), Boston, MA: Charles River Media.

Finn J.D., & Rock, D. A, 1997, Academic success among students at risk for school failure, Journal of Applied Psychology, 82(2), 221-234.

Fredricks, J. A., Blumenfeld, P.C., & Paris, A.H, 2004, School engagement: potential of the concept, state of the evidence, Review of Educational Research, 42(2), 59-109.

Goleman, D, 1995, *Emotional Intelligence: Why it can matter more than IQ,* Random House, New York.

Greene, Robert L, 2009, Repetition and learning, Retrieved on Jan, 2011 from http://www.education.com/reference/article/repetition-and-learning/

Hayes, R.T, 2006, *The Science of Learning: A Systems Theory Approach*. Boca Raton, FL: Brown Walker Press.

Hecker, Chris, 2010, Achievements considered harmful?, Presented at Game Developer's Conference, San Francisco, March 2010.

Heeter, C, 1992, Being there: the subjective experience of presence, Presence: Teleoperators and Virtual Environments , 1, 262-271.

Hintzman, D, Curran T, and Oppy B, 1995, Effects of similarity and repetition on memory: registration without learning, *Journal of Experimental Psychology: Learning, Memory, and Cognition*.

Husain, Talib PhD, Murphy, Curtiss, Bowers, Clint, Cannon-Bowers, Janis, Menaker, Ellen S., Pounds, Kelly, Koenig, Alan, Wainess, Richard, Lee, John, 2009, Designing and developing effective training games for the US Navy, 2009 Interservice/Industry Training, Simulation, and Education Conference, Orlando, FL.

Johnson, Soren, 2009, Analysis: asynchronicity in game design, Game Developer Magazine, March 2009.

Johnson, Soren, 2011, The end of games? Or, will free-to-play swallow the industry?, Game Developer Magazine, May 2011.

Konradt, U., Filip, R., & Hoffmann, S, 2003, Flow experience and positive affect during hypermedia learning, *British Journal of Educational Technology*, 34(3), 309-327.

Koster, Raph, 2005, *A Theory of Fun for Game Design*. Paraglyph Press.

Koster, Raph, 2011, Social mechanics for social games, Presented at the Game Developer's Conference, San Francisco, CA, Mar 2011.

Lazarro, Nicole, 2004, Why we play games: four keys to more emotion without story, Proceedings of the Game Developers Conference 2004.

Lee, J.H, 1999, Test anxiety and working memory, *The Journal of Experimental Education*, 67 (3), pp 218-240.

McKinney, F, 1935, Studies in the retention of interrupted learning activities, *Journal of Comparative Psychology*, vol n° 19(2), p. 265-296.

Miller, Jeremy, Westerman, Deanne, Lloyd, Marianne, 2004, Are first impressions lasting impressions? An exploration of the generality of the primacy effect in memory for repetitions,Published in Memory and Cognition, 2004.

Mory, E.H, 2004, Feedback research revisited, In D.H. Jonassen (Ed), *Handbook of Research on Educational Communications and Technology* (pp. 745-783), Mahwah, NJ: Lawrence Erlbaum Associates.

Murphy, Curtiss, 2005, A low cost methodology for achieving joint objectives - ONR game, Published and presented at the Interservice/Industry Training, Simulation, and Education Conference, Orlando, FL, Dec 2005.

Murphy, Curtiss, 2010, How to create an award winning serious game, Presented at the Interservice/Industry Training, Simulation, and Education Conference, Orlando, FL, December 2010.

Murphy, Curtiss, 2011, Why games work – the science of learning, (in publication) Presented at Modsim World, Virginia Beach, VA 2011, available online at http://www.goodgamesbydesign.com/Files/WhyGamesWork_TheScienceOfLearning_CMurphy_2011.pdf.

Peterson, Steve, 2012, Game Industry Legends: Will Wright, an interview retrieved from http://www.gamesindustry.biz/articles/2012-03-29-game-industry-legends-will-wright.

Pink, Daniel, 2009, *Drive - The Surprising Truth About What Motivates Us*. Riverhead Hardcover.

Ricci, K., Salas, E., & Cannon-Bowers, J, 1996, Do computer-based games facilitate knowledge acquisition and retention?, Military Psychology, 8(4), 295-307.

Rouse Richard III, 2004, *Game Design Theory And Practice – Second Edition*. Wordware Publishing, Inc.

Ryan, R. M., & Deci, E. L, 2000, Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being, American Psychologist , 55, 68-78.

Schell, Jesse, 2008, *The Art of Game Design, a Book of Lenses*. Morgan Kaufmann Publishers.

Schwartz, Barry, 2004, *The Paradox of Choice, Why More is Less,* Harper Perennial.

Schwartz, Barry, 2006, The paradox of choice, why more is less, Presented at Google and available as a Google Tech Talk at http://video.google.com/videoplay?docid=6127548813950043200&hl=en&emb=1#.

Shute, V, 2008, Focus on formative feedback, *Review of Educational Research* 78(1), pp. 153-189.

Teachman, B.A, 2005, Information processing and anxiety sensitivity: cognitive vulnerability to panic reflected in interpretation and memory biases, Cognitive Therapy and Research, 29, pp 483-503.

US Department of Transportation, 2008, *Aviation Instructor's Handbook,* Federal Aviation Administration.

Van Eck, Richard, 2006, Digital game-based learning: it's not just the digital natives who are restless, EDUCAUSE Review, vol 41, no 2, March/April, 2006.

Vroom, V. H, 1995, *Work and motivation (2nd ed.),* New York: Wiley.

Whitehall, B. & McDonald, B., 1993, Improving learning persistence of military personnel by enhancing motivation in a technical training program, Simulation and Gaming, 24, 294-313.

Williams, K. Williams, C, 2010, Five key ingredients for improving student motivation, Research in Higher Education Journal.

Witmer, B. G., & Singer, M. J, 1998, Measuring presence in virtual environments: A presence questionnaire, Presence: Teleoperators and Virtual Environments , 7, 225-240.