"Ninja Looting" for Instructional Design: The Design Challenges of Creating a Game-based Learning Environment

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"Ninja looting" is when a player in a MMORPG steals treasure … without first asking the other participants … for permission to do so. (Wikipedia, 2005)

Abstract

Computer and video games have become an increasingly prevalent form of entertainment. While the primary purpose of games is entertainment, the underlying design employs a variety of strategies and techniques which require players to analyze, synthesize, and to use critical thinking skills. Ironically, these are also many of the same types of critical thinking skills educators and instructional designers attempt to foster when creating educational materials and media. The purpose of this paper is to present an overview of a 3D game-based learning environment and to highlight some of the issues that arose during the design, development, and production. Specifically, this paper presents (a) game design elements which can be appropriated (looted) from game design, (b) cognitive research that supports the integration of the elements for instructional design, (c) a discussion of challenges encountered while creating a 3D game-based learning environment with limited resources, and (d) various low-cost and free resources (to avoid ninja looting).

Keywords: Instructional design, education, game design.

1 Introduction

During the past two decades computer and video games have become an increasingly prevalent form of entertainment. While the primary purpose of games is entertainment, the underlying design employs a variety of strategies and techniques intended to engage players in gameplay. Strategies of design that lead to engagement differ depending upon the game genre and individual game, but typically during the course of gameplay, players may be required to analyze, synthesize, and use critical thinking skills in order to play and execute moves. Ironically, these are also the same types of critical thinking skills educators and instructional designers attempt to foster when creating educational materials and media. The field of instructional design has much to learn from contemporary games because game designers have become well versed in creating activities and environments which foster intrinsic motivation and cognitively engage players.

The field of instructional design has a long history of appropriating elements of popular digital game design for teaching and learning [Bowmen 1982; Dickey 2005; Malone 1981; Prensky 2001; Provenzo 1991; Rieber 1996; Squire 2003]. Innovations in technology have provided instructional designers with a wider array of options in which game elements can be appropriated for teaching and learning. With innovation, however, comes additional challenges; particularly for instructional designers and educators attempting to integrate game design elements with limited resources.

The purpose of this paper is to present an overview of a 3D game-based learning environment and to highlight some of the issues that arose during the design, development, and production. Specifically, this paper presents (a) game design elements which can be appropriated (looted) from game design, (b) cognitive research that supports the integration of the elements for instructional design, (c) a discussion of challenges encountered while creating a 3D game-based learning environment with limited resources, and (d) various low-cost and free resources (to avoid ninja looting). The goal of this paper is twofold: the first is to address how game design can inform the field of instructional design in the development of interactive and game-based learning environments, and the second is to discuss pragmatic strategies for attempting this type of design with limited resources.

2 Ninja Looting from Game Design

The current movement within the field of instructional design is toward the cultivation and development of interactive learning environments [Winn 2002]. The emergence of learning environments has been fueled in part by the epistemological shift towards constructivism and in part by the impact and integration of technology in learning [Hannafin et al. 1999; Jonassen 1999; Winn 2002]. The theoretical assumption underlying interactive learning environments is that learners construct understandings by interacting with information, tools and materials as well as by collaborating with other learners. Yet, learning environments must also help scaffold the learning process. Digital games are an obvious source of inspiration for the field of instructional design because many of the same elements present in games (i.e. interactive challenges, exploration, collaboration and community) parallel the types of elements instructional designers and educators attempt to foster in learning environments [Dickey 2005]. Strategies of design that lead to engagement may include role-playing, narrative arcs, challenges, and interactive choices within the game as well as interaction with other players.

Digital games are by no means novel to the field of education. Educational games and edutainment represent 7-9% of the computer/video game market [IDSA 2002]. Although educational computer games have stimulated a significant body of research, much of this research focuses on how educational games may enhance existing curriculum and materials. However, research into design aspects of games in studies by such diverse researchers as Barab, et al. [2001], Bers [1999], Bers and Cassell [1999], Bowman [1982], Bruckman [1997], Dickey [2005; 2006], Gee [2003], Malone [1981], Malone and Lepper [1987], Prensky, [2001], Provenzo [1991], Rieber [1996], and Turkle [1995], indicate that many of the strategies, tactics, and methods employed in digital game design may also provide compelling strategies for the design of interactive and game-based learning environments.

Bruckman's [1997] and Turkle's [1995] respective research into MUD and MOO environments deals with aspects of role-playing and community. Bruckman's [1997] investigation into her text-based virtual world, *MOOSE Crossing*, revealed that this game-like virtual world setting provides avenues for community support and the development of social relationships. Turkle's [1995] investigation into MUDs revealed that virtual environments allow users to experiment in a safe, non-threatening environment and to expand, explore, and reflect on different aspects of themselves. Similarly, Barab, et al. [2001] and Bers and Cassell [1999] found that game-like virtual worlds can be used as

effective tools in fostering rich understandings of phenomena and identity. While Bruckman's [1997], Barab, et. al.'s [2001], Bers and Cassell's [1999] and Turkle's [1995] respective research focused primarily on social aspects and role-playing in virtual environments, research into psychological and sociological benefits of play revealed that games support intrinsic motivation, as well as opportunities for imitation and learning by providing feedback, fantasy, and challenges [Malone 1981; Malone and Lepper 1987; Rieber 1996;].

Several explanations have been proposed as to why games are popular and which aspects might best be appropriated for instructional design. Bowman [1982], Malone [1981], and Provenzo [1991] each investigated the motivational supports in popular game designs of their eras. Bowman applied Csikszentmihalyi and Larson's [1980] *flow state interaction* to help explain motivation of extrinsic supports found in the game *Pac-Man*. Malone [1981] investigated a series of games and identified three primary characteristics of computer games which fostered intrinsic motivation: challenge, fantasy, and curiosity. Malone and Lepper [1987] further expanded this framework adding the elements of choice and control as supports of intrinsic motivation. Provenzo [1991] later applied Malone's [1981] initial elements of challenge, fantasy, and curiosity to deconstruct and explain the intrinsic motivational support of *Super Mario Bros. 2*. Although Bowman [1982], Malone (1981), and Provenzo [1991] each contemplated how game design elements might be integrated into education, Bowman's [1982] study focused primarily upon the feedback cycle and motivation, whereas Malone's [1981] and Provenzo's [1991] respective research addressed aspects of intrinsic motivation.

Rieber's [1996] research into the psychological and sociological benefits of play also reveals that games support intrinsic motivation by providing feedback, fantasy, and challenge [(Rieber 1996]. Rieber's work further addresses how narrative/fantasy can foster intrinsic motivation and potentially be an aid to learning when it is integral to the gameplay experience. Similarly, Dickey's [2005, 2006] work addresses how narrative in games provides a cognitive framework for problem-solving because the narrative storyline in games provides an environment in which players can identify and construct causal patterns which integrates what is known (backstory, environment, rules, etc.) with that which is conjectural yet plausible within the context of the story.

From multiple perspectives, contemporary video and computer game design provides instructional designers and educational technologists with models and methods for designing engaging interactive and game-based learning environments. For the most part, however, the integration and creation of game-based learning environments have been limited due to the considerable resources necessary to support design and integration. Many practitioners in instructional design, education, and K-12 education often work with limited resources in terms of access to software, programming skills, and digital artistry skills. These limitations pose many challenges for those attempting to create interactive and game-based learning environments. The following provides an overview of the design of a game-based learning environment and some of the challenges encountered when attempting to create this learning environment with limited time, resources, and talent.

3 A 3D Game-based Learning Environment

Murder on Grimm Isle is a 3D game-based learning environment designed to foster argumentation writing skills for students in grades 9-12, as well as first-year and sophomore level college students. The backstory of the environment centers on a murder which has taken place on Grimm Isle. Learners are cast in the role of an investigator of a crime scene. As they move throughout the environment, they construct arguments based on information and artifacts they encounter. In turn, they are also constructing a narrative of the events that occurred. The underlying environmental design is loosely based on the adventure game genre, as found in *Myst*, *Syberia*, and the *Nancy Drew* series, although, there are also design elements borrowed from the massively multiple online role-playing games (MMORPGs) genre as well.

The adventure game and MMORPG genres served as a source of design because both game genres use narrative as a tool for problem-solving. Typically, in educational materials, the narrative is based upon a linear timeline. This may be attributable to the fact that books, films, and video often serve as the primary medium for educational media. However, digital gaming environments illustrate how space and architecture can be used as compelling infrastructures for narrative based on spatial relationships rather than timelines. Games are narrative spaces [Jenkins 2002]. These narrative spaces allow players to interact with other players, non-player characters (NPC), and the environment. Narrative spaces are mapped throughout an environment, and the narrative is constructed by the relationships between space and events. Similar to the hero's journey in epic poems or the narrative architecture imposed on gothic cathedrals, these spaces allow for a co-construction of the story with a possible shift in narrative authority. Carson [2000], an environmental designer, argues that virtual environments, like those found in 3D games, allow players to experience a story through an imagined physical space. Because narrative is a type of causal thinking in which the narrative (cognitive) schema identifies categories (protagonist, situation, conflict, outcome, etc.) and relevant types of relationships (temporal, motivational, and procedural), the environment allows players to come to their own conclusions in cause and effect vignettes. In daily interactions, individuals use narrative to not only frame their thoughts, but to also guide their actions [Polkinghorne 1988]. Thinking within a narrative framework requires integrating experiences, which do not necessarily occur in narrative form, into a plausible storyline [Robinson and Hawpe 1986]. Adventure games and MMORPGs play upon individuals' cognitive schema of creating narrative and players use this narrative to problem-solve. The design of Murder on Grimm Isle is one attempt to appropriate elements of narrative space. Because the purpose of Murder on Grimm Isle is to foster argumentation writing and much of the argumentation is predicated on learners buying into the classic "who done it" narrative.

4 Design and Production Challenges

Murder on Grimm Isle (MGI) was developed at a mid-sized, liberal arts state university by a single faculty member, though two undergraduate students voluntarily assisted with some aspects of the 3D environment. The development has evolved over a period of time and has involved many changes as a result of limited resources. Funding for the project was sought in the form of several small grants and through the cooperation of several departments. Initially, the primary software used to create the 3D content was a personal copy of NewTek's Lightwave. During the process of production, however, the university purchased a site license for Alias|Wavefront's Maya and subsequent development continued with this software. It should be noted; however, for instructional designers with more restrictive budgets, Caligari's Truespace, Amabilis' 3D Canvas, or Blender provide lower cost or free alternatives.

The focus of MGI is a murder mystery and because learners are cast in the role of investigator, the environment plays a predominant role in this game-based learning environment. The

initial prototype consisted of a Website with 3D images similar to *Myst* and the *Nancy Drew* series. Learners could click on sections of the images to move from frame to frame. Much of the 3D image content was either custom created or purchased from low cost 3D object and texture vendors such as DAZ Productions, TurboSquid, and the Renderosity Art Community. It was decided, however, that this environment was too restrictive because learners needed to be able to move through the environment to gather evidence. In turn, this meant refocusing the production phase and retrofitting some of the 3D environment to work within a 3D virtual world or game authoring system. Several 3D virtual world applications and game authoring systems were initially considered. Because of limited resources, it was necessary to explore various low cost or freeware software. Several of the virtual world applications were considered including Adobe Atmosphere, VRML, and Active Worlds. Additionally, several 3D game authoring platforms and graphic rendering engines were also considered including Panda3D and Blitz3D, and Ogre.

Several issues were involved in selecting a 3D authoring platform. For instructional designers and educational technologist working with limited support, certainly issues of cost and ease of use are predominant factors, however, other factors should also be considered. During the process of developing MGI, Adobe discontinued supporting Atmosphere and although Atmosphere was not used for MGI, it certainly raised concerns about the need to develop content that was not solely platform dependent particularly when working with freeware and shareware platforms. For theses reasons, the further content for MGI was developed using Maya.

After some of the initial environment was created, it was converted and used to build parts of a second version, using Disney and Carnegie-Mellon University's jointed developed 3D engine, Panda3D. Panda3D was selected because it was being used in other initiatives at the university. Additionally, it is cost free and allows for the easy conversion of Maya files into the appropriate format for Panda3D. However, during trials for the second version, it was determined that the use of Panda3D required more programming then was available to fully develop interactive components of MGI. Fortunately, more recent funding has allowed for the development of subsequent versions using Active Worlds Educational Universe. Subsequently, the original Maya files had to be converted into RenderWare object format to be used the most recent version of MGI using the Active Worlds Educational Universe.

Two of the main challenges encountered during the process of adapting content for various platforms involve both artistry and technology. The process of creating compelling game environments relies heavily on skillful low-polygon object modeling along with texturing and digital painting abilities. Technology challenges include the process of converting 3D objects into appropriate file formats for the Active Worlds platform. Because the decision was made to develop the environment as an immersive desktop virtual world, more 3D objects had to be created, bought, or borrowed. The Active Worlds developers and the wider community of users have an array of free objects that can be used to create an environment. Additionally, there are several individual vendors who provide 3D objects for low cost and who can create customized environments or objects as well. These options were considered during the development of MGI and several objects such as trees were purchased from vendors, while other content was borrowed from Active Worlds' object library. However, because the environment of MGI plays a pedagogically predominant role, much of the original content created in Maya had to be reformatted and converted into RenderWare objects in order to be used in Active Worlds.

The process of converting files can be challenging for those working on a restricted budget. Some 3D engines such as Blitz3D and Panda3D have converters which will allow developers to easily convert 3D objects created with tools such as Maya, Lightwave, and Blender. Active Worlds, however, does not provide an easy method for converting common 3D object file formats such as .obj into RenderWare formats. Okino's NuGraf and PolyTrans are commonly used for 3D file conversions and with the addition of PolyTrans for Maya or PolyTrans for Max, files created with those modeling and animation tools can be converted in RenderWare files. For more restrictive budgets, shareware such as AccuTrans can be used. Additionally, Caligari's Truespace and Amabilis' 3D Canvas allows exporting of 3D objects in RenderWare format.

Although the visual element of MGI played a prominent role during production, audio is a large component in game design and can greatly enhance a game-based learning environment. However, like graphic content, sound effects and music can pose a challenge for instructional designers working with limited time, funding and talent. Low cost music and sound effects for MGI were purchased from Royalty-free.tv and various sound effects were located from both the FindSounds Website and FlashKit Website.

5 Conclusion

Contemporary game design provides a plethora of models, strategies, and techniques for creating rich interactive environments that cognitively challenge and engage players, however, much more research needs to be conducted. In order to conduct more research, accessible tools and technologies need to be developed. Currently, the process of appropriating and adapting these models, strategies, and techniques from contemporary game design to use in learning environments may be prohibitive to many instructional designers and educators who work with limited funds and support. The purpose of this paper is to address both the type of design elements that might be borrowed (ninja looted) from game design and appropriated for education, and to provide insight into and strategies for the pragmatics of creating a game-based learning environment with limited funds and support. The process of creating a game-based learning environment is difficult even under ideal circumstances. Although there are some options for circumventing limitations of funding, skills, and artistic talent, the underlying goal of the paper is to appeal to developers to address the growing need for accessible tools, platforms, and content so educators (higher education and K-12) and instructional designers can find accessible means of integrating game design elements to create cognitively challenging and engaging learning environments for all learners.

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A Software and Resources

3D Canvas – http://www.amabilis.com
AccuTrans 3D – http://www.micromouse.ca
Active Worlds – http://www.activeworlds.com/edu/index.asp
Blender – http://www.blender.org
Blitz3D – http://www.blitzbasic.com
DAZ Productions – http://www.daz3d.com
FindSounds – http://www.findsounds.com/
FlashKit – http://www.flashkit.com/index.shtml
Lightwave – http://www.newtek.com
Maya – http://www.alias.com
Ogre – http://www.ogre3d.org
Panda3D – http://panda3d.org
Renderosity Art Community – http://www.renderosity.com
Royalty-free.tv – http://www.royalty-free.tv
Truespace – http://www.caligari.com
TurboSquid – http://www.turbosquid.com
Royalty-free.tv – http://www.royalty-free.tv