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Virtual Worlds, Simulations, and Games for Education:
A Unifying View
by Clark Aldrich

Many practitioners have been struck by a paradox. They sense an overlap between virtual worlds, games, and simulations, and yet they know that one is not synonymous with the other. The three often look similar; they all typically take place in three-dimensional worlds that are populated by three-dimensional avatars (Figure 1). Yet as I have argued elsewhere (Aldrich 2009), the differences are profound. Games are fun, engaging activities usually used purely for entertainment, but they may also allow people to gain exposure to a particular set of tools, motions, or ideas. In contrast, simulations use rigorously structured scenarios carefully designed to develop specific competencies that can be directly transferred into the real world. Finally, virtual worlds are multiplayer (and often massively multiplayer), three-dimensional, persistent social environments with easy-to-access building capabilities. They share with games and simulations the three-dimensional environment, but they do not have the focus on a particular goal, such as advancing to the next level or successfully navigating the scenario.

It is not enough, however, to categorize virtual worlds, games, and simulations as either entirely synonymous or utterly different. It is more useful, and perhaps more complete, to see virtual worlds, games, and simulations as points along a continuum, all instances of highly interactive virtual environments (HIVEs) (Figure 2). This framework recognizes the relationships among virtual worlds, games, and simulations:

- All games take place in some kind of virtual world—and not solely a Second Life-style, massively multiplayer online environment. Even physical games are played in a synthetic world structured by specific rules, feedback mechanisms, and requisite tools to support them. Children playing stickball on the curb create a play world structured by the broad requirements of the game and overlaid by its rules. Those rules become stricter in more intricate games and in simulations.
- Simulations share key characteristics with games, including the use of a virtual world (that is, to some extent, also structured by the rules and constraints of the simulation) and the focus on a particular goal, but simulations use a more highly refined set of rules, challenges, and strategies to guide participants in developing particular behaviors and competencies that are highly transferable.
- Participants often shift subtly between the various modes, moving from undirected exploration of a virtual world then to games and then to more structured simulation as they become comfortable in the environment.

The Swimming Pool

One of the most natural examples to show how participants move across the different uses of a HIVE while staying in the same virtual environment is the process by which children are introduced to the swimming pool. The pool is a synthetic, albeit not a virtual, environment. Some of the rules associated with dry land are the same in this new enviroment, and some rules are different. From the moment they first approach the pool, children naturally move from treating the pool as a virtual world, to seeing it as a place for more-structured games, and then to using it as a venue where they practice the skills they will need to swim well.

Their behavior and expectations as well as the expectations of those around them change at each stage. At first, new young swimmers perceive the pool as a scary, foreign environment. The challenge at this stage is simply to get them to enter and move around in this strange world. A parent or swim teacher may force them

to get in or coax them in, or the novices may dip their toes in while watching other people or they may just jump straight in. Similarly, when introducing students to a virtual environment, an instructor's first goal is to get students into the environment and practicing basic tasks of navigation, manipulation, and communication. In a third environment, a would-be pilot experiencing a flight simulator for the first time begins by looking around and perhaps trying to move the plane a bit. The goal is to get comfortable simply existing in this new environment.

Once children get comfortable in the pool itself, they start to play. They see how long they can hold their breath; they do flips in the water or sit on the bottom of the pool. They invent small games or their swim teachers give them broad rules for light games, such as tag or undersea kingdom. These games start off very casually and tend to become more structured and more complex. Likewise, as students get more comfortable in the virtual world to which their instructor has introduced them, they begin to mess around. They build crazy objects; they change their clothes and hair and body; they visit places they are not supposed to. In the same vein, the new pilot may try to see what the virtual airplane can do, perhaps by trying to fly it under a bridge or into similarly unlikely situations.

Finally, the children begin to test themselves (either on their own or because their swim teachers or parents push them) through increasingly rigorous rules and specific challenges. They go into the deep end, sometimes getting unwelcome mouthfuls of water. They practice new strokes. They try to swim the entire length of the pool underwater. They go from open-ended tag to racing each other. This is the educational simulation part of the experience; these exercises force them to learn skills that they can transfer to other bodies of water, such as lakes or oceans. Meanwhile, the students in the virtual world, having demonstrated their comfort in that world, receive an assignment requiring them to work together to achieve an instructor-defined goal. They fight a bit as a team and get frustrated; they resolve the frustration and complete the assignment. When the work is done, the class debriefs around a conference table or, perhaps, in the virtual world itself. The pilot-in-training is also working harder, having been tasked with increasingly challenging scenarios, such as landing with broken gear or under stormy conditions. The pilot crashes quite a bit at first but gradually gets more and more comfortable and confident.

The ease with which the children in the pool, the students in the virtual class, and the pilot in the flight simulator move from exploratory virtual-world behaviors to structured but simple games to taking on rigorous simulation challenges illustrates both the differences across these three instances and the connections that link them. It is only by building from open experimentation to increasingly rigorous rules, structures, and success criteria that children learn transferable water survival skills and pilots learn critical flying skills.

Distinctions and Connections

As the HIVE model sees virtual worlds, games, and simulations as both different and connected, there are two large sets of consequences: one emerging from appreciating the distinctions among the three and one related to the view of them as connected.

Distinctions

The HIVE model asserts that virtual worlds, games, and simulations are all different; each has its own affordances and purposes. A virtual world will not suffice where a simulation is needed. The virtual world offers only context with no content; it contributes a set of tools that both enable and restrict the uses to which it may be put. An educational simulation may take place in a virtual world, but it still must be rigorously designed and implemented. Organizations routinely fail in their efforts to access the potential of virtual worlds when they believe that buying a virtual world means getting a simulation.

Likewise, a game is not an educational simulation. Playing *SimCity* will not make someone a better mayor.

Some players of, for instance, *World of Warcraft* may learn deep, transferable, even measurable leadership skills but not all players will. The game does not provide a structure for ensuring learning. Just because some players learn these skills playing the game, that does not mean either that most players are also learning these skills or that it should be adopted in a leadership development program. Conversely, a purely educational simulation may not be very much fun. The program may have the three-dimensional graphics and motion capture animations of a computer game, but the content may be frustrating. Specific competencies must be invoked, and students' assumptions about what the content should be, likely shaped by their experiences with games, will be challenged.

Connections

However, the ease with which players in a new virtual environment move from exploratory behaviors to more structured simulation structures also illustrates the connection among virtual worlds, simulations, and games. There are overlaps of both processes and best practices between them. For instance, the same structures that help students get access to a virtual world (say in a university or corporation) also help them get access to a simulation and vice versa. These include help desks, technology test tools, accurate and understandable download information, and password and username management. The aspects of computer game design, such as scoring mechanisms, scripted storylines, and competition-based motivation, can drive increased engagement in an educational simulation. By the same token, a good teacher with a good curriculum can use a relevant game as part of a meaningful learning experience, but the experience must be carefully prepared, presented, and debriefed ([Exhibit 1](#)).

One example of the commonality across all HIVEs is the need for introductory structures. These asynchronous, self-paced levels or locations allow students to learn and demonstrate basic competencies in manipulation, navigation, and communication before moving on to the "real" exercise. These have been successfully adopted in Second Life where students often have to navigate through a custom challenge before joining a class for the first time. Computer games frequently have single-player levels with scripted stories and even their own training sequences that players must complete before joining multiplayer teams. Given the parallels between simulations, games, and virtual worlds, multiplayer simulations designed to teach specific skills may do well to include a significant single-player mode in which students can first learn the basic interface and gameplay.

A second area of commonality is the need for communities around games and simulations. Community-building tools and opportunities can be built in as a seamless, integrated piece of technology within the world or simulation or they can be provided separately via a chat room or other tool.

The biggest area of commonality, and this will be true for years and perhaps for decades, is that HIVEs get people to do things. In a formal learning program, this means that they can be integrated with the goal of getting students to learn how to do, not just what to know. To accomplish this, instructors in virtual worlds will find a range of techniques already refined in stand-alone simulations useful, including assessment methodologies such as benchmarking and coaching strategies to manage student frustration and to provide effective debriefing. More complex interactive structuring techniques, such as the use of branching structures or mathematical modeling to allow students' decisions to guide the development of events in the world, can also help by increasing the interactivity of these environments.

Implications

This HIVE taxonomy has a range of implications for instructors structuring classes and for students exploring virtual worlds. Accepting the idea that HIVEs exist on a continuum, each providing its own benefits but each also being linked to the others, will affect how classes in virtual worlds, serious games, and educational simulations are conceptualized, developed, and deployed. Virtual environments provide a natural way for

people to learn by nurturing an instinctive progression from experiencing to playing to learning; instructors should encourage the shifting across experimentation, play, and practice in which students naturally engage. In fact, instructors can exploit that behavior by providing stages that accommodate each stage. Light games and self-paced introductory levels can be used to get students comfortable with basic concepts and the interface necessary to exist in the virtual world, and the complexity can be increased to encourage students to move on to play and practice stages.

Content created for virtual worlds should reflect the nonlinear nature of HIVE learning and exploit the opportunity to learn by doing. The goal should not be to repurpose existing content but to rethink its goals and to imagine new types of content and new modes of presentation that fully access the power of HIVEs for learning. While best practices in content structuring may be transferred from stand-alone educational simulations to virtual world-based simulations, metrics and learning objectives for the different contexts should be different. Learning objectives and assessments around games, for instance, should be focused on the engagement, exposure, and use of simple interfaces while those for educational simulations should measure the development of complex, transferrable skills.

Community is also an important element in virtual world-based learning, whether in games or simulations. Even stand-alone simulations need to provide participants some opportunity to access a community even through a separate tool if it is not possible to integrate the community into the simulation platform itself.

Conclusion

This emerging, unifying view of HIVE learning is the future of education (Exhibit 2). It represents, finally, the practical convergence of best practices and technologies, leveraging and building upon what we already know for better results for all involved. However, the critical trick for today is knowing when to look at virtual worlds, simulations, and games as part of a greater whole, sharing best practices when appropriate, and when not to let this holistic view obscure the critical differences among them, optimizing the sense of place and presence offered by virtual worlds, the fun engagement provided by games, and the rigor and transferability of skills promised by simulations.

References

Aldrich, C. 2009. *The complete guide to serious games and simulations*. Somerset, NJ: Wiley.