NSU NOVA SOUTHEASTERN UNIVERSITY Abraham S. Fischler School of Education

Innovate: Journal of Online Education

Volume 2
Issue 4 *April/May 2006*

Article 2

5-1-2006

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by Michael Young, P. G. Schrader, and Dongping Zheng

Yes, video games are mainly for play and fun. But video games are educative as well as interesting and engaging—something that we all hope that more classrooms could be. Many of today's students spend more time playing video games than they do watching television, reading books, or watching films. Massively multiplayer online games (MMOGs)—long and surprisingly complex gaming environments that normally require over forty hours to get beyond novice levels (Squire 2004)—represent the latest development in the history of video game technology (Exhibit 1). Success in a MMOG requires developing new literacies, understanding intricate and intersecting rule sets, thinking creatively within constraints, collaborating with other participants towards shared goals, and perhaps most importantly, taking on new identities as players (via their avatars) inhabit game spaces (Gee 2003). Such properties offer significant potential for educational contexts, as indicated by the emergence of MMOGs specifically designed to enable student interactions and centered on instructional topics (e.g., *Quest Atlantis*, *AquaMoose 3D*, and *RiverCity*).

In order for instructors, researchers, and designers to understand and develop the educational potential of MMOGs fully, it becomes necessary to situate these games within a theoretical framework that fully defines the distinctive cognitive and learning processes that they promote in their participants. Towards this end, and in accordance with previous research (Young 2004), we propose that certain key concepts of ecological psychology offer the most useful theoretical foundation for the continued study and implementation of MMOGs in educational settings. In this article we offer an overview of such concepts, and we then apply them to certain features of two MMOGs—a commercial MMOG (*The Sims Online*) and an educational MMOG (*Quest Atlantis*)—in order to illustrate their respective qualities as learning environments.

Ecological Psychology and MMOG Design

Understanding how people learn is essential for all educators. Learning does not simply involve the mastery of content (knowledge acquisition) but also involves establishing the learner's initial engagement, fostering the learner's motivation and enthusiasm, and supporting the learner's subsequent transfer of understanding into action. Contemporary educational research identifies additional factors such as how learners and mentors collaborate, how mentoring occurs, how learners modify their environment to learn (distributed cognition), and how new learning goals emerge and transform over the course of time. For educational researchers, games offer new ways of understanding these aspects of the learning process in the context of rich virtual environments where learning is inherently social and embodied by the movement of avatars within vast virtual spaces. The tenets of ecological psychology provide a set of theoretical principles that are particularly helpful in characterizing the cognitive processes that arise from MMOG experiences.

Ecological psychology finds its roots in a number of intellectual traditions and disciplines. In accordance with the philosophy of empiricism, it presumes that we learn about the world through perception rather than through fixed, inborn understandings (Gibson 1986). At the same time, in accordance with the philosophy of existential phenomenology (e.g., Heidegger 1927a, 1927b; Merleau-Ponty 1962), it rejects a static dichotomy between the mind and the world and instead presumes that learners have a basic "comportment" towards the world; it thus prefers an integrated agent-environment view of learners as embedded and embodied in everyday cognition. For this reason ecological psychology rejects a view of cognition based on models drawn from information processing theory or traditional computer science and instead draws on models from physics and biology that emphasize a more dynamic, systemic interrelationship between the mind and its surrounding environment (Gibson 1986).

Arising in large part from foundations established by ecological psychology, situated cognition is a theoretical orientation towards learning that has emerged in the literature of cognitive psychology within the past few years (e.g., Borrett, Kelly, and Kwan 2000; Wilson 2002; Young 2004). Situated cognition entails the premise that the learning process is always contextual in nature, informed by specific traits of one's actual and immediate circumstances. From this perspective, nearly all everyday cognition occurs as embodied and embedded thinking; thinking and action are tied in an endless perception-action cycle that is conditioned by the built-in attributes of one's environmental setting. The term "affordance" is used by theorists to describe these attributes, and the process of situated cognition is often measured in terms of "duals" or variables that co-define each other. Learning can thus be seen as the product of "agent-environment duals," which involve both the influence of environment on human action and the transformation of environment by human action. Specific learning scenarios can also be seen in terms of "affordance-effectivity duals," which involve the reciprocal relationship between potentially useful aspects of the learner's environment and the learner's ability to make them useful through effective action (for example, a pond only has the affordance "swimmable" for agents who possess the effectivity to swim, whereas the ability to swim can only be realized when it is co-defined by a swimmable environment such as a pond). Finally, as noted above, perception and action are duals in this view of learning; rather than being passive and receptive, perception, from an ecological perspective, is always *for* action, and actions provide the dynamics for perception.

Armed with an ecological description of the duals of agent-environment, affordance-effectivity, and perception-action, it is possible to suggest the critical educational components of MMOGs. This perspective translates to the avatar-based environment for MMOGs where players engage in multiple levels of interactions in a complex perception-action dynamic. The activities within MMOGs are described by the dynamics that emerge as players/avatars move, discover new possibilities, adopt emergent goals, and begin to perceive and act toward the attainment of the discovered goals. From the ecological perspective, primacy is given to the agent's online thinking, objectives, and intentions as informed by certain boundary constraints as well as the agent's ability to modify certain boundary constraints in the learning process. For this reason it is important to note that such games allow for an "ontological descent of intentionality" in the learning process; that is, they allow room for the emergence of new goals nested within the broader goals of the story theme or the general goals of playing the game (see Kulikowich and Young 2001).

Young (2004) has described nine key principles of ecological psychology that apply to the role of video games as instructional tools, and these principles in turn may be applied more specifically to the educational potential of MMOGs and their design for learning contexts (Exhibit 2). In what follows, we apply these nine principles to specific attributes of two MMOGs in order to illustrate their educational value in the context of ecological psychology.

Ecological Psychology in Action: A Look at Two MMOGs as Learning Environments

In the online Soapbox discussion forum, expert gamers like Cory claim, "The most important things to remember are multiplayer, creative, collaborative, challenging, and competitive" (IAETE 2003, "Cory, Monday"). From the player perspective, virtual environments like *The Sims Online* and *Quest Atlantis* have certain key affordances for learning and fun. These include the ability to interact socially with preprogrammed players and other human players, the experience of new and unusual circumstances beyond everyday activities, the ability to form social alliances and perform feats beyond the capabilities of any one player alone, the accommodation of a range of player abilities from novice to expert in a variety of areas, and the ability to detect progress or success in a competitive way. These attributes—particularly those related to mental engagement, clear rules, authentic contexts, and the experience of role play in creative storylines—can be particularly valuable in a learning context as well (Schrader 2004).

Albert and The Sims Online

During 2004-2005, and with our help, the avatar "Albert" entered the world of *The Sims Online*, living on the Calvin's Creek server. Unlike the Sims in the single player version, which has been used for educational

purposes already (Purushotma 2005), Albert entered an online environment where hundreds of players simultaneously chat, engage in work and play activities, and support each other with simulated interactions (e.g., dancing, hugging, teasing, greeting). He learned about this world by experiencing it directly, talking to other Sims, trying to make pizza, moving from place to place, and pressing buttons on the machine to make robots at his job in the robot factory (Principle 2). Players can collaboratively practice (Principle 3) in order to achieve higher levels of skills in areas such as cooking, charisma (Figure 1), body strength, logic, creativity, and mechanical ability. The game makes each of these skill sets clearly visible in terms of their respective constraints on human action (Principle 4). For example, cooking activities entail certain constraints that do not characterize activities such as computation or tennis playing; at the same time, players have the opportunity to create their own personal goals and achieve high levels of proficiency in any of the skill sets.

Albert perceives and acts within *The Sims Online* game space, and we—his controllers—perceive and act in our life world as we sit in front of the computer. But these are not two separate space-times. The two interact and become one moment in the perception-action cycle of the player (Principle 1). Albert is merely an extension of the player's perception-action cycle within the virtual game space, much as the manipulation of a cane is an extension of a blind walker's perception, the swing of a bat is an extension of a baseball hitter's perception, or the steering of an automobile is an extension of a driver's perception. For example, with increased charisma, Albert acquired a dancing ability that in turn changed how he perceived (and was perceived by) his fellow Sims; as a result, he would often choose a girl to play chess with in hopes of convincing her to dance with him. In this way, Albert's ability to act guided his perception, which, in rapid turn, directed his further actions, all of which was afforded by the game environment.

Like most MMOGs, *The Sims Online* presents a somewhat unique perspective for video gaming since it is not organized by a single goal and has no explicit winners based on that single goal. As in real life, Sims' lives can be governed by quests for money, or skills, or other achievements based on the interests and experiences of the players. Thus the goals that direct a player's behavior emerge and change from moment to moment within the shifting constraints of the game environment, and any given goal can give rise to other associated or nested goals (Principle 6). For example, Albert was initially interested in becoming a teacher, but to do so, he quickly learned that he needed to practice and develop his skills in charisma and logic; meanwhile, he also met friends whom he wanted to help by earning money for furniture in their house, and sometimes they needed a fourth Sim to make pizza and thus show off their cooking skills (Principle 8).

Thus while game designers set the boundary constraints for the affordances of the virtual space (Principle 4), they cannot control the entirety of the game. This not only applies to the virtual world of the game itself but also to how players often extend their actions beyond the virtual game space into other contexts. For example, on eBay, one can exchange $16 US for §1 million Sims Online Simoleans. Here the economies of the real and the virtual intersect, providing a single set of affordances based on the effectivities of the Sim (to earn Simoleans) and the player (to trade them on eBay) (Principle 5). Many have discussed the dichotomy of game space and life world (Clinton 2004; Hirose 2002), nicely illustrated in *The X-Files Game* when the first-person perspective of the gamer encounters a bathroom mirror and looks at one's self to see Agent Wilmore staring back (Taylor 2003). However, in this case such a dichtomy tends to be effaced in the experience of the player. Such an extension of the player's life world into the game world and vice-versa is a phenomenon that can best be understood through the embedded/embodied view of learning (Principle 2) afforded by ecological psychology.

Meanwhile it should be noted that the additional variants of the *Sims* series, as well as third-party "mods" of *Sims* games, indicate the potential of this gaming environment to be structured with focused hypothetical scenarios (Principle 7) that allow the transfer of knowledge to new contexts (Principle 9). For example, the release of *SimHealth* during the 1994 healthcare debate gave players the opportunity to formulate and implement their own healthcare policy, *SimTower* allows players to design and manage a multi-purpose skyscraper, and *SimFarm* allows players to manage a farm and adjust their decisions in response to changes in the weather. In addition, as variants such as *The Sims 2* have lent themselves to additional customized "mods" via new programs such as SimPE and Simlogical, designers have the ability to refine this gaming

environment further with additional scenarios, activities, and affordances to players.

Quest Atlantis

In an effort to merge the properties of MMOGs with instructional objectives, *Quest Atlantis* (*QA*) provides its participants with an Internet-based learning and teaching environment. Like *The Sims Online*, *QA* makes use of avatar-based, 3-D, multi-user virtual environments to immerse players in the gaming context; however, *QA* 's primary focus for its participants (children aged 9-13) is on educational activities and fostering student reflection about those activities, all of which takes place behind the protection of authenticated and monitored synchronous chat. As such, *QA* offers a valuable tool for educators seeking to promote enjoyable and engaging forms of intellectual exploration for their students (Barab, Arici, and Jackson 2005; Barab et al. 2005).

Like other MMOGs, *QA* inspires its players with a story-based context (Principle 7) and with a variety of associated activities anchored in this backstory. In this case, the story context involves the social, cultural, and environmental decay of the mythical world of Atlantis; the overall goal of participants is to travel to a variety of virtual worlds (Unity World, Culture World, Healthy World, and Ecology World) in order to retrieve knowledge that may help save Atlantis from destruction. In their travel, participants use a virtual portal called the OTAK to select a variety of designated quests that entail specific educational activities; for example, one quest may require the participant to investigate an animal and its habitat in order to bring this knowledge back to Atlantis and eventually submit an action plan for environmental improvement. In this respect the structure of each quest entails certain clearly established goals (Principle 6) and boundary constraints (Principle 4) while also allowing participants to transfer the knowledge they gain in the quest from one setting to another (Principle 9). As they do so, participants create virtual personae for themselves while also having regular opportunities to consult and collaborate with other participants or mentors during their quests (Principle 3).

The *QA* interface features toolbars, a window displaying the avatar's 3-D view of the world that is dotted with special spinning OTAK symbols highlighting places to begin *QA* quests, a sidebar page area for information about each avatar or other avatars in the *QA* world, and a synchronous chat area (see Figure 2). There are a variety of other features including bulletin boards, e-mail, polls, telegrams, trading cards, and other tools and activities as well as supporting materials summarized in Figure 3. Most of the interface is customizable, allowing the users to govern how they interact with the virtual space.

Every quest in *QA* also requires an associated reflection, thereby repeating the theme of reflection on action and allowing participants to "show what they know" (Principle 8); for example, after completing a task involving the investigation of water pollution, the participant might be asked to reflect on how this problem affects life on earth as well as the world of Atlantis. With the added presence of a teacher, new goals can emerge from student activity within *QA* or can be induced by teacher instructions. But within *QA*, the backstory of helping Atlantis characters gain knowledge is consistently maintained in the quests and contextualized by the feedback to students from teachers posing as Atlantis Council characters (Principle 7).

Implicit in the design of the virtual worlds and explicit within the designed curriculum are social commitments that students can fulfill by completing their quests. As participants complete their quests, they receive credit in part by the granting of Lumins, small bits of rare crystal from the world of Atlantis; in turn, by applying the knowledge gained from quests to the social improvement of Atlantis, the participant can eventually gain enough Lumins to illuminate a particular segment of the *QA* Shardflower—each segment of which represents one of the seven social commitments designated within the overall design of the game (Exhibit 3). Such a reward system thus gives greater clarity and structure to the user's intersecting goal sets (Principle 6) as the game unfolds.

As in *The Sims Online*, players in *QA*'s virtual worlds can thus learn by doing, perceiving, and acting. *QA* avatars serve as extensions of players' actions and intentions, such that the players' life world and the avatars' game world become a single space-time for perception-action (Principle 1). The process of learning

likewise becomes embodied (Principle 2) in the form of avatars that walk, swim, or fly, and the interaction of these abilities with the virtual environment of the game allows for a range of affordance-effectivity duals (Principle 5)—as in the case of a quest in which a swimming avatar allows the participant to learn about aquatic ecosystems or a quest in which advanced students can collaborate with other students to build houses and discuss the function and placement of doors in context. As such, *QA* provides a similar variety of affordances to those provided by other MMOGs like *Sims Online*.

However, because of the educational focus and incorporation of pedagogical goals, *QA* offers additional and instructionally relevant affordances to its participants. For example, the player-to-player chat that blends the real-world experiences of the players with their avatars' virtual accomplishments in the game provides an opportunity for native English speakers to collaborate with students from other cultural settings. When English-as-a-Second-Language learners are co-questing with native English speakers, they can work together to coordinate the actions of their avatars by using English in the chat function (e.g., "Meet me in the Van Gogh room in Culture World") and negotiating the meaning of their messages when necessary. As all players are afforded the ability to co-quest within the game, *QA* provides the backdrop for a whole range of authentic collaborative learning activities. Moreover, by providing opportunities for exchanges between students from remote regions, the game fosters cross-cultural dialogue and understanding—thereby allowing real world forms of social awareness to emerge through shared tasks within the virtual world of the game.

Meanwhile, special log files—made possible by "bots" within *QA*—record what is said, what is done, and where it happens, thereby providing valuable data to educational researchers seeking to understand the unique affordances of the *QA* gaming environment in accordance with the principles of ecological psychology. As MMOGs continue to be explored and designed for educational purposes, *QA* will undoubtedly remain an important precedent for future innovations.

Conclusion

Contemporary theories of learning as embodied and embedded in action support the idea that MMOGs can offer valuable tools for educators, and ecological psychology provides a particularly salient and parsimonious set of principles by which to understand, design, and utilize the rich learning that can occur in such gaming environments. Just like our everyday experience, the virtual interaction among MMOG players via their avatars can be viewed as a form of situated cognition, characterized by agent-environment duals, perception-action duals, and affordance-effectivity duals that allow learning to arise from active forms of engagement rather than the mere storage and retrieval of information from memory; in turn, additional principles from ecological psychology help to shed further light on the features of MMOGs that foster distinctive learning goals in their participants. By adopting these principles to understand the learning process afforded by games such as *The Sims Online* and *Quest Atlantis*, it may become possible to adapt MMOG environments further in service of instructional goals, state objectives, and national curricular standards. In this way ecological psychology can help conceptualize features of MMOGs that have potential to enhance classroom thinking, problem solving, and learning for students in the future.

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