

The Play of Imagination

Extending the Literary Mind

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As games, particularly virtual worlds, become increasingly popular and as they begin to approximate large scale social systems in size and nature, they have also become spaces where play and learning have merged in fundamental ways. More important is the idea that the kind of learning that happens in the spaces of these massively multiplayer online games is fundamentally different than what we have come to consider as standard pedagogical practice. The distinction the authors make is that traditional paradigms of instruction have addressed learning as “learning about,” while these new forms of learning deal with knowledge through the dynamic of “learning to be.” It is the authors’ contention that the experiences offered within virtual worlds provide a fundamentally different way of thinking about learning that may provide some keys to the development of future pedagogical practice.

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In the past decade, beginning with Ultima Online, a new genre of interactive play has emerged in the form of massively multiplayer online games (MMOGs).¹ These games combine the power of traditional forms of role-playing games (RPGs) with a rich, textured graphical framework. The result has been the emergence of game spaces that provide players with new and unusual opportunities for learning.² As these games become increasingly popular and as they begin to approximate large-scale social systems in size and nature, they have also become spaces where play and learning have merged in fundamental ways and where players have become deeply enmeshed in the practices and cultures of interactive play, collaboration, and learning. More important is the idea that the kind of learning that happens in these spaces is fundamentally different from the learning experiences associated with standard pedagogical practice. In this article, we examine how this new world of games has captured the imagination and how the play of imagination that it engenders yield insights into the way play, innovation, and learning are connecting for the 21st century.

The power of these particular games rests with the way in which they allow players to construct vivid and meaningful “conceptual blends” by taking different worlds (such as the physical and the virtual) and combining them to create new and better

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ways to understand both the game world they inhabit and the physical world. Where MMOGs differ from other kinds of games is in their deeply social nature. Whereas a traditional “game” remains at the core of MMOGs, the rich social fabric that the game produces blurs many of the boundaries that we tend to expect such as the distinction between the physical and the virtual, the difference between player and avatar, and the distinction between work and play. Furthermore, we argue throughout the article that the learning that happens in MMOGs is tied to practices, but those practices are not solely the practices of game play or even skills such as resource management. They are, instead, the skills of learning how to use one’s imagination to read *across boundaries* and be able to find points of convergence and divergence between different worlds to understand their relationships to one another. MMOGs encourage the use of imagination to bridge the gaps and boundaries between worlds to provide a more complete and a more complex understanding of both the virtual and the physical worlds the player inhabits.

To grasp the scope and significance of the phenomenon that MMOGs represent, it is necessary to understand what is happening within the complex social worlds these games create. Doing so allows us to understand why so many people play these games (nearly 8 million in World of Warcraft alone) and what about them may engender new forms of learning that exercise the imagination and foster innovative thinking. Accordingly, the goal of this article is twofold: to show, in some detail, what these games do and, armed with that knowledge, to demonstrate why they matter.

From MUDs to MMOGs

In 1979, Roy Trubshaw and Richard Bartle created an online world called MUD, the first multiuser adventure game accessible online. The game was enormously popular and was eventually licensed to CompuServe, where it ran until 1999. The idea behind the first MUD, which has spawned hundreds of other similar games, was to provide a virtual environment where players used text to create and describe the world they inhabited. The virtual worlds were games, but they were also literary worlds. Not surprisingly, many MUD-like worlds that have spawned in the past decades have, themselves, been literary-themed worlds where players create characters in contexts such as J. K. Rowling’s *Harry Potter* novels, Frank Herbert’s *Dune* universe, the *Dragonlance* series of books, or John Norman’s world of *Gor*, to name only a few. In these worlds, players provide textual descriptions of who they are, what they look like, and how they act and react to others in the world. They are worlds in which role-playing is valued and players are judged by how well they pose within the world. In that sense, MUDs were text-based games, which afforded users a high degree of control over how they created and played the characters they invented (Figure 1). Because these worlds that were the products of a large number

Figure 1
Text-Based MUD

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C:\Private\arena_12_05_04>
File Edit Window Help
You envelope Greylock in a Holy Storm!
HP: 285 GP: 186
sc
Hp: xxx(xxx) Gp: xxx(xxx) Xp: xxxxxx Socp: 1000
>
Your weapon rages forth with a blinding power, aiding your storm.

Magic blasts and heals you!.
You envelope Greylock in a Holy Storm!
HP: 302 GP: 186
unhold salvation
You lower your Salvation.
> e
Arena Dragon missed you.
Arena Dragon missed you.
Arena Dragon swats its massive tail into you. for 20 HPs.
> Arena, Outside [nw,w,sw,ne].
Arena Dragon is here.
> ch
You bellow out thy challenges to the cravenly Arena Dragon.
> You stab Arena Dragon with your Cobra fang for 26 HPs damage.
You chew on Arena Dragon's rear legs for 35 HPs.

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of people playing together, MUDs were also the first persistent games, meaning when a player logged off, the world continued functioning without them.

During the same period of time, video games began to develop from tests of hand-eye coordination (e.g., Pong and Space Invaders) to games that provided players with ongoing content and storylines. In the 1990s, games that combined sophisticated graphics with narrative elements formed the bulk of RPGs, which were designed to allow the player to experience parts of the game world, solve puzzles and mysteries, and engage in combat with nonplayer characters, or NPCs. These games provided a heightened sense of interactivity, where the player was put into the role of a main character in the narrative and then able to experience the story from a first-person point of view. With an intense focus on graphical representation and guiding the player through the story, RPGs immerse the player in the experience of the world, but unlike film or television (both passive media), these games allow the player to experience the narrative as the central character. In the Tomb Raider series of games,

Figure 2
Avatar-Based Game Play



for example, the player is no longer watching Lara Croft; she *is* Lara Croft. Because she is the central (and only) character in the game, when she quits or pauses the game, the world comes to a halt, allowing her to start, stop, pause, and restart at her leisure (Figure 2).

MUDs and RPGs, then, exist on different ends of the spectrum of imagination. Whereas MUDs allow the player to create and be, literally, anything she can type, RPGs radically constrain the player's identity, forcing her into a predefined role and narrative that she is then able to experience. Both call on the literary imagination, with MUDs placing the player in the role of author, or more accurately, coauthor, along with all the other players in the game and with RPGs creating a new position for the player as a kind of experiential reader, where she absorbs the narrative not by reading it, but rather by interacting with and experiencing it.

In the late 1990s, with *Ultima Online*, game designers fused the two elements, launching a new genre of games called massively multiplayer online role-playing

Figure 3
Massively Multiplayer Online Game



games, MMORPGs (or MMOGs for short). These games combined the two earlier traditions by incorporating the generative, literary elements of MUDs into a graphical universe of narrative and interactivity. In *Ultima Online* and the games that followed it, players create a character that is part of a predefined universe or game world, but because these worlds are online and persistent, the worlds respond to and are shaped by the actions and choices of the players who inhabit them. Like MUDs, MMOGs are part of the literary imagination, where meanings are shaped by the players who inhabit the world. And like RPGs, they are graphical worlds, experienced within a narrative framework that is both first-person and highly interactive. In short, they combine the agency of authorship from MUDs, with the experiential, narrative notions of readership from RPGs. The result is a space where players are both author and reader. It is a site of intertextuality, where the text of the game (created by the developers) is central to but indistinguishable from the texts that players create by inhabiting and playing in the world. By experiencing the world, the player actually

changes it. The actions that players take, the choices they make, create meanings and values that are experienced by others in the shared space of the game world.

As these games have evolved, MMOGs have created extremely rich, interactive, persistent worlds where players have both identity and agency and where narrative provides a framework for interpretations of meanings without constraining players' notions of identity. In worlds such as *World of Warcraft*, we can see how multiplayer aspects of MUDs are brought to life through a graphical interface (Figure 3).

It is this combination of text and graphics that creates an entirely new space for what Mark Turner, in his germinal work *The Literary Mind* (1998), has called "conceptual blending." It is a combination of agency and play that positions the player as both a producer and consumer of the world she inhabits that makes MMOGs something distinct from either the MUDs or RPGs that preceded them. It is also this fusion of horizons that opens up a new space for the play of imagination that, we believe, moves MMOGs into a space beyond the traditional literary mind.

Understanding Games

One perspective for understanding games is through the direct transfer of skills, which has been used to examine how games and simulations can teach skills and impart knowledge (Bowman, 1982; Bransford & Schwartz, 2001; Gredler, 1996; Kubey & Larson, 1990; Malone, 1980; Prensky, 2000; Provenzo, 1992; Thiagarajan, 1998) or examine the impact of games on violence and aggression (Anderson & Ford, 1986; Calvert & Tan, 1994; Cooper & Mackie, 1986; Dominick, 1984; Graybill, Kirsch, & Esselman, 1985; Graybill, Strawniak, Hunter, & O'Leary, 1987; Schutte, Malouff, Post-Gorden, & Rodasta, 1988; Silvern & Williamson, 1987).

A second perspective examines the role of games in relation to theories of situated knowledge (Barab & Duffy, 2000; Brown, Collins, & Duguid, 1989; Brown & Duguid, 1996; Jenkins & Squire, 2004; Squire, 2002; Shaffer, 2006). This research examines how games provide new investments in learning and provide epistemic frames for creating new ways of knowing. Jim Gee (2005), for example, suggested that games can provide a sense of "embodied empathy for complex systems"³ and provide "embodied experiences," giving a player the feeling that they are inside the system they are analyzing. Likewise, Shaffer, Squire, Halverson, and Gee (2005) argued that "the virtual worlds of games are powerful because they make it possible to develop situated understanding" (p. 105).

These approaches have value, but this article explores an additional aspect of games, one that is both particular to large-scale MMOGs and that does not fit neatly into either the frame of direct transfer or of situated knowledge. Whereas both these frameworks address questions of how information gets from the game to the learner, that is, how do games "teach," we are interested in a different aspect of learning,

asking how MMOGs invoke the imagination and what the implications of such vivid, imaginative thinking may be.

What we are offering is a set of analytic categories designed to help us understand what virtual worlds do that is different from the typical learning environment. This is not to say that standard forms of learning do not occur in games or virtual worlds. They do. Our point is that there is something additional happening, something that makes the learning experience in MMOGs very powerful but also very different from the way education has traditionally been conceived.

A timed quest in *World of Warcraft* provides an illustration of the different perspectives. These missions must be completed within a set amount of time, typically 45 minutes to an hour. A direct transfer perspective would focus on skills, such as improved hand-eye coordination, or more abstractly, the ability to solve puzzles or develop analytic reasoning. A situated learning perspective may examine how it is that the pressures of time constraints might help improve time management skills or broaden a player's understanding of how various interconnections work within those time constraints, providing what Gee (2003, 2005) called an "embodied empathy for complex systems." All of these are, undoubtedly, valuable skills to develop and understand. But none addresses the broader and unique context of the social systems embedded within MMOGs.

Within our perspective, we want to understand how players experience and learn from something like a timed quest not as an isolated event, but as part of a shared social experience that involves joint, coordinated action with others and the participation in a culture of learning and knowing that both defines and is defined by the game. In our perspective, we borrow from Brown and Duguid (1996) to suggest that learning "is not simply a matter of acquiring information; it requires developing the disposition, demeanor, and outlook of the practitioners" (p. 126).

MMOGs are game spaces that combine three things: player-created avatars; game mechanics (usually in the form of quests or missions involving combat, resource acquisition, or exploration); and a complex social, economic, and cultural network that has a direct and deep impact on how meaning and actions are valued and interpreted by players within the world itself.

It is the combination of these elements that we believe makes MMOGs a unique space for a new form of learning, one that produces new dispositional stances, exercises the play of imagination, and provides for a complex sense of agency.

Vivid Spaces of Imagination

As the quality of games has increased, so has the quality of representations in them. Much of the focus in new game systems and platforms is on creating photo-realism and accuracy. How is it that a game like *World of Warcraft*, which runs at low resolution and is populated with cartoon-like characters and scenery, attracts and holds close to 8 million subscribers?

Our central thesis is that the power of MMOGs rests in their ability to create a play of imagination, whereby the player is immersed in a world of dense and vivid representations that provoke them to think beyond what they see on the screen. In that sense, we are interested in understanding the gaps between player and avatar, between virtual and physical, and between players themselves, that are continually filled in and traversed by acts of imagination. Furthermore, we contend that MMOGs are extremely vivid spaces that not only allow for imaginative thinking but integrate imaginative thinking into the fabric of the social and game experience of play.

Understanding how these spaces function in terms of learning requires us first to understand what is unique about the ways MMOG players approach questions of knowledge, information, imagination, and play.

Dispositional Stances

The relationship between play and learning is both complicated and fundamental. As Piaget (1962), Vygotsky (1926), and Huizinga (1938) have all described in some of their most germinal works, learning and play are in many ways inseparable. More than simply a means to learning, play is a way of thinking about more than what we know. It is, following Gilbert Ryle's (1949) notion of mind, a disposition toward the world, a way of not only seeing the world but of seeing ourselves in it and the various possibilities that the world presents.

This notion of disposition is central to our understanding of the intersection of play and learning for two important reasons: First, it describes a set of attitudes or comportment toward the world, generated through a set of practices that can be seen to be interconnected in a general way. Second, and perhaps more important, disposition is distinct from what Ryle (1949) called the "episodic." This means that dispositions are not descriptions of events or practices; they are the underlying mechanisms that engender those events or practices. For example, being disposed toward smoking is not the same thing as smoking a cigarette, though the idea of a disposition could explain why one is smoking, just as it could explain why one is fidgeting on a long plane flight. In that sense, being a gamer is a disposition that sheds light on how particular practices work, acquire meaning and value, and are shared within and among various communities and networks.

Take, for example, the basic notion of a quest. Within a typical MMOG, a quest provides a description of a task to be performed, basic information about what resources are needed, and a reward to be received when the task is completed. One of the key traits of a questing disposition is the willingness to find, analyze, and evaluate resources needed to complete a task. One's disposition toward the world is characterized by the belief that *if you try hard enough* you will find what you need along the way, that the world itself will afford the resources that are needed to solve it. Accordingly, a quest disposition is one that is tied to resources and that focuses on

Figure 4
Character-Based Design in World of Warcraft



the contingency and possibility, but also that demands a high level of situational awareness. The more aware one is of one's environment, the more likely she is to find the tools needed to complete the quest. In that sense, one set of dispositions is tied to abilities and the basic agency that the game affords players.

The social network of the game itself also creates and modifies players' dispositions. Those dispositions are the result of what one might consider "legitimate peripheral participation" (Brown & Duguid, 1996, p. 40; Lave & Wenger, 1993). MMOGs, unlike other games, are dynamic and constantly evolving systems, both in terms of their design (developers add content and make sometimes radical changes on a regular basis) and in terms of the participation of players who have an active hand in shaping both the content and meanings within the world (Figure 4).

As a result, players are forced to continually adjust and readjust their dispositional stances not only to the game world but also to other players within the world. In doing so, players develop a correspondingly flexible attitude toward dispositions that is, as Sherry Turkle (1997) has described it, protean in nature. These dispositions, however, have a richness that mirrors the complex worlds in which they are

generated. Both the player's impact on the world and the world's impact on the player are gradual and incremental, and the dispositions that form as a result are generated over extended periods of time, taking months to develop.

Although disposition provides some insight into how gamers think about the world, it is imagination that provides a connection between the virtual and physical worlds.

Ability, Agency, and Emergent Collective Action

MMOGs, like all games, have a set of constraints and affordances built into them. When a player enters the world, she can do various things by design as part of the central game mechanic. For example, players can buy and sell goods, engage in combat, craft items, and move about the world to explore or acquire information or to embark on quests. These elements, programmed into the game, are what we refer to as *abilities*, which include the benefits and limitations of a character class or race (e.g., Tauren Hunter, Undead Priest, Human Paladin, or Night Elf Rogue), which a player selects at the time of character creation.

At the most basic level, abilities give rise to a sense of agency, the things a player can actually do in the world. Throughout the game, as the character evolves, the player acquires increasing amounts of agency, new spells, access to new items, and the ability to travel to new places or face new challenges.

A player's sense of agency becomes increasing powerful as it is linked to the social network of play.⁴ Players learn to use items and spells, for example, that not only benefit themselves but that may provide benefits to other players or an entire group or party. Within World of Warcraft, there are spells that are so beneficial, they are considered "must-have" spells for a class or character, and not having the ability can even get a player kicked out of a group or raiding party. But the power of such spells or items is not based in having them but, rather, in knowing how and when to use them. For example, a priest who knows how to heal efficiently is much more valuable to a group than a priest who may have better spells or equipment. A well-timed heal can turn a battle to the party's advantage, whereas poorly timed heals can result in defeat. In that sense, this more complicated sense of agency is linked not just to abilities, but also to practices.⁵

One of the things that differentiate MMOGs from other types of games is the dynamics of coordinated action. Every character class in an MMOG has a skill set that helps the character with personal achievement (advancement and leveling), but it will also have skills that are most useful only in conjunction with other players. A sense of agency emerges, primarily, as the result of coordinated, joint action with the diversity of roles within the group. Instances or dungeons are prime examples.⁶ Instances are quests that require a group of players (from 5 to 40, in World of Warcraft, for example) to complete. Moreover, these groups must be composed of different, complementary character classes to succeed. Character classes are often

understood in terms of their abilities, such as tanking (the ability to distract enemies and draw their attacks toward yourself, called “holding aggro,” to keep other party members safe, usually done by warriors), DPS (characters that inflict large amounts of damage, the name referring to “damage per second,” usually done by mages and rogues), and healers (characters who can regenerate health in other party members, usually done by priests, shamans, and paladins). In a successful group, the three must function as a unit: The tank “holds aggro” while the healer keeps the tank alive and the DPS party members kill the target.

Regardless of one’s particular responsibility, a player must maintain constant awareness of the situation and the role she is to play in the larger group dynamic. There is no point at which players can ignore other party members or the effect that their own actions or inaction will have on them. Players are acutely aware that seemingly small mistakes, even though not central to the overall effort, can have disastrous results. Likewise, the success of the party is not dependent on the success of any individual player or character, but on the contributions that each makes to the joint, coordinated effort. When functioning in unison, the team works as an ensemble. As Peter Brook (1995) described the phenomenon in theater, working as an ensemble leads “actors to the point where if one actor does something unexpected but true, the others can take this up and respond on the same level. This is ensemble playing: in acting terms it means ensemble creation, an awesome thought” (p. 114). Brook’s description mirrors the generative process of MMOG game play, where in Brook’s terms, players begin to act out of a sense of instinct and rhythm rather than intellect.

What transfers in such a situation is not specific knowledge of how to kill an end-game boss or negotiate passage through a dungeon, but how to respond to cues from other players, how to think ahead, and how to perform tasks in concert with others. At its best, then, a successful group functions as an ensemble, rather than as a grouping of discrete players or characters. An ensemble exists without direction and is the product of extensive rehearsal, creating an atmosphere where group members blend and emerge into a unified whole. Membership in a group, like questing, both constructs and informs players’ dispositions and provides the framework for the play of imagination.

The third sense of agency, *emergent collective action*, provides further insight into what makes the MMOG experience both powerful and unique. Emergent collective action happens when events unfold in unpredictable or unexpected ways. For example, after a particularly difficult battle, players will pause and rest to regenerate their health and mana, as well as to rebuff their characters; cast beneficial spells; and heal wounds, curses, or poisons. It is at these times that players and parties are at their most vulnerable. Occasionally, within dungeons or instances, random monsters spawn (often called patrols) and attack groups without provocation.

At such moments, groups can generally expect to have their entire party killed. In a position of vulnerability, caught unprepared, and without a plan or strategy, the result is usually a “wipe,” forcing the players to exit the dungeon and start again

from the beginning. There are times, however, when, against all odds, the players are able to do just the right things in just the right ways to survive and defeat the patrol. These are moments of emergent collective action, where players accomplish something they thought was impossible, often with little or no knowledge of how they accomplished it. They are also moments of simultaneous joy and reflection, where players are elated at the accomplishment, but also likely to wonder how it is that they accomplished it.

These moments of emergent collective action are some of the most powerful learning experiences in the game because they invite reflection on a wide range of issues, including unintended consequences, synergy, and, from our perspective most important, imagination. When a player succeeds in the face of overwhelming obstacles, she usually does so because she was able to imagine a new approach or new use of an item to dynamically alter the situation. Rather than confronting an unexpected situation as a problem, successful players are more likely to redefine the problem space itself, resulting in a reimagined context for new innovative solutions.

This combination of disposition, imagination, and agency creates a new and particularly *vivid* situational awareness that provides the opportunity for the player to live in a space of possibilities, which we see as powerful training for innovative thinking. Moreover, this sense of vividness that MMOGs provide allow players to immerse themselves deeply in a world of simultaneous similarity and difference, which results in the development of key practices of situational awareness. In particular, we see these practices as an extension of what we describe below as “conceptual blending.”

A Theory of Transfer and Conceptual Blending

Experience in virtual worlds is a tricky thing to understand because existence within virtual spaces is always multiple. For each avatar, there is both a character (the in-world representation) and a player (the physical-world person controlling the character). The experience of play is always, at some basic level, a duality. But there is also a process of recognition that occurs, an understanding among players that the interactions between and among their characters is more than just engagement in a virtual space. There are real people behind the screens and keyboards, and as a result, the things that happen in game worlds are not totally detached from experience in the physical world. Commonplace references such as “AFK” (away from keyboard) or “bio break” (the player denoting they need to use the bathroom) illustrate the ways in which physical world constraints can affect game play.

A very specialized form of transfer comes in the form of collateral learning, the learning that occurs in relation to the game and that represents not only the basic substance of learning within game worlds, but also the kind of learning that is most likely to stimulate the play of imagination. Collateral learning is often deployed as a

means to teach within multicultural settings where worldviews or paradigms are radically different, but learners experience little cognitive dissonance moving between paradigms and are able to form long-term attitude change as a result of resolving conflicts between differing views of the world (Jegade, 1994, 1995, 1996).

Most frequently, collateral learning is used to theorize how students from radically different cultures can learn what appear to be conflicting and incompatible ideas, ideas that are deemed incompatible primarily because they are understood to be radically contextual and situated and culturally conditioned not only by epistemological forces, but also by material ones. Jegede (1996) cited, for example, the notion of “rainbow making,” which may have two different culturally grounded readings. In one reading, the discourse of science, rainbows are refractions of light as they hit water, but in what Jegede called “traditional thought,” they may be read as a python crossing a river or as the sign of the passing away of a tribal chief (p. 67). Students can hold both views simultaneously and can deploy each appropriately as the context demands. The choice of which to deploy depends largely on one’s disposition toward the world at any given time.

Learning About Each Other

The practices of play that emerge in MMOGs are as complex as the people who play them. Over time, sets of practices emerge from long series of interactions, oftentimes crystallized by moments of collective emergent action. For such an emergence to be meaningful, players must have a shared set of meanings to draw upon to both communicate and interpret such events as well as a shared history, such that the impact of those events has meaning not only in the immediate sense, but as part of the collective experience and memory of those who participate.

One repository of such practices in large MMOGs is guilds (sometimes called “clans,” depending on the game). Guilds are more than just loose confederations of players. They are often people who are connected through the game in a deep way and, as a result, perceive a shared and meaningful investment in the actions of the group. Whereas guilds themselves are dynamic, with players joining and leaving from time to time, most members see the structure itself as embodying a core set of values that unite how players feel about and engage with the game. In short, most guilds that are successful are composed of people who share similar dispositions about the game and game play.

Because different dispositional stances facilitate (or limit) different practices, the process of becoming a member of a guild is a long process of enculturation, and most established guilds have significant trial periods that require prolonged interaction with the guild members to gain approval for full membership. Likewise, as guilds accept new members, the nature and structure of the guild may shift, growing and changing to accommodate new members and practices.

Those elements of guild membership, which mirror closely notions of communities of practice, are the precursor to the possibility for meaningful collective action. Accordingly, the more deeply embedded one is in guild or clan culture, the more definitive the shared moments of collective action are likely to be. The importance of game events is tied less to the event itself than to the people with whom it is shared.

Convergence, Divergence, and Triggering

What transfers in MMOG learning is not just information or skills, but dispositions and the ability to translate those dispositions from inside the game to outside the game through an act of imagination. That moment of transfer is a point of convergence when experiences in virtual worlds are shared among or between players and produce a trigger that allows the player's imagination to transcend the boundary of the game. These triggers are objects that are experienced and that are recognizable as having significance both within the virtual world and within the physical world. For example, a group of players may enter a dungeon to complete a quest that requires them to slay a particularly difficult monster at the end. The process of getting to the end of the quest may take several hours, during which players all work together to achieve the common goal. At the end, players find the end to be extremely difficult, resulting in repeated deaths of the entire team. Yet they persist and in the end finally defeat the monster and claim their reward.

When these encounters produce moments of emergent collective action, they also create the possibility of incredibly strong bonds among the participants. As a result, dispositions are constitutive of the social context in which the game world develops. As part of a deeply engrained set of social practices, play in MMOGs is often as much about the people who play as it is about the game itself. Those connections often transcend the boundaries of the game world and provide a clear example of how dispositions from game experiences can transfer to the physical world.

Such is the case of Galataea and her guild. As players progress through World of Warcraft, there are several key instances that are considered very challenging at certain levels. One of the first is Shadowfang Keep, which is set for players in the mid-20s level (Warcraft characters cap at level 60). Playing to level 25, especially for the first time, requires a substantial investment of time and is also the point at which players in the guild have begun to establish routines and partnerships with other players in their guild.

For a party of level-25 characters, the end boss in Shadowfang Keep can be a particularly difficult fight. Getting to the end boss is not easy either, requiring 3 to 4 hours of play just to reach the point where you can engage the final monster. In this case, when a group of five party members took on the instance and its end boss, Arugal, they found themselves repeatedly dying at the final battle. These events, referred to as "wipes," can be particularly demoralizing, as they require the entire party to run back to the dungeon in ghost form and then track all the way back

through the instance to begin the fight again. On the sixth attempt, everything clicked and Arugal was defeated without a single party member dying. After several hours, much frustration, and hefty repair costs to their battered armor, the group emerged victorious. The event was also one of guildmates bonding with one another. It represented a capstone moment not only in the game, but also in the players' relationships with one another. Having come together to defeat a powerful and dangerous foe, the guild members created their own shared history, which could then be passed on as part of the institutional knowledge of the guild itself.

Perhaps the most interesting reflection of this newfound social bonding came not in the game, but outside of it. Not long after, Galataea (one of the five party members) was at a conference panel where a speaker referred to one of her guildmates and a fellow party member from the recent Shadowfang Keep run as his "good friend." Her response surprised her. She said to herself, almost taking offense at the presenter's familiarity, "He may be your good friend, but have you ever killed Arugal together?" The connection she felt to the group had been powerful and intimate, and she had to reflect on why it was she felt so strongly toward someone with whom she had shared *what appeared to be* a relatively brief, virtual experience (the act of killing Arugal), but actually represents a powerful moment of convergence.

Convergence

Galataea's response illustrates the way in which the experience of in-game activity can function as a trigger, as a connection that transcends the bounds of the game and demarcates a powerful, shared experience that offers a point of convergence between the domains of the virtual and the physical. Galataea's response revealed that the incident was much more than the single killing of a boss monster in Shadowfang Keep; it was a social and cultural experience that brought together and unified an entire series of prior events (months of playing together) and would become institutional guild knowledge that would inform the guild's and other players' futures. Those connections forged a social bond that triggered an imaginative jump from inside the game to the context of an academic conference presentation. Their mutual play had created, in this case, an experienced point of convergence that functioned as a trigger to bridge the two worlds, worlds that should be different yet provide a strong sense of similarity that invited reflection.

Virtual worlds also create the possibility of experiences that are impossible in the confines of physical space but that have important connections back to the physical world nonetheless. They allow for what Dewey (1916) described as the "play of imagination," the means by which people are able to learn and experiment without the risks associated with real-world decision making. For Dewey, play is not a product, but is, instead, a process of discovery and learning, the means by which all learning is made possible. In *Democracy and Education* (1916), he wrote,

Were it not for the accompanying play of imagination, there would be no road from a direct activity to representative knowledge; for it is by imagination that symbols are translated over into a direct meaning and integrated with a narrower activity so as to expand and enrich it. (18:2)

MMOGs are, in that sense, a space that provides the tools to allow boundary crossings between virtual and physical spaces, expanding and enriching our interpretations of each in the process.

Divergence

Divergence is necessary for the process of understanding and intellectual growth, but it is also the means by which we make sense of experience and draw useful lessons from it. Imagination is the tool for translating experience into learning. For that reason, we want to emphasize the importance of the kind of learning that happens in MMOGs and virtual worlds as distinct from systems of simulation of training whereby activities are repeated in a virtual space to transfer a set of skills to the physical world (e.g., using a flight simulator to train pilots).⁷ Within the framework of agency, learning, and experience, fidelity between the physical and the virtual no longer serves as an effective standard for measurement. Learning that stems from divergence is the process where one takes experiences (not skills or facts) that are radically distinct from, or even impossible within, the physical world and translates them into meaningful dispositions in the physical world.

At the highest level of abstraction, the disposition of a gamer is one that recognizes the importance of situational awareness and develops practices to heighten and refine that disposition. What the gamer learns and what is transferred is not any particular skill set (noticing proximity of monsters, listening carefully to the language in group or guild chat, or knowing how to position your character safely for combat), but the recognition that situational awareness itself is important. The game can tell you very little about how to be situationally aware in different contexts (such as work or home), but it can dispose one to behave with awareness regardless of the context or environment. Although different contexts may require awareness of different things, they each require the same kind of imaginative thinking.

Perhaps most important for Dewey (1916) is the idea that the process of imagination is transferable between domains of work and play. As Dewey argued,

But it is still usual to regard this activity as a specially marked-off stage of childish growth, and to overlook the fact that the difference between play and what is regarded as serious employment should be not a difference between the presence and absence of imagination, but a difference in the materials with which imagination is occupied. (18:2)

Metaphor and Imagination

The idea of convergence and divergence fits well with a number of linguistic, philosophical, and cognitive models of learning. Chief among them is the fundamental idea of metaphor, the basic notion of understanding through comparison and difference, in Ryle's (1949) terms, it is the expression of an item from one category explained through the language of another, treating a thing *as if* it were something else. In that sense, metaphors gain their power from the play of similarity and difference. For a metaphor to work, it must compare two things that are different to highlight similarity. As a statement, "the king is a lion" is patently false. As a metaphor, it draws upon that difference to invite reflection and comparison; it is a challenge to the listener to find the points of similarity, which are highlighted by difference. In the most powerful metaphors, a single point of similarity is capable of erasing the entire framework of difference that animates it. The king is a lion, because he is fierce. If the metaphor works, that is what we take from it, erasing all the physical differences between humans and lions, as well as the myriad contextual ones.

This idea of critical reflection is an essential part of the learning process, which allows the player to think back on events from the virtual and project them in meaningful ways onto the physical world. Those projections do not rely just on things that the players know but also take ways of knowing and ways of being, dispositional stances, and project them onto nonconflicting frames of meaning. In essence, the transfers that occur between virtual and physical worlds are what we will outline below as "conceptual blends."

Metaphorical thinking differs from analogy (or in linguistic terms, metonymy), for which similarity is important. A good analogy minimizes difference, by pointing out the ways in which two things are identical in the most fundamental or important ways, with the goal of explaining something unknown with something known. It is a system of comparison grounded in similarity, rather than difference.

To return to an earlier distinction, the difference between MMOGs and simulations, and the kinds of learning that occur in each, can be read through the lens of metaphor and analogy. The learning that occurs in MMOGs is a kind of learning by metaphor, by which two radically different spaces (the virtual and the physical worlds) offer up a single point of experiential convergence (a trigger) that invites (or requires) reflection and imagination to translate. Learning by analogy, the kind of learning that happens in simulations or simulation-based games, focuses on creating spaces that are measured based on their convergence between the real and virtual worlds and attempts to minimize divergence. The purpose is to remove imagination and reflection as requirements for learning and provide a system of instruction and direct transfer of skills and knowledge from the virtual to the physical.

Games, Innovation, and Learning

The connection between learning and innovation is strengthened in games not only because of the ways in which they produce both convergent and divergent knowledge but also because of the opportunities they create for innovative or imaginative thinking. The connection between the virtual and the physical affords the greatest possibility for the play of imagination and as a result is ideally situated as a space for innovative thinking. Beyond the simple distinction between metaphor and analogy, virtual worlds also provide a medium for what Mark Turner and others have described as conceptual blending, “dynamic integration processes which build up new ‘blended’ mental spaces” and that develop as emergent structures for the construction of meaning (Turner & Fauconnier, 1998).

Conceptual blending provides not only an explanation for how we learn but, more important, for how we innovate. Accordingly, we look at the process of metaphor and reflection as a key ingredient in conceptual blending and suggest that virtual worlds and MMOGs provide one of the key tools for integrating imaginative thinking into new systems of education and learning.

The space of virtual worlds and MMOGs is more than just a space characterized by metaphor and analogy or convergence and divergence; it is a space of “both/and,” which is to say it is *both* metaphor *and* analogy; it is *both* convergent *and* divergent. They are almost ideal examples of “blended spaces,” spaces that have the power to evoke the process of conceptual blending, but to do so in a way that is not unidirectional. At its most basic level, conceptual blending is a system of projection, where we take a source image and project it upon a target image. Conceptual blending occurs when the two image schemas are able to align and not conflict. Turner’s (1998) example of such blending is the blend of the “talking animal” familiar to us from fables, stories, tall tales, and the like. The blend occurs when we project speech onto an object such as a donkey. The resulting blend seems both commonplace and natural and exemplifies what Turner calls “a basic process of thought” (p. 11).

Blended spaces move beyond the model of projection to suggest that in addition to “input spaces,” the original sources of projection, “blended spaces can develop emergent structure of their own and can project structure back to their input spaces. Input spaces can be not only providers of projections to the blend, but also receivers of projections back from the developed blend” (Turner, 1998, p. 60). This formulation has two significant implications for understanding how conceptual blending works in virtual worlds. The ability to deal in specifics but not be constrained by them is an essential aspect of virtual worlds that provides a key to understanding their power.

Turner (1998) referred to the “freedom to deal in vivid specifics” (p. 60). By this, he simply meant that each input space can be as rich and textured as possible, because the image schemes or frames that are being blended are both well under-

stood in their own terms and are able to align. There is nothing fundamentally incompatible, for example, about being a player in a game and an avatar in the game. Each aspect can be as fully developed as one likes, and there is no point at which the schemes of player and character will ever conflict. As a result, even though the two things are different, one need not sacrifice any aspect of detail or sophistication in one's understanding of either input space to blend them. In fact, the more complete the understanding of each aspect, the richer the blend is likely to be.

The second aspect, however, is where the true force of the blended space comes into play. Although a blended space must show some "conformity to its own logic," it remains "free of the constraints that restrict its input spaces" (Turner, 1998, p. 60). Blended spaces get all the richness of their input spaces, but only some of their constraints. In the most basic analysis, if we take a virtual world counterpart to Turner's (1998) talking donkey, we can apply exactly the same logic to a World of Warcraft avatar. Avatars are pixilated representations of character sexes, classes, and races (e.g., a Female Night Elf Rogue). They cannot move or speak. Just like the donkey, once we project the player's attribute of speech (and movement and play) onto the avatar, we create a conceptual blend that we immediately understand. Like talking animals, it is so familiar, it almost escapes notice. And whereas players must follow the internal logic of the game world (such as its physics and geography), the avatar may be as richly defined in its input space as the player is in her physical space. But when they blend, they do not have to behave as a Night Elf any more than they have to behave as a 35-year-old professor.

Virtual worlds and MMOGs have an important added dimension: the ability to account for their own blends. In many ways, each MMOG is nothing more than a blended space. There is no game or world underneath that players are relating to or modifying. The structure of the world its rules, geography, game mechanics, and constraints and limitations are only one input space. The players, with their social norms, experiences, interests, and worldviews, are another. Players are not merely projected into the world any more than the game world is projected onto them. Instead, these blended spaces (like Azeroth in World of Warcraft) are complex structures, capable of accounting for the blends that are created in the world and to project that emergent structure back onto itself. In other words, the blends resulting from the projection of players onto characters *creates* the world as a blended space. The decisions that players make shape and define the blend, and as the world continually mixes and remixes, it remains dynamic. The ability to negotiate, manage, and make sense of this continual sense of blending, which is to say the agency a player develops within that world, is what we see as the tool for innovation for the 21st century.

Turner's (1998) notion of the conceptual blend and what he called the "literary mind" provides a provocative and powerful explanation for how we create meaning from seemingly diverse and different conceptual frames. It is ideally suited to describe

how the virtual and the physical worlds might interact to produce new and vivid meanings. What Turner did not envision is the addition of emergent collective action into the notion of conceptual blending. Players in virtual worlds, unlike literature of other media, are not external to the concepts they are blending. They are, instead, part of the blend itself, and it is that notion, combined with what we have outlined as critical reflection, that takes the idea of conceptual blending to a new level.

It is out of this continual system of blending and change that the player is able to construct meaning. As Turner (1998) argued,

By the means of these specifics from both input spaces, the blended space can powerfully activate both spaces and keep them easily active while we do cognitive work over them to construct meaning. Upon that circus of lively information, the mind can dwell and work to develop a projection. (p. 60)

In our terms, it is both the convergent and divergent aspects of virtual spaces that function together, equally active and equally powerful, which provide a powerful tool for the mind to create meaning.

Players in virtual worlds are neither authors nor readers, but they are, themselves, a new conceptual blend: both author and reader, both player and character, both virtual and physical. And it is not only the phenomenon of blending, but the player's ability to recognize, reflect on, and incorporate those reflections back into those worlds, both real and imagined, that make MMOGs a powerful space for the exercise, the play, and the agency of imagination.

Conclusion

The significance of conceptual blending in MMOGs is not found in the blends that are created, but rather in the act of blending itself. Conceptual blending is a process where one does not simply project one space onto another or privilege one view and subordinate another to bring them into concert. Conceptual blending is the process of using the imagination to construct something that is altogether new, a blended space that is able to account for the vividness and complexity of each perspective, doing violence to neither, by producing something that is undeniably true of both elements that compose it. To do this requires not only understanding each component in depth, but it necessitates an act of pure imagination to produce something that both embodies and transcends the elements that are contained within it. The source of its power is not in making meaning, but in changing perspective. As Turner and Fauconnier (1998) noted, "blending imaginatively transforms our most fundamental human realities, the parts of our lives most deeply felt and most clearly consequential" (p. 28).

In that sense, conceptual blending goes beyond traditional notions of bricolage and rearrangement. The true power of this process of blending, and what we see as a central component of MMOG play, is the act of creation itself. It is, in that sense, a way of seeing and making sense of the world, one that we think is well suited to meet the challenges of the 21st century and, in many ways, defines innovation. It is those acts and practices of imagination that are continually exercised in MMOGs.

The spaces that virtual worlds offer provide a radical break from traditional spaces of educational practice. More important, they provide a new way of thinking about education itself. Rather than focusing attention on the direct transmission of knowledge, this kind of learning addresses a much wider and much deeper set of issues. If students are to be adequately prepared for the 21st century, they will need to learn how to approach situations with flexibility and they will need to be able to treat new situations as blended spaces, not only managing the dynamism and flux, but embracing them, using them, and accounting for them within their own thought processes.

Success for the next generation will be more about the ability of workers and managers to enculturate themselves and others into communities of practice, account for both convergent and divergent ideas, and create blended spaces in the context of globalization than it will be about a stockpile of any kind of particular knowledge or information.

The power that games afford is in the ability not only to stimulate the imagination but to do so in an amazingly complex, profound, and vivid way. By tying that notion of vivid conceptual blending and imagination to an understanding of enculturation and shared practice, we believe that MMOGs can provide a valuable space to help both educators and students alike understand the implications and possibilities for extending the literary mind.

Within the spaces of virtual worlds, we can begin to see a new way of learning emerge, focused on the ideas of agency and disposition, facilitated by modes of transfer that are no longer about fidelity between worlds, but are about the power of imagination to explore the differences and similarities between them and to use experience to translate those differences and similarities from the virtual to the physical world.

The power of the play of imagination is in its ability to break traditional frames and dichotomies and allow us to explore a space where fantasy and play are no longer subordinated to reality and work and where we are able to find richer ways of identifying with the other. The ability to play imaginatively and see and experience from many different vantage points, rather than just one, provides a new set of tools for imaginative and innovative thinking.

The model that virtual worlds provide offers a glimpse into the possibilities of what our classrooms might become: spaces where work and play, convergence and divergence, and reality and imagination intertwine in a dance where students grow to understand the importance of communities of practice and learn how to *be* the things they imagine.

Notes

1. For recent analyses of the scope and impact of massively multiplayer online games (MMOGs), see Castronova (2005), Taylor (2006), and Dibbell (2006).
2. A few authors have challenged the conventional wisdom that video games have limited educational value and may in fact be harmful. See, in particular, Johnson (2006) and Beck and Wade (2004).
3. Gee's (2005) notion of embodiment refers to the connection one feels with the system itself (the rules, structures, choices, and characters), not necessarily a connection between avatar and player.
4. In a related sense, we would also claim that this sense of agency is richly constitutive, as players' actions both influence and create the worlds in which they are participating.
5. In a more complicated way, this sense of agency is related to the player's disposition as well. In certain circumstances, players may find their agency either extended or limited by their dispositions toward other players, roles, and preferences they have available. Often "specs," which define particular groupings of traits or skills in character classes, will have significant influence on player dispositions.
6. *Dungeons* typically refer to indoor spaces or areas where players go to complete quests. Instances are a particular type of dungeon, which only allow a single group of players to enter at a time, requiring them to complete all tasks without the assistance of (or interference from) players outside their group.
7. We use the term *simulation* to include a wide range of entities from training simulators on one side to "serious games" on the other. These games all strive to mirror those aspects of the world they are trying to convey information about.

References

- Anderson, C. A., & Ford, C. M. (1986). Affect of the game player: Short-term effects of highly and mildly aggressive video games. *Personality and Social Psychology Bulletin*, 12(4), 290-402.
- Barab, S. A., & Duffy, T. (2000). From practice fields to communities of practice. In D. Jonassen & S. M. Land (Eds.), *Theoretical foundations of learning environments* (pp. 25-56). Mahwah, NJ: Lawrence Erlbaum.
- Beck, J. C., & Wade, M. (2004). *Got game: How the gamer generation is reshaping business forever*. Cambridge, MA: Harvard Business School Press.
- Bowman, R. F. (1982). A Pac-Man theory of motivation. Tactical implications for classroom instruction. *Educational Technology*, 22(9), 14-17.
- Bransford, J. D., & Schwartz, D. L. (2001). Rethinking transfer: A simple proposal with multiple implications. In A. Iran-Nejad & P. D. Pearson (Eds.), *Review of research in education* (Vol. 24, pp. 61-100). Washington, DC: American Educational Research Association (AERA).
- Brook, P. (1995). *The empty space: A book about the theatre: Deadly, holy, rough, immediate*. New York: Touchstone.
- Brown, J., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 17, 32-42.
- Brown, J., & Duguid, P. (1996). Stolen knowledge. In Hilary McLellan (Ed.), *Situated learning perspectives* (pp. 47-56). Englewood Cliffs, NJ: Educational Technology Publications.
- Calvert, S. L., & Tan, S. (1994). Impact of virtual reality on young adults' physiological arousal and aggressive thoughts: Interaction versus observation. *Journal of Applied Developmental Psychology*, 15(1), 125-139.
- Castronova, E. (2005). *Synthetic worlds: The business and culture of online games*. Chicago: University of Chicago Press.
- Cooper, J., & Mackie, D. (1986). Video games and aggression in children. *Journal of Applied Social Psychology*, 16(8), 726-744.

- Dewey, J. (1916). *Democracy and education*. New York: Macmillan.
- Dibbell, J. (2006). *Play money: Or, how I quit my day job and made millions trading virtual loot*. New York: Basic Books.
- Dominick, J. R. (1984). Videogames, television violence, and aggression in teenagers. *Journal of Communication*, 34(2), 136-147.
- Gee, J. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave.
- Gee, J. (2005). *Are video games good for learning?* Keynote address at Curriculum Corporation 13th National Conference, Adelaide, August 2006.
- Graybill, D., Kirsch, J. R., & Esselman, E. D. (1985). Effects of playing violent versus nonviolent video games on the aggressive ideation of aggressive and nonaggressive children. *Child Study Journal*, 15(3), 299-305.
- Graybill, D., Strawniak, M., Hunter, T., & O'Leary, M. (1987). Effects of playing versus observing violent versus nonviolent video games on children's aggression. *Psychology: A Quarterly Journal of Human Behavior*, 24(3), 1-8.
- Gredler, M. E. (1996). Educational games and simulations: A technology in search of a research paradigm. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 521-539). New York: Macmillan.
- Huizinga, J. (1938). *Homo Ludens: A study of the play element in culture*. Boston: Beacon.
- Jegede, O. J. (1994). African cultural perspectives and the teaching of science. In J. Solomon & G. Aikenhead (Eds.), *STS education: International perspectives on reform*. New York: Teachers College Press.
- Jegede, O. J. (1995). Collateral learning in the eco-paradigm in science and mathematics education in Africa. *Studies in Science Education*, 25, 97-137.
- Jegede, O. J. (1996, September 23-27). *Effects of traditional cosmology on science education*. Paper presented at Mito, Japan.
- Johnson, S. (2006). *Everything bad is good for you*. New York: Riverhead Trade.
- Kubey, R., & Larson, R. (1990). The use and experience of the new video media among children and young adolescents. *Communication Research*, 17(1), 107-130.
- Lave, J., & Wenger, E. (1993). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.
- Malone, T. W. (1980). *What makes things fun to learn? A study of intrinsically motivating computer games* (Report CIS-7). Palo Alto, CA: Xerox Palo Alto Research Center.
- Piaget, J. (1962). *Play, dreams, and imitation in childhood*. New York: Norton.
- Prensky, M. (2000). *Digital game-based learning*. New York: McGraw-Hill.
- Provenzo, E. F. (1992). What do video games teach? *Education Digest*, 58(4), 56-58.
- Ryle, G. (1949). *The concept of mind*. Chicago: University of Chicago Press.
- Schutte, N. S., Malouff, J. M., Post-Gorden, J. C., & Rodasta, A. L. (1988). Effects of playing videogames on children's aggressive and other behaviors. *Journal of Applied Social Psychology*, 18(5), 454-460.
- Shaffer, D. (2006). *How computer games help children learn*. New York: Palgrave Macmillan.
- Shaffer, D. W. (2005). *Epistemic games*. Retrieved February 1, 2007, from <http://www.innovateonline.info/index.php?view=article&id=79>
- Shaffer, D. W., & Gee, J. P. (2005). *Before every child is left behind: How epistemic games can solve the coming crisis in education* (WCER Working Paper No. 2005-7): University of Wisconsin-Madison, Wisconsin Center for Education Research.
- Shaffer, D. W., Squire, K. D., Halverson, R., & Gee, J. P. (2005). Video games and the future of learning. *Phi Delta Kappan*, 87(2), 104-111.
- Silvern, S. B., & Williamson, P. A. (1987). The effects of game play on young children's aggression, fantasy, and prosocial behavior. *Journal of Applied Social Psychology*, 8(4), 453-462.
- Squire, K., & Jenkins, H. (2004). *Harnessing the power of games in education*. *Insight*, 3(1), 5-33.
- Squire, K. D. (2002). Rethinking the role of games in education. *Game Studies*, 2(1). Retrieved February 1, 2007, from <http://gamestudies.org/0201/Squire/>

- Taylor, T. L. (2006). *Play between worlds: Exploring online game culture*. Cambridge, MA: MIT Press.
- Thiagarajan, S. (1998). The myths and realities of simulations in performance technology. *Educational Technology*, 38(5), 35-41.
- Turkle, S. (1997). *Life on the screen: Identity in the age of the Internet*. New York: Simon & Schuster.
- Turner, M. (1998). *The literary mind: The origins of thought and language*. Oxford: Oxford University Press.
- Turner, M., & Fauconnier, G. (1998). Metaphor, metonymy, and binding. In A. Barcelona (Ed.), *Metonymy and metaphor*. Berlin: Mouton de Gruyter.
- Vygotsky, L. S. (1926). *Educational psychology*. Boca Raton, Florida: St. Lucie Press.

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