

UnrealEd for Education

by Paula Wellings

Overview

The purpose of this paper is to consider the opportunities and challenges associated with creating an online community of learners to explore the use of the UnrealEngine2 Runtime for educational purposes. This paper begins by considering why people are interested in utilizing video game models in education and what communities have formed to investigate the intersection of learning and gaming in computer virtual environments (CVEs). Interaction models used in educational CVEs are then contrasted with models used in best selling video games. Based on an interest in utilizing gaming models for education, the paper identifies areas of spatial learning that may align with the interaction types utilized in gaming, and suggests the significance of this learning with respect to academic achievement. Having identified an opportunity for using gaming in education, the paper introduces Epic's Unreal games, editor, engine and newly released UnrealEngine2 Runtime, which is available for free for use in educational and not-for-profit projects. Associated with Unreal is an active online game design community. The activities of this community are considered in order to identify practices that may assist in the development of a new online community interested in using UnrealEngine2 Runtime for education. This paper then concludes with recommendations for the founding of a new online community.

Informal Learning to Education: Gaming to Learning

People have been playing video games for the past 30 years. During that time, video games have been used as models for education, with varying degrees of success. Learning games such as "Zoombinis", "Where in the World Is Carmen Sandiego?" and "Oregon Trail" have been lauded as educational successes, while others, such as Jumpstart titles are considered "edu-tainment" which has come to connote 'only useful for drill and practice activities associated with route memory'. Since 2000, a new approach to video games and education has emerged through the academic investigation of video games. This new field, called ludology, from ludus, Latin for game, is investigating video games and game play from a multitude of perspectives, engaging sociologists, ethnographers, psychologists, historians, literary theorists, and educators. Among the many areas for investigation in this new field, a number of researchers are engaged in considering the nature of learning within the context of video game playing. Some researchers are focused on identifying commercial video games that are suited to classroom use, such as Civilization, Rollercoaster Tycoon, and SimCity, while other researchers are examining how the ubiquity of video games in children's lives inform our understanding of literacy for the 21st century. Still other researchers are considering how complex gaming models, principally enacted in computer virtual environments, can be utilized to support more formal learning practices. Many researchers engaged in exploring the use of gaming models for education, see an untapped and transformative opportunity to provide to game players learning experience that can transfer beyond the gaming interface.

A number of research groups have formed and websites have launched in order to support the interest in game development, game play, and educational utilization and adaptation of gaming models for learning. I have selected a number of these groups to

briefly profile in order to demonstrate the breadth of their pursuits, and simultaneously the limitations of their online community activity.

DiGRA: Digital Games Research Association is a group of academics and practitioners whose work focuses on digital games and associated activities. In cooperation with the International Game Developers Association, DiGRA is working to bridge the gap between academic game researchers and game developers through a monthly column entitled "Ivory Tower" which explicitly raises fundamental game research issues to the broader game development community. A recent column addressed the fact that the two groups have different goals, with the game studio seeking a product with commercial potential and the researchers looking to have something that will make an impact in the research community. DiGRA has been operational as a group since the beginning of 2003, and in this time fewer than 100 posts have been made to its forum area. Primary community activities appear to take place at conferences. (<http://www.digra.org>)

Social Impact Games: Entertaining games with non-entertainment goals is a website developed through the initiative of Marc Prensky. The website is primarily a large index of games organized by themes such as policy, health, business, military, political/social, advertising and branded games, commercial off the shelf, and education. Users are able to log-in to contribute to the index, submit articles, and participate in the forum area. The site currently has 11 users, 5 posts, and the index was last updated in September 2003. Similar to DiGRA, community activity appears to take place at conferences, a Serious Games summit will be held in March 2004 in conjunction to the industry-wide Game Developer's Conference. (<http://www.socialimpactgames.com>)

Associated with the University of Wisconsin at Madison, **Room 130** is an interdisciplinary research group devoted to digital games, learning, and literacy. Lead by Jim Gee and Kurt Squire, the group is associated with the New Literacy movement of the London Group. Key areas of research include The Genesis of Online Gaming Culture, The Discourse of Massively Multiplayer Online Gaming, and Innovating Qualitative Methods for Digital Domains. Room 130 sees video games as providing learning principles for teaching science, social studies and mathematics, and revolutionizing learning communities. The Room 130 website provides access to a listing of academic papers, but does not include community features. (<http://labweb.education.wisc.edu/room130/>)

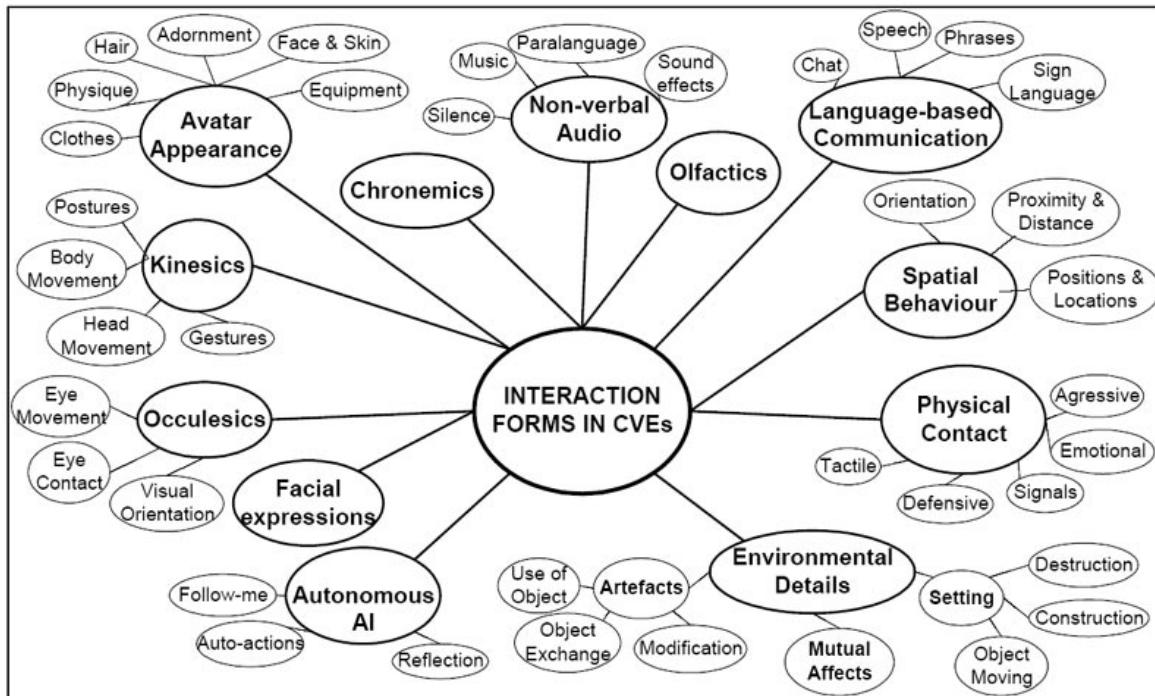
The Digital Media Collaboratory is part of the IC2 Institute at the University of Texas. This group hosts classes, workshops, and conferences on gaming for both game developers and academics. The DMC hosts a number of wiki associated with its conferences and initiatives. The group has recently received a grant from the National Science Foundation to research the educational and commercial merits of a science-based video game for middle school students. Additionally, through the group's Future Media Institute, the group is hosting a recurring Game Design and Development competition for high-school students in the Austin, Texas area.

The **Education Arcade** originated at the Massachusetts Institute of Technology two years ago with the purpose of determining whether high quality educational games could be made and used effectively in the classroom. Through a Microsoft iCampus initiative, the group has developed a number of game prototypes and worked with teachers and students at MIT and local high schools to determine their effectiveness. While the Education Arcade website has standard community forum features, there are few postings and the most members online at the same time occurred on October 2nd, 2003 when 4 members were on at the same time. Instead, the majority of extended community activity centers on its conference gatherings which draw key players in the learning-gaming area.

A common feature of all of these organizations is that the online community component of their websites is underutilized. In all cases, community relationships are either conducted in face-to-face environments such as conferences, workshops and geographically-based design competitions, or relationships are conducted through other means such as phone, email or intranet that do not allow for inclusion of all members and potential members. It is safe to say that these organizations do not currently function as online communities.

The Education Arcade does provide information on its website regarding current prototype development. One of the prototypes highlighted is a multiplayer online role playing game set during the American War for Independence, called Revolution. While it is difficult to be certain from the description and screenshots on the site, the game appears to follow a number of interaction paradigms utilized in existing educational computer virtual environments.

Many of the computer virtual environments developed for educational purposes have utilized interaction paradigms modeled on social interaction and world creation. Examples of these environments include ActiveWorlds, Tapped-In, MooseCrossing, and WhyVille. Each of these environments enables the learner to chat with other virtually embodied learners, customize attributes of their avatar and/or physical space, and travel around looking at the objects and avatars that the space is populated with. Utilizing Manninen's rich interaction concept model for computer virtual environments, the primary forms of interaction in these educational worlds include: Language-based communication, Facial Expressions, Avatar Appearance, and some aspects of Environmental Detail. Kinesics is sometimes utilized, but generally as an ambient accompaniment to language-based communication. One of the challenges of these environments is that once learners have customized their avatar and created their space, the motivation to return is premised on enjoyment of social interaction with other online learners and/or the incentive to acquire more personalization for their space or avatar. This motivational feature is demonstrated in WhyVille where children gain world money by engaging in science activities, with which they can purchase new face parts and home decorations. It is also demonstrated in Tapped-In, ActiveWorlds and MooseCrossing, where participation drops off after learners have completed the personalization of their virtual selves and spaces.



Manninen T. (2002) [Interaction Forms in Multiplayer Desktop Virtual Reality Games](#). Rich interaction concept model in terms of top-level categories.

In contrast to the interaction models utilized in learning CVEs, the ten best selling video games of 2003 ¹ focus on interaction forms that employ Physical Contact, Spatial Behavior, Non-verbal Audio, Autonomous AI, Chronemics, and Environmental Details. The interaction forms of educational CVEs and gaming CVEs have very little overlap. This may suggest that people interested in developing learning games based on gaming models have yet to find educational activities that align with the interaction forms commonly featured in gaming. Using gaming as a model for education means understanding more than its surface attributes and requires the alignment of the deep interactive features of video games with learning objectives. Without this consideration, new learning-game designs risk becoming forced and stilted edu-tainment.

One potential area where gaming interaction forms may align with learning goals is in the area of spatial cognition and the application of spatial intuition to math and science learning.

Work in the area of spatial cognition has found that there are gender-based differences in spatial ability, with the largest difference in favor of males found on measures of mental rotation, and smaller difference found on measures of spatial perception. These findings are significant because differences in spatial ability have been mapped to performance on academic tasks such as the Scholastic Aptitude Test—Math (Casey et. al, 1995), and have been found to influence girls and women’s confidence in science, math, and engineer fields (Pezaris, 1993).

¹ MADDEN NFL 2004, POKEMON RUBY, POKEMON SAPPHIRE, NEED SPEED: UNDERGROUND, ZELDA: THE WIND WAKER, GRAND THEFT AUTO: VICE CITY, MARIO KART: DOUBLE DASH, TONY HAWK UNDERGROUND, ENTER THE MATRIX, MEDAL HONOR RISING (NPD Group: http://www.npdfunworld.com/funServlet?nextpage=trend_body.html&content_id=780)

However, it appears that spatial ability is not a fixed characteristic of sex. In a recent meta-analysis on the magnitude of sex differences in spatial abilities, it was found that a “decrease in the magnitude of sex differences in recent years argues for the fact that attitudes concerning sex-related cognitive differences have changed. This attitude change is likely to have affected the way children are raised and the way women and men approach different tasks.” (Voyer et. al, 1995) Additionally, Agogino and His have demonstrated that spatial ability can be improved through instruction (1995) Baenninger & Newcombe have found that “spatial experience is related to good spatial test performance. Prior participation in spatial activities (sports, games, real life settings) is correlated with higher spatial test scores” (1989). Humphreys has conducted neuropsychological studies that indicate that perception-action couplings are crucial to our conscious representation of space (Humphreys, 2004). Together these findings suggest that efforts to support the development of spatial ability can be fruitful for both girls and boys and that improvement in spatial ability may influence learner’s performance on academic tasks. Continued investigation into spatial cognition within the context of video game development will be important to see that its potential is realized. Past work looking at the game Tetris, found that spatial expertise developed in that particular game did not transfer to objects of other shapes, such as letters and pictures (Sims et al., 2002). There is still much to learn about spatial cognition, but CVEs provide an ideal platform with which to conduct further investigations through the development of games for learners and through the development of games by learners.

There is a body of research that suggests that in order for video games to be appealing to girls there must be an increased orientation towards the drama of human relationships, creativity, and a social goal orientation (Brunner, C. et al. 1996). It will be important to be mindful of these potential requirements, while also keeping in mind that many of the learning opportunities associated with spatial cognition may rely on “physical” action within the 3d simulated world. Creating a 3d environment where players’ primary activity is talking to each other is not likely to result in improved spatial abilities.

Unreal: Game, Editor, Engine, UnrealEngine2 Runtime

In order to effectively explore the potential to use gaming models to support learning in the area of spatial cognition and to determine possible impact of this learning on math and science learning and performance, the interactive attributes of gaming CVEs need to be available for exploration. One tool that has recently become available to educators for no cost is Epic Game’s UnrealEngine2 Runtime. In order to better understand what opportunities and capabilities UnrealEngine2 Runtime presents, it is useful to first understand what is Unreal, what is the Unreal Editor (UnrealEd), and what is the Unreal Engine. Additionally, it is useful to see the types of online communities game players and designers have formed around the use of these tools.

What is Unreal?

Unreal is an online multi-player first person shooter video game developed by Epic Games. The games are based on a science-fiction warrior model, with game modes currently including both team and individual-oriented play surround such tasks as Capture the Flag, Death Match, Team Death Match, Double Domination, Last Man Standing, Mutant, and Invasion. The first version of the game, Unreal 1 was released in 1998. Since that time, Epic Games has release five additional games, Unreal Championship, Unreal Tournament, Unreal II—the Awakening, Unreal Tournament 2003, and most recently Unreal Tournament 2004. Additionally, Epic Games has released a Mission Pack to extend the game play of Unreal II, which is Epic Game’s sole single-player only game.

What is UnrealEd?

Players themselves can also extend game play in all Unreal games by using the Unreal Editor, UnrealEd, to modify and create their own game worlds in which to stage competitions. UnrealEd, is a real-time game design tool that enables What You See Is What You Get manipulation of lighting, texture placement, and geometry operations, providing extremely fast feedback while building levels (UDN.com). UnrealEd supports sophisticated object-based manipulation of the physics and lighting characteristics of the environment, as well as enabling control and movement of objects and characters throughout the world. Creating and playing in worlds developed within UnrealEd may provide unique experiences to player/designers that support spatial visualization, object manipulation within an object-oriented environment, and exploration of virtual-physical systems such as light and gravity. UnrealEd enables people to create and share multi-player virtual gaming worlds. This feature has motivated informal learners to extend the Unreal game to suit the overall game objectives, which center on play patterns associated with team battle-type games.

What is the UnrealEngine?

The UnrealEngine is the core software platform which games are based on. Simultaneously to Epic Games developing the Unreal game series, they have also been active in licensing their game engine to other game developers, who have released such games as Harry Potter—Chamber of Secrets PC, Dr. Brain Action Reaction—Knowledge Adventure, America’s Army—US Army, Thief III—Eidos Interactive, Lineage II, and Deus Ex—Eidos Interactive. These releases demonstrate the flexibility of the engine to support the construction of many different types of virtual game worlds and player interactions. For example, in Harry Potter players interact with the world through casting spells and manipulating objects; in Thief III, players sneak through the environment, attempting to be undetected while gaining knowledge and wealth; in Lineage II, players form clans and engage in quests where they use hand-to-hand combat and cast magical spells. The variety of game play suggests that the editor and game engine are capable of supporting the development of many kinds of worlds and interactions.

The Unreal Engine has numerous features that make it an attractive game development environment. The following areas may be especially important for the use of the engine in projects related to spatial cognition and science and math understanding:

Physics: The Karma 1.2 rigid body physics engine allows for complex physics simulations encompassing between actors, environments, and objects. The sophistication of the engine enables the construction and exploration of a plethora of real and simulated physical phenomena.

Lighting: Multiple light types are supported: directional, point lights, and spot lights. Lights can be any colour and brightness, and dynamic lighting and shadowing effects can be simulated. These features enable the ability for designers and players to interact with the qualities of light in a simulated environment.

Textures: Detail textures within the engine allow for extremely close-up details to surfaces, such as fine wood grain, pock marks on brick surfaces, or scoring to metal. It has been found that there are sex differences in the way that people navigate through space. Females are more likely to utilize landmarks in the environment. It is possible that in the past, lack of texture variation within 3D environments has made navigation more difficult for landmark-based navigators. The ability of the engine to display detailed textures may improve way finding experiences within virtual spaces.

Artificial Intelligence: AI properties are exposed to level designers for setting up patrol routes, individual creature moods and more. The ability to manipulate the behavior of actors within a system can be appealing to a designer's sense of control, which may be especially compelling to children. Additionally, the use of AI actors within a world can enable the exploration of participatory simulations within virtual worlds.

Audio: The engine provides detailed control over the auditory experience through the support of 3D spatialization, attenuation, pitch and Doppler shifting. A number of researchers who study girls and gaming have suggested that providing girls creative opportunities related to sound may increase their interest in technology. (Brunner, C. et al. 1996)

Networking: Since its inception, the Unreal Engine has been developed for networked play. The engine supports gamers traveling between Unreal servers much like browsing web pages, with teleporters providing links between servers. It also supports automatic downloading of new content (levels, textures, sound, models, scripts) while browsing Unreal servers. (UDN) For supporting classroom experiences and other online community activities, it is of value to be able to seamlessly migrate between multiple user created worlds and environments.

What is UnrealEngine2 Runtime?

Recently, Epic Games has released UnrealEngine2 Runtime for non-commercial and educational use. This release of the engine makes use of UnrealEd free to educators and students using the Runtime engine for non-commercial purposes. This Runtime version of the engine and editor is a blank slate for exploration. The characters, guns, and violent game play present in the Unreal games have been removed from this engine. Additionally, it is not possible to import maps and models from the commercial

games. This stripping of the engine opens up the cultural environment to the exploration of all sorts of play and world design. To learn more about how people have used UnrealEd to create their own games, it is valuable to look at the existing online community of game editors.

Unreal Editing Community

From the beginning of Unreal, Epic Games has not directly focused on supporting player use of UnrealEd, but many player-initiated communities have been created to assist players in understanding, designing, and problem-solving game levels. The majority of these sites focus on providing support for the design and decoration of virtual-physical environments. Common site features include tutorials, discussion boards, and the exchange and playing of player created environments. Online tutorial sites do not fully document the capabilities of the editor, but unlike development tools like Photoshop or Maya, there have been no in-depth resources developed to support the use of UnrealEd.

Community composition

It is difficult to accurately describe the demographics of the UnrealEd community by looking through community sites. The intuition is that the community is dominated by boys and men, based on screen names, sites look and feel, and the general tone of forum conversation. While English is the predominate language of Unreal sites, there are many sites in German, French and Spanish that I did not consider. To bolster my intuition regarding the English speaking UnrealEd community, I looked at the population of the speakers for the upcoming 18th annual Game Developer's Conference, which claims to define the future of the \$10 billion game industry. Of the 517 speakers at the conference, only 33 of these speakers are women, with a quarter of these women representing the business and legal aspects of the industry, not design and development. The majority of speakers appear to be under the age of 50 and Caucasian.

It is safe to say that this community has advanced technology skills and income above the poverty line. In order to run UnrealEd, a relatively powerful computer is required. While the RAM requirements are midline at 256 MB, a Pentium III 1.5GHz or greater processor and at least 64 Megs of video memory are required. Internet connectivity is generally also necessary for community and resource access, as no books have been printed on using UnrealEd.

Community Activities

The Unreal community occupies a sophisticated network of websites where community members learn, work and play. As a community that merges the boundaries between consuming and producing, the multiple sites of community activity form the structure of what John Seely Brown refers to as a "learning ecology" — " a collection of over lapping communities of interest, cross pollinating with each other, constantly evolving [and] largely self organizing." The breadth of activities within the realm of learning, working and playing also situates the Unreal community as an environment highly supportive of legitimate peripheral participation, as learner/player/workers travel across the

community, for example transitioning in identity from expert player to novice game designer, or from amateur game designer to professional game designer.

There following are some of the activities that community members engage in and examples of sites that support these actions.

Learn

These sites support community members in using UnrealEd to realize the capacities of the Unreal engine through game level design and programming.



Participants have a long term relationship with some community sites

Originally launched in 1998 as Planet Unreal, when the first Unreal 1 was released; the Beyond Unreal website has weathered numerous changes in servers, file mirrors, and affiliations. The site has evolved its focus from primarily Unreal games and modifications to many types of games utilizing the Unreal-engine.

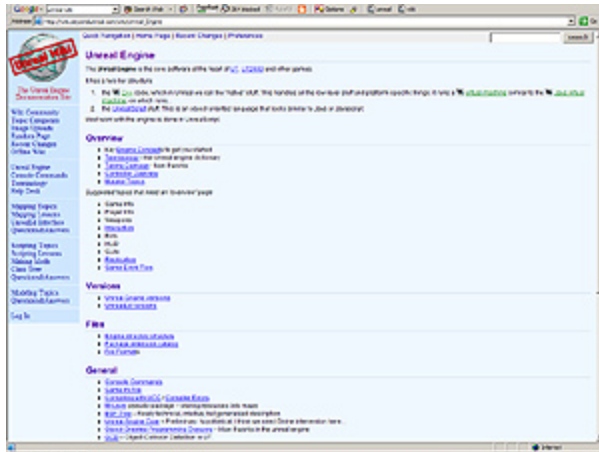
The resources available on the site broadly address both game playing and game designing activities. Beyond Unreal has also become a free host to other invited Unreal engine oriented websites.



Participants use tutorials and write tutorials

Level Designer.com brands itself as "a place to talk among your peers". The site enables the uploading and updating of tutorials by community members. The site tracks the number of times a tutorial is viewed, and provides a cross-index of tutorials and authors. A listing of most viewed tutorials is available. A discussion forum is also on the site, but activity on this component of the site is very low.

<http://www.leveldesigner.com/>



<http://wiki.beyondunreal.com/>

Participants contribute to community knowledge bases

Unreal Wiki: The Unreal Engine Documentation Site is an active knowledge base accessed and created by community participants. Areas of Unreal that people would like to learn about are included in the pages as incomplete links that other participants can then provide information and pages for. Unreal Wiki has a high level of member participation and members have recently created pages associated with UnrealEngine 2 Runtime.



http://sv2.3dbuzz.com/vbforum/unr_main.php

Participants vary in their level of commitment to a site's community

3d Buzz hosts Unreal Technology, a site that offer free training videos as well as selling online classes. It was found that people were coming to the site to download videos without participating in the associated forums. As part of 3d Buzz's business model is associated with advertising revenue, 3d Buzz instituted a star system where videos cannot be downloaded unless member participate in community activities that expose them to advertising and extend their time on the site.

Work

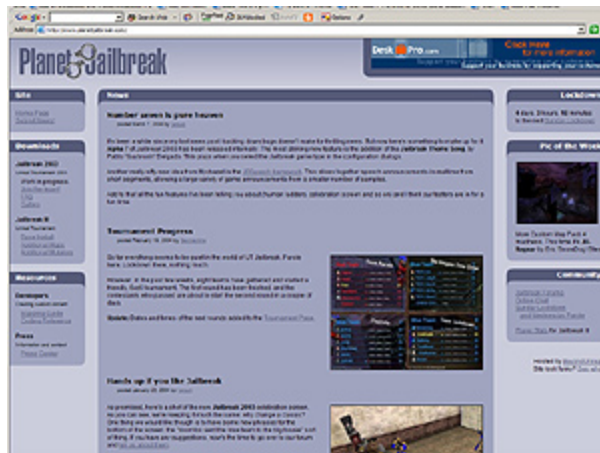
These websites bridge the amateur practice of game design with the practices engaged in by professional game designers.



<http://udn.epicgames.com/Main/WebHome>

Participants and Unreal Engine developers interact

The Unreal Developers Network is the official site of Epic's Unreal Engine. This site provides resources and forums related to the use of the engines and includes a new forum specifically about Runtime. Information is exchanged between amateur game designers and professional developers through this site. Additionally, this site has secure areas to support groups that have paid to license the commercial version of the Unreal Engine 2. Unreal Engine 2 Runtime for education can be downloaded from this site.



<http://www.planetjailbreak.com/>

Participants blur the lines between amateur and professional activities

At Planet Jailbreak, community members band together to become semi-professional development teams focused on collaborating on levels and modified game interactions. The website features current version game downloads, a schedule of upcoming game play events, and a call for mappers and modelers to join the development team.



<http://www.angelmapper.com>

Participants are discovered by professional game developers

"I made my own website as a portfolio of my level design so that I could get a job making games, and to tell people a little about the places I've been and the things I've seen. :) I also started writing tutorials for the Unreal Editor last year, so I've been posting them up on my site as well. ... CliffyB at Epic took notice of my work and gave me a referral at Secret Level in June, a few days later I got an email from them and started doing remote contract work the next week. Last month they hired me on as a full time employee, so I moved down here to San Francisco and have been loving it ever since."

Interview with Rachel Cordone by
LadyGamers.com

(<http://www.ladygamers.com/focus/september/angelmapper.html>)

Play

Game playing is a key activity of the Unreal Community. Without the sharing and playing of game levels, the learning and working aspects of the community would be irrelevant. Play drives community engagement and sustains member participation.



<http://www.unrealplayground.com>

Participants download and play maps created by community members

Unreal Playground is an area where community members can upload their own game design maps and well as download and play maps created by other members. The site hosts mapping contests, and provides developer resources. It also allows for the rating of maps and well as discussion forums tied to game play. Players on the site are also rated based on their game play activities.



Participants also make game artifacts to share with the community, such as levels, mods, mutators, meshes, and animations.

<http://modsquad.beyondunreal.com>

What can be learned from the Unreal community?

Online learning communities are generally analyzed at the level of a single web site. Barab et al. describe a framework of six dualities central to understanding community life that they apply to a single site. These dualities include: Participation/Reification; Designed/Emergent; Local/Global; Identification/Negotiation; Online/Face-to-Face; and Coherence/Diversity (Barab, 2004). As a 'network aware' community, the unit of analysis for the Unreal community is not a single site. Instead individual sites can be found in these duality continuums, but the aggregate community has evolved to the point where sites are complementary in aggregate. For example, Beyond Unreal has a global and designed focus that enables reliable and long-term community activity. Its identity shifts slightly with the release of new Unreal technologies but is stable enough to enable members to identify with its long term activities. Planet Jailbreak on the other hand has a very local focus, the direction of the site is emergent based on participation, and the identity of the site is open to negotiation through the development of new game characteristics and game levels.

The Unreal community is not constrained to participating only in one site. Instead, individual members use what is useful for a number of sites as their participation abilities, levels and interests change. This migration through information spaces has been described by Brown as a form of Bricolage:

"...working with digital media suggest bricolage to us more than abstract logic. Bricolage...relates to the concrete. It has to do with the ability to find something—an object, tool, document, piece of code—and to use it to build something you deem important (Brown, 2000).

As the Unreal community is an emergent community that exists beyond the level of a single site, it is difficult to draw standard what-works conclusions at the level of community design proposed by Kim. Instead, it is possible to consider a few key features that make this community possible, that have the potential to be guiding principles for a new community:

1. **People play** It is true that community members also work and learn, but social play is the cumulating event that ties together individual efforts. A love of playing the game helps people share their knowledge, as the person they are sharing with may make the next great game to play.
2. **People make things** The Unreal community has a utilitarian focus that makes legitimate peripheral participation accessible to its members. By engaging in digital crafts such as 3D object creation and mod programming, people can contribute to the community at the level of their expertise, while learning new skills.
3. **Ability and contribution matter** Unlike the scientific laboratories discussed by Finholt, the making and playing orientation of the Unreal community means that status is accorded to those who demonstrate ability and contribute to the community, regardless of external prestige. These status effects are also diffused by the distributed nature of the community
4. **DYI** In part due to the technical fluency of community members, if people don't like the resources or environments available to them, they make their own. This Do It Yourself mentality enables the community to continue to grow and develop, instead of implode from the dissatisfaction of individual members.

Getting the UnrealEngine2 Runtime ready for class time is an ill-defined problem.

The formation of a new community, or sub-community, to make UnrealEngine2 Runtime ready for class time requires a dedicated group of founders. This multidisciplinary founding team must be committed to discovering emergent learning opportunities present in interactive gaming models. Community founders must be willing to get their hands dirty, to engage with the here-and-now of existing code and cultural environments while being mindful of the long term potential of developing communities of learners invested in making these powerful tools available to educators and students. Community founders will need to eyes-wide-open celebrate the accomplishments of the existing Unreal Community and not flinch when someone says "frag fest". At the same time, community founders need to be mindful of the cross-cultural implications of going from game world to girl world, child world and student world, being ever attentive to the needs of all students in designing materials and examples. It will be important that some of the Communities founding members have coding and technology skills, that some have gaming interaction skills, while other members are skilled in spatial cognition and math and science oriented learning practices and methods of complex instruction. Amidst all of these serious requirements, Community founders must also like to have fun and to create artifacts to play with. Without the desire to play and the commitment to spend time playing, utilizing gaming models for learning will fail. A key lesson to be learned by the Unreal Community is that people make things they want to play with and things they want their peers to play with.

Online tools to support a new community

As demonstrated by the existing websites of organizations interested in gaming and learning, community tools do not a community make. However, there are a number of tools that might prove useful to a new online community, based on the expectation that it will be valuable for community members to established shared reference and joint attention through concrete means as they become familiar with taking about and

sharing development experiences. A recommended list of web site features includes:

Tools to support joint attention across distance:

- easy to use remote screen sharing
- persistent presence via an instant messenger

Tools to support community identification and participation

- skill and interest profiles
- discussion boards
- resource and game rating systems
- calendar
- ability to create work and play teams and schedule meetings

Tools to support group resource development and use

- a wiki-based collaborative tutorial library with areas identified to expand upon by participants
- shared object/model/code/level library with associated communication features
- access to content area resources

Tools to facilitate playing together

- dedicated UnrealEngine2 Runtime server for hosting game play
- weekly/monthly challenges like the Math Forum's Problem of the Week

Tools to facilitate working together

- project management visualizations that break down goals into actionable activities for members
- game capture plus diver type tool might enable people to discuss their game designs asynchronously

Next steps: UnrealEngine2 Runtime for education?

While rich and deep in scope, the activities of the Unreal community focus primarily on developing worlds where people interact with the world and other players via guns. The community is primarily male identified and many of the individual websites utilize look and feel conventions that may be off putting to some girls and boys. Additionally, the language utilized in the forums maybe be considered inappropriate for children and their parents. The editing tool is complex and the Runtime engine requires improvements. Overall, popular culture and education have an unsteady relationship. Given this situation, it is worth considering the value of investing resources into making UnrealEngine2 Runtime ready for class time.

To aid in contemplating this predicament, it is valuable to take a lateral jump to a scenario that at first may seem nothing like one at hand, the home improvement industry. Twenty years ago, a hardware store was a place filled with bins nails, screws, fasteners, faucet heads, and many other items exotic to the uninitiated. Hardware parts and pieces were decontextualized from their final use, so that if you did not have a conceptual understanding of hardware use before entering the store, you would not likely acquire one within the store. Additionally, it was not uncommon to see posters

and calendars of half-clothed women holding tools in provocative poses—suggesting that hardware stores prioritized the male gaze and male participation. Since that time, hardware stores have evolved into home improvement centers. Within popular home improvement centers such as Home Depot, you now find fully assembled kitchens and bathrooms, Do-It-Yourself Clinics, and tools and hardware organized by final use. Additionally, many hardware stores now brand themselves as helpful, such as “Ace Hardware, the Helpful Place,” and “TrueValue—help is just around the corner.” This shift in orientation has significantly changed the demographic of people making purchases at hardware stores, with women making 50% of purchases at Ace Hardware and 55% of non-contractor purchases at Home Depot, and with more people in general engaged in activities that use hardware.

The purpose of this lateral jump is to suggest that the use of power(ful) tools is situated within social contexts where the ability to participate cannot be attributed solely to individuals, but must be considered within the broader context of an environment of distributed intelligence.

There are many reasons to embrace the UnrealEngine2 Runtime tool. As Eisenberg argues in his conceptualization of new directions for output devices for students, our imaginations should not be limited to imagining computers as business machines (Eisenberg, 2003). Software in part, determines a computer’s identity and utility. To have students move from creating PowerPoint presentations to both developing and playing in computer virtual environments requires a paradigm shift of meaningful proportions for “what is considered to be the curriculum will vary when the technologies used for reasoning in a domain change” (Pea, 1993) UnrealEngine2 Runtime introduces an object-oriented method of spatial thinking and visualization that is difficult to achieve without the intelligence embedded in the application. Making this tool accessible and available to educators and students provides new means with which to think, and provides to researchers new ways to explore our understandings of spatial cognition and its relationship to mathematics and science.

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