Vol. 1 No. 3

iDMAa

Spring 2005

The International Digital Media & Arts Association

Journal

THE INTERNATIONAL

DIGITAL MEDIA & ARTS

ASSOCIATION

JOURNAL

VOL. 2 NO. 1
SPRING 2005

SUBMISSION GUIDELINES: Articles on digital media and art related topics are welcome at any time. An abstract of not more than one page should be submitted to the editor via e-mail (cgleber@mailer.fsu.edu).

Upon review, authors will be advised of acceptance for submission. The Journal will include a section for invited and refereed articles. While length will vary from issue to issue due to themes, articles will generally be 1500 to 4000 words. Any author preferring a peer review will automatically have the submission considered for the refereed section of the Journal.

While the Journal will normally appear in electronic form (PDF), at least one print version will be published annually.

All new Journals evolve and the iDMAa Journal is no exception. Please refer to our web site www.idmaa.org for updates.

Submit articles by mail to:
Conrad Gleber, Editor
Florida State University
2522 Marston Road
Tallahassee, FL 32306-1150
By e-mail to:
cgleber@mailer.fsu.edu

SUBSCRIPTIONS: Membership in iDMAa includes a subscription to the journal. See the web site (www.idmaa.org) for details. The annual subscription rate for institutions is $95 which covers access to the electronic version as well as two copies of the printed issues per year.

Table of Contents

Editor's Note

Preface

Section 1 STUDY

TEACH Section 2

BUILD Section 3

EDITOR'S NOTE

Welcome to the first issue of the second volume of the International Digital Media and Arts Association Journal. Inspired by our first efforts, the journal continues to bring to our members an in-depth review of a particular area of digital media and arts activity. In this case the various aspects of game research, pedagogy and design provide the opportunity for us to gain insight into the dynamic gaming environment and its emerging academic disciplines.

This issue owes its existence to the inspiration and commitment of our guest editors, Ken S. McAllister and Judd Ethan Ruggill, co-directors of the Learning Games Initiative at the University of Arizona. Together they have organized a journal that will undoubtedly become a pivotal reference for future researchers. Because of their work the iDMAa Journal continues to fulfill its goal to become a forum for the myriad ways that academia is adapting to the disciplines of digital media and art.

The contributors to this issue are experienced scholars, professionals and graduate students. The broad spectrum of gaming is apparent in the variety of areas they cover; but it is their perceptive and insightful views that help to define the current state of research and academic approaches to gaming.

The first section presents six papers that bring to our attention how we should look at gaming—its history, evolution, language and roles of participants re-shaped by interactive environments. Together they focus our attention on achieving a way to shape the meaning of gaming today and how our perceptions of the field may evolve.

Most of the discussion in sections two and three is based in learning and teaching. It is here that we confront the implications that game studies can have on pedagogy and contributes to the changing view of our thinking selves. Several of the authors share their experiences in putting game studies into action. They offer an invaluable glimpse at planning a program, meeting students' expectations with novel curriculum design and developing a research agenda that will realize the potential of games in society.

The iDMAa Journal is grateful to the authors and the guest editors for the opportunity to broaden the audience for their compelling field. The production schedule was extremely tight and the editorial board wishes to acknowledge the generous time and effort Gail Rubini and Katrina Ferguson put toward preparing this issue. Jennifer deWinter and Aaron MacGaffey designed the cover, also under a tight deadline. Together everyone involved contributed to fulfilling the founding mission of iDMAa—to offer a place to exchange ideas and embrace the complex diversity of emerging digital communities. Underlying the vision that motivates our commitment you will notice we all share an infectious level of enthusiasm. Something is happening and we want share it with you. Let us know what you think—your thoughts, comments and participation are always welcome.

Conrad Gleber
Editor

Preface

Ken S. McAllister and Judd Ethan Ruggill

Scholars from disciplines across the academy are discovering what game developers, publishers, and players have known for years: video and computer games are not only fun, but remarkably compelling. They engage players deeply, and facilitate rich (and sometimes even unusual) kinds of human/computer, computer/computer, and human/human interactions. More importantly, games teach. In fact, they always teach—at the simplest level, a player must learn a game's rules in order to play. For a classic title such as *Galaga* (1981), these rules might only involve a few play logics (e.g., move left, move right, and fire). Contemporary titles, by contrast, often demand that players learn dozens (sometimes even hundreds) of play logics, and ultimately synthesize those logics into elaborate resource management and interpersonal skills including high-level multi-tasking, complex hand/eye movements, and even learning the principles of textile manufacturing, cartography, and metallurgy (e.g., *A Tale in the Desert II* [2004]).

Video and computer games teach more than just rules, however. They ask players to learn new languages and styles of information processing and communication. As sociologist Johan Huizinga notes:

> The great archetypal activities of human society are all permeated with play from the start…law and order, commerce and profit, craft and art, poetry, wisdom and science. All are rooted in the primaeval soil of play. (4-5)

Because play is at the heart of all games (whether they are fun or not), games embody the most fundamental ways human beings interact with each other and the world around them. It is no wonder, then, that scholars throughout the humanities, arts, and sciences are starting to attend more closely to the compelling world of video and computer games.

This issue of the *International Digital Media and Arts Association Journal* marks the first in a series of special issues devoted to the burgeoning field of video and computer game studies. Though still inchoate, the field is startlingly broad, making comprehensive analysis difficult. As a result, each of the issues in this series will function as a snapshot, encompassing only a small portion of the game studies vista. The idea is that over time, these snapshots will together form an historical panorama of sorts. Our hope is that this panorama will provide the next generation of computer game scholars with a genealogy of the discipline. Tomorrow's scholars will be able to look back and see not only which ideas today's scholars considered important, but also which ideas enjoyed continuous investigation, which were anomalous, and which (by their very absence) were not considered important at all.

The contributors to this issue are as diverse as the field of game studies itself, and their interests range from the study to the teaching with to the building of games. In keeping with this diversity, we have left the essays relatively unadulterated. Part of capturing a snapshot of a field is capturing the various languages, styles, and theoretical orientations at play in its formation. Thus, this issue contains work by and in the patois of lexicographers, computer scientists, university administrators, game developers, and others. Readers will also find represented in the following pages work by scholars spread across the career continuum, from graduate students to full professors. This range, too, is important to apprehend because it illustrates many of the ways that the medium of the computer game—a medium that itself has experienced a dramatic demographic expansion over the past three decades—is approached by different generations of scholars. We hope you enjoy this first snapshot, and see in it ways you might initiate your own game studies.

Works Cited

Huizinga, Johan. *Homo Ludens: A Study of the Play Element in Culture*. Boston: Beacon, 1955.

Game Studies: What is it Good For?

Espen Aarseth
IT University of Copenhagen and University of Oslo

Computer games (game software) have been around at least since A. S. Douglas programmed a tic-tac-toe game for his doctoral dissertation in Computer Human Interaction at Cambridge in 1952. And after more than two decades of sporadic academic writing focused on computer games, some sort of field seems to be forming, championed by international efforts such as the Digital Games Research Association. But what field? And for what purpose? There have been games for eons, as long as there have been mammals, possibly longer, so why start a new discipline or field at this point? Who needs it?

To answer these questions, we must first consider the many empirical roles games play in research, as well as in cultures and societies. Where are games already studied, and why? What games? There are already several academic traditions of game study:

- Game theory, a branch of mathematics and economics that is really not about (entertainment) games at all, but competitive situations in general;
- Play research, a tradition focused on understanding children's play;
- Gaming and Simulation, an experimental field that explores and crates games for learning and training purposes;
- Ludomania research, the clinical treatment of gambling addicts;
- Board game studies, the historical study of board games and their evolution;
- Philosophy of Sport, the philosophical investigation of physical sports, often associated with university athletics programs.

And since 2001, computer game studies:

- Game ontology (ludology);
- Game criticism & history;
- Serious games (learning games, persuasive games, advergaming);
- Game sociology, economics, and ethnography;
- Game design theory;
- Game computer science (AI, visualization, content management, etc.).

Among these six top fields, computer game studies seems the most varied and interdisciplinary. The six sectors of computer game studies could easily be expanded to more sub-fields, such as the study of game markets and marketing, the study of game production, the study of online game management, the study of cybersports, and transmedia game migrations.

Given this fragmented and tentative picture, it seems both very difficult and very pretentious to use the term "game studies" in a focused, inclusive, and productive way. How can there be one field of game studies? What impudence!

Indeed, with such a wealth of diverse disciplines involved, how can there be a center, or consensus? Will computer scientists working on game design ever want to talk to cultural critics who are examining the ideological significance of game iconography? Are we naïve to think that there will ever be bridges among the technological, aesthetic, and ethnographic game research traditions? And if a common ground can be reached, will it prove productive and useful, or simply too much trouble? Why not leave well enough alone, and let researches go on, peacefully, in their respective labs, centers, groups, and departments? The gargantuan effort required to make unaligned disciplines work together in a world where even academic units such as English departments are divided between linguists and literary scholars who rarely talk to each other (let alone cooperate in their research) might seem unrealistic and a big waste of time.

And yet, there seems considerable potential benefit from a successful merger between computer game research disciplines. The main reason is games themselves, which are clearly interdisciplinary in their genesis. A computer game is the complex result of technological, aesthetic, and user-oriented knowledge and applied research. If game developers have to master these three very diverse fields in order to produce successful games, how can a theorist of games hope to be successful without a similarly interdisciplinary approach? Games are research objects that call out for interdisciplinarity, but this trinity of approaches can only come to pass after considerable intradisciplinary maturation and diplomacy. Working together takes mutual trust and respect, and these are not automatically present at the outset, even if there may be good will and a willingness to listen.

More than anything else, cooperation among humanists, social scientists, and technologists demands common goals. But what would these be? Traditionally, humanists focus on individual artistic achievement, while social scientists focus on collective patterns, and technologists on producing more efficient and advanced machinery. When looking at a complex, "massively" multiplayer game such as *World of Warcraft* (2004), a humanist might see a vast depiction of a rich fantasy world, while a social scientist might see a "third place" for structured social interaction. A computer scientist would likely see software components such as 3D renderers, network protocols, back-end database scripts, and non-player character AI—all intricately working together against the strains of multiple user inputs. None of these three scholars would see the same things, and therefore might not have anything relevant to say to each other.

Inevitably, the only powerful nexus among these diverse approaches then becomes *design*. Humanists, technologists, and social scientists come together through a common interest in outstanding design. Game design will have to unite the insights from social science, technology, and art, and so becomes the overruling discipline whereby all the other approaches are measured. The value of technology, social theory, and aesthetics can be measured through the lens of design, because it is closest to the practice itself. However, this is problematical for a number or reasons.

For one thing, design theory is quite underdeveloped compared to the other traditions. There is a clear danger that commercial success and sales numbers will dominate the discourse, to the detriment of scholarly values and strength of argument. In the production world, the value system is based on practical achievement. You are only as good as your last product. "Show me the money!" trumps theoretical insight every time. While this regime is rational in the production studios, it does not work well in the academic world. Also, academic design will never compete with commercial design, simply because the material conditions (budget, talent, etc.) are so unequal. At best, university research labs can hope to become subcontracting deliverers of specialized components, such as a rendering optimization here and a pathfinding algorithm there.

Even so, from the industrial point of view, the academic world's best value for the industry lies in our ability to train workers, so that industry won't have to. It is extremely expensive to run a competitive business with no prior educational options for your specialist staff—ultimately, you have to educate them yourself, sometimes from scratch, while they are busy working on your cutting-edge project. This is risky, inefficient, and frustrating for all involved. A game study school that can teach the craft of game-making and filter the best students from the rest, means money saved and more projects delivered for game companies.

But do we need game studies for that? What is wrong with art schools, computer science schools, and the odd creative writing school? Again, the key is interdisciplinarity; the game industry is based on teamwork, and workers must be able to communicate ideas across disciplinary boundaries and traditions. A game study school that accepts students with different talents and backgrounds and lets them work in teams will have lifted a great burden from the industry.

The industry might even benefit in other ways, too. Today, the stark contrast between the innovative and the conservative aspects of games are glaring. Games have vastly improved artwork and graphics, immensely impressive physical simulation engines, and highly efficient back-end server solutions capable of handling thousands of concurrent users. At the same time, gameplay structures are the same as two decades ago. While the rubber is superior and the spokes definitively more shiny, the shape of the wheel is basically unchanged. *Take Half-Life 2* (2004), for example: it is a graphically and technically superb game, yet sports the same linear corridors as Warren Robinett's graphical *Adventure* game from 1978. *World of Warcraft* (2004) is little more than a graphical version of Richard Bartle and Roy Trubshaw's text-based *Multi-User Dungeon* from 1979-80.

While the technical and graphical development of the last two decades is nothing short of astounding, gameplay design seems locked into a certain number of simple variants: the linear adventure exploration game; the *Dungeons and Dragons*-inspired role-playing game; the chess-like, real-time, or turn-based strategy games; and the multiplayer action-shoot'em ups, originally found in Steve Russell et.al.'s *SpaceWar!* (1961-2).

The holy grail of large parts of the game industry, including many prominent game designers, is to combine gameplay and storytelling, and make games that give the player the feeling of being the main character in a story: "a game that has the drama of theater and the narrative complexity and emotional impact of a novel, but still has all the things a game gives you: making your own path, never being the same game twice" (Barker). This dream has surfaced many times in the history of computer games, often with marketing claims of this or that "game's revolutionary approach to storytelling" (Gettys). Unfortunately, these efforts all fall miserably short of the hype, for one reason or another. Usually, to work as a believable "interactive story," a game has to contain characters that will respond intelligently to the player's input, and this requires a level of artificial intelligence that does not yet exist. Hence, the stories that can indeed be "told" by games are limited to simple labyrinth tales, where the hero must conquer a hostile landscape and non-speaking animalistic enemies. Bring in a few non-hostile characters, and the differences from novels and plays become striking and embarrassing. The belief that games will behave as novels and plays without believable human characters seems singularly naïve, and yet it continues to dominate the game industry and new generations of game designers. While skeptical humanists trained in narratology and the history of games might not come up with a constructive alternative solution, they may still help game developers realize the nature of the literary/dramatic arts and their limits when transformed into a dynamic media format.

So, instead of merely becoming a source of useful workers, game studies could serve as an archive of game concepts and designs, and a place for critical feedback. Game studies might also be the place where students could be allowed to experiment and think "outside the box" at no extra cost to the industry.

More important than helping the industry, of course, would be game studies' responsibility to the public itself. For years, computer games have been vilified as low culture trash—a waste of time at best, and a source of criminal and sociopathic behavior at worst. Young game players have felt the unjustified disdain of their elders, and while there are good and bad games, there are just as many good and bad books. The culturally unopposed, dominant idea that all games are bad places an unhealthy burden on the young mind. The joys of gameplay should be recognized as legitimate, on par with sports, reading novels or watching movies. However, such recognition takes a culturally informed public, trained in the critical assessment of game quality by game scholars and academically-educated game critics.

A third way game studies could prove itself useful is by providing non-commercial game developers free alternatives to today's expensive middleware solutions. The cost of game-making tools makes professional game design unreachable for small developers with limited funding and programming talent. A free game development toolset and open source game platform developed collectively by academic game researchers and game studies departments would provide artists, educators, researchers, and hobbyists with the possibility of making high-quality games and game-based applications for markets and audiences that the mainstream game industry is unable to reach. Such games would most likely not compete with the big productions for revenues or popularity, but they would empower the public and unleash creative forces that are sorely needed, especially in an age when games have been changed from the free activities of pre-computer days to subscriber-based services or shrink-wrapped products.

Game studies has a tough balancing act coming up. On the one hand it must work out a useful relationship with a hyper-commercial industry, without sacrificing the independent status and credibility of academic research. On the other hand, it must negotiate the disciplinary differences and divergent goals of the academy. How can everyone be happy with the end result? Will some groups feel excluded? Probably, but the alternative, that game studies remains fragmented over a large number of non-communicating disciplines, seems far less productive. A critical branch that does not speak with the creative branch, or does not even speak the same language, would simply be a wasted opportunity. Film studies, rightly or wrongly, has many times been singled out as the chief example of such a non-speaking non-relationship. However, if we instead look to drama and theatre studies, or to literary studies, we find a rich tradition of communication, cooperation, training, influence, and mutual benefit between academy and industry, the critical and the creative. This tradition shows that it is indeed possible, and also desirable, to play together.

Works Cited

Barker, Clive. “Clive Barker Interview.” GameSpy (December 2000). 19 Feb. 2005. <http://archive.gamespy.com/interviews/december00/clive/index2.htm>.

Gettys, Jim W. “Choose Your Own Destiny.” Xbox.com. 19 Feb. 2005. <http://www.xbox.com/en-us/fable/spotlight.htm>.

The Two Faces of Reality

Chris Crawford

One of the ideas that dominates my thinking about game design is the distinction between two completely different kinds of thinking. There is a dichotomy fundamental to our universe and our thinking. It takes many forms and has been described with different terms in different fields of endeavor. In linguistics, we call it "noun versus verb"—the two fundamental components of language. The noun is the static, the item of existence, the entity, while the verb is the action, the process, the dynamic.

Economists refer to the same idea as "goods versus services." Physicists know it by "particle versus wave." Theorists of military science talk about "assets versus operations." Computer scientists think in terms of "data versus processing," or "bytes versus machine cycles." On the Internet, it's "storage versus bandwidth."

There is nothing fundamentally superior about one view or the other, but in some situations one of these two styles of thinking enjoys higher utility. It's a lot easier to think of a person as a noun, a thing, an object, than as a "human being"—an "act of existence of the human kind." It's also easier to think of a computer program as a set of verbs (instructions) than as a collection of numbers that represent those actions.

But sometimes the two ideas mix maddeningly. Physicists have this problem with photons (particles of light). Is a photon a particle or is it a wave? It surely behaves like a particle when it knocks an electron loose from an atom, but it also acts like a wave when it diffracts through a slit. Which is it?

Or consider the profound conundrum that assaults every economist at a hamburger joint: is the hamburger he purchases a good or a service? Is he purchasing beef on a bun or the service of cooking the beef and delivering it fresh to him? You could lose your dinner over this vexing problem.

The significance of all this becomes clear when we consider the nature of interactivity. One of the fundamental characteristics of interactivity is choice. Without choice, there can certainly be no interactivity. But what is the nature of choice? We often think of choice in terms of a menu: should I have the smoked salmon, the medallions of lamb, or the Double Cheese Monster Burger? When we think of it this way, it seems that choice is a list of nouns. But that's not truly the nature of our choice: the true choice is between *buying* the smoked salmon, *buying* the medallions of lamb, or *buying* the Double Cheese Monster Burger. Choice is a selection among actions, not a selection among things.

Thus, every interactive process provides the player or user with a set of verbs from which to choose. Do I press the "m" key or the "r" key while I'm using my word processing document? When I'm browsing the web, do I want to take this link or take that link? When I'm playing a game, do I shoot the monster or duck for cover? Do I run away or blast away? It's verbs that lie at the heart of everything that we do with computers. We can turn this around and use verbs to characterize any game or, for that matter, any piece of software. If you examine a game and write down all the verbs available to the player, then give that list of verbs to me, I can tell you exactly what that game is about just from the list of verbs. Thus, the verb list provides us with an architectural skeleton for games. Boil a bunch of games down to their verb lists and you have an excellent way of organizing them into a taxonomy. Just as biological taxonomists learned to ignore prominent but uncharacterizing features of various animals, concentrating instead on fundamental structural details such as the shape of the pelvis, so too must scholars of game design concentrate on the properties that matter: the verbs. Ignore such extrinsic details as graphics, sound effects, animation, and so forth; strip away the showy fur, feathers, and skin and look at the skeleton of the game. Thus will you obtain a clearer view of the reality of the game.

Another useful exercise is to consider the size of the vocabulary of the game (or software product). The old Atari 2600 games had five basic verbs: "go left," "go right," "go up," "go down," and "fire." Modern games have expanded on this core repertoire, but they still retain a tight verb set. This is usually accomplished by conflating verbs. One does not bother to "pick up" an object lying on the floor; the mere act of moving over that object suffices to pick it up. One does not explicitly open a door; the simple act of moving into it accomplishes the job. In many shooters, one controls the direction of motion, the line of sight, and the line of fire with just two basic verbs: "turn left" and "turn right."

We must be careful to differentiate between verbs and direct objects in such censuses. A single verb that allows us to select a typeface in a word processor may offer one hundred different typefaces, but that does not constitute one hundred different verbs; it is one verb with one hundred direct objects.

A characterization of software products by vocabulary size can illuminate a great many questions. The cleanest, simplest, easiest to learn games always have fewer than ten verbs. Typical games these days have between ten and twenty verbs. Big games, especially strategy games and flight simulators, offer several dozen verbs, and a few monsters tip the scales at a hundred verbs. And full-scale application elephants such as *Microsoft Word* shake the earth with their lumbering collections of several hundred verbs, only a few of which most people ever learn.

It is also instructive to examine the history of vocabulary sizes. The general trend is simple: a game genre starts off with a small vocabulary, which slowly grows as competitors attempt to one-up each other. As the vocabulary expands, new buyers are discouraged and sales fall. Then somebody comes up with a leap forward that permits them to fall back to a smaller vocabulary. Sales soar, a star is born, and then the copycats differentiate themselves by adding new verbs to the basic vocabulary.

Another interesting line of research is to examine vocabulary sizes by genre. In general, shooters and fast action games will have the smaller vocabularies, while strategy games and flight simulators will have the larger vocabularies. A careful examination of these trends can reveal much about the nature of the games.

The distribution of verb usage also provides some interesting insights into the nature of software. Clearly, some verbs will be used more frequently than other verbs—what are the ratios of usage between the most frequently used verbs and the least often used verbs? If an uncommon verb is used, say, 1,000 times less frequently than the most-used verb, does that suggest that the rarely-used verb is superfluous? Should not the best games maintain a fairly even distribution of the usage of verbs, so that every verb that the player takes the trouble to learn provides the same amount of actual gameplay? Conversely,would a game heavy with seldom-used verbs prove too onerous for most players?

Conclusion: to see the true nature of any piece of software, ask, "What does the user DO? What are the verbs?"

Real-Time Performance: Machinima and Game Studies

Henry Lowood, Stanford University

Introduction

In computer and video games, the player resides at the interface of viewer and actor. This position makes possible the player's creative participation in these interactive media, a contribution that cannot be described in terms of the traditional roles of creator or consumer. The player is more than a consumer of what game developers and designers have created, and more than a reader or viewer. A game designer "creates a *context* to be encountered by a *participant*, from which *meaning* emerges" (Salen and Zimmerman 41). In the last decade or so, game players have used computer games as platforms for creating their own games, narratives, texts, and performances. They have reshaped the context of computer play, not simply by creating personal artifacts equivalent to a home movie, doodle, or diary, but by fully exploiting games as a new medium for performance and artistic expression. These efforts on occasion have challenged storytelling technologies such as frame-based animation, and have entered the mainstream through music videos, web-based serial programming, and other popular formats. The performer has pushed forward into the spotlight of game culture.

So, how might game studies reveal players as performers? Learning more about the meanings players attach to play gestures, studying high-level competitive play, understanding what it means to watch others as they play, examining more closely the significance of replays and game movies in game culture, describing the formation of player identities, documenting in-game social dynamics, and tracing the networked virtual communities that thrive around computer games are but a few of many topics that might contribute to better understanding of game performance. This article presents a few ideas about players' active participation in game culture through one mode of visible public performance: machinima and related game movies.

Game-Based Filmmaking and New Game Cultures

Machinima is the making of animated movies in real time through the use of computer game technology. More elaborately, Paul Marino has defined machinima as visual narratives "created by recording events and performances (filmmaking) with artistically created characters moved over time (animation) within an adjustable virtual environment (3D game technology platform or engine)" (3). The word "machinima" (initially, "machinema") was derived from "machine cinema" ("Machinima"). A more apt derivation might be "machine animation" or "machinimation."[1] Whether we think of machinima as cinema or animation, it means making animated movies in real-time with the software that is used to develop and play computer games. Game developers produce software called "game engines" to manage sophisticated real-time graphics, physics, lighting, camera views, and other facets of their games. Games such as first-person shooters immerse the player in the rapid action of gameplay by drawing and re-drawing the virtual environment as a 3-dimensional space on the screen from the player's point of view. They do this in real time and at high frame-rates as the player "moves" through that space. Early on, machinima-makers learned how to re-deploy this sophisticated software for making movies, relying on their mastery of the games and the software. Beginning as players, they found that they could transform themselves into actors, directors, and even "cameras" to make these animated movies inexpensively on the same personal computers used to frag monsters and friends in *Quake* (1996) and other games. They recorded their actions, generally in real time, as replay files.[2] The next step was learning how to decompile, edit, and recompile these files to change the camera view (known as "recamming") and edit sequences of gameplay. The finished movies could then be distributed inexpensively via the Internet, either as files that required the game to view them or in encoded media formats such as those with .avi and .mov extensions.

Since the mid-1990s, machinima and other kinds of game movies (speedruns, demo movies, gameplay captures) have produced some of the most creative expressions of player culture. Early machinima projects such as The Rangers' *Diary of a Camper* or Clan Undead's *Operation Bayshield* launched this "convergence of filmmaking, animation and game development" (Dellario).[3] The story of machinima's subsequent development, which I have told in greater detail elsewhere, reveals much about the impact of improvements in computer graphics and game technology generally on game-based performance.[4] However, the history of machinima is more than a lesson about the rise of real-time animation techniques. Like the cell phone camera or music remixing, machinima shows how the dissemination of accessible tools—even if they are not necessarily easy-to-use—gives rise to the emergence of unexpected content in a postmodern environment that values playful experiments and throwaway pieces alongside more traditionally startling and original forms of creative expression.[5]

The availability of technology for producing 3-D animation in real time or for capturing, storing, manipulating, and distributing movies of in-game performance is not a sufficient explanation for the advent of machinima. For a more complete picture, it is necessary to attend to the social nature of game performance. Machinima movies depend on the interest game players have in watching other players. Machinima is created within and for virtual communities of enthusiasts devoted to multiplayer and competitive games. A technical and social infrastructure built around computers, the Internet, and computer games—in fact, the same infrastructure that supports networked multiplayer gaming—accounts for the distribution of these movies. The "participatory" culture of game development, with its blurring of the line between producer and consumer of popular media,[6] has grown out of this strong linkage of game technology and virtual communities.

The Player as Performer

Machinima as "high-performance play" emerged from the interrelationships of gameplay, technical virtuosity, and storytelling (Lowood). Each of these factors has played a role in defining machinima through new practices of computer game performance. Released in December 1993, id Software's *Doom* established competitive multiplayer gaming as the leading-edge genre of PC games, followed in 1996 by *Quake*. Just as important as improvements in graphics and networking technology, *Doom* revised notions of authorship by allowing for game modifications, third-party level design, and the creation of independently-developed software tools. The resulting variability of content and participation by players in the creation of new content is precisely what Lev

Manovich has called the new "cultural economy" of game design. The first-person shooter has since become the genre of choice for extensive "modding" of game content; beginning with *Doom*'s successor, *Quake,* it has also been the game genre upon which most machinima projects are based. Manovich contrasts modifiable games to the more customarily authored game such as *Myst* (1994)*,* which he describes as "more similar to a traditional artwork than to a piece of software: something to behold and admire, rather than take apart and modify." This contrast partly explains why narrative-driven game genres, such as adventure games and role-playing games, have been less popular in the machinima community than first-person shooters.

id Software's focus on games built for competitive play and the opening up of access to technology and tools for modifying content fostered the creation of active communities of players and coders. id openly encouraged the creation of clans as "organized bands of warriors," bands that "signal[ed] the next stage in online gaming."[7] Such clans, organized for competitive play, produced most of the pathfinding *Quake* movies and machinima projects. These included the Rangers' *Diary of a Camper* and Clan Undead's *Operation Bayshield*, as well as later projects such as the machinima of Clan Phantasm or the masterful Ill Clan. Of course, the community of clans and players also provided an audience for the new medium. Performers crave spectators, and the existence of communities engaged at every level of their work—clans of players, teams of movie-makers, or virtual networks of programmers and tool builders—cannot be underestimated as a factor in high-performance play.

Technology

Quake, as software, was more complex than *Doom*, but knowledgeable players found it more accessible "under the hood" for modifications or the programming of editing tools. Id supported the creation of a Usenet discussion group devoted to *Quake* editing, disseminated some *Quake* source code to encourage level editing and modding, and provided a scripting language, QuakeC, which would prove particularly useful to machinima-makers. A community of coders and modders formed around the sharing of information about *Quake* editing. Some specialized in the development of tools specifically for the analysis and modification of demo movies and replays.[8] As Douglas Thomas has noted in his study of hacker culture, programming feats alone do not a hacker make. Hackers emerged into public view by affiliating with other elite programmers, sharing information and refining skills in groups such as the infamous Legion of *Doom* and Masters of Deception. Sharing information and text files served "to solidify [these] hackers' reputations, illustrating the degree to which they understood the systems they infiltrated" (Thomas 90) The *Quake* player operated in a different technical realm, yet s/he also sought recognition through community-based "performance of technology" (47-52). Immediately after *Quake*'s release, players formed affiliations in response to the vast improvement of multiplayer connectivity and chat options over *Doom*. Like hacker gangs dissecting the intricacies of computer networks, these *Quake* Clans shared techniques of high-performance gaming, both playing *and* programming. The Ranger Clan provides a telling example. Arguably the most famous clan of all, the Rangers' top-notch players contributed visibly to the community that formed around the game. They participated in the first pre-release test of the *Quake* engine distributed to the *Quake* community. One member designed the original Capture the Flag mod; another founded one of the major sources of information about *Quake* development, Blue's News; in all, about half of the 25 members or so remained active in game development or went on to work in the game industry (cf. Hancock). With their reputation for stellar performance as players and programmers firmly established, they impressed the *Quake* community in October 1996—barely a month after the commercial release of the game—with an exploit of another sort: the first machinima movie, *Diary of a Camper*.

Gameplay

Machinima is not just a performance of technological skill, nor is the spectator only interested in watching a story unfold. As important as these two aspects of performance are, machinima is also about skilled exploits of gameplay. Players have competed publicly since the early days of computer games.[9] The introduction of *Doom*'s new modes (deathmatch, for example) *and* technologies of networked play intensified multiplayer competition. *Doom* also provided means and motive for recording game movies. The game's unprecedented success as a platform for competitive play heightened interest in the feats of stellar players, especially as word got out about their prowess in the growing player community. Players took full advantage of the ability to record "demo movies." As the name implies, these movies demonstrated skills by documenting actual matches recorded as replay files. These demos were distributed and replayed by other players with a copy of the game, who watched often to observe the masters and thus improve their own skills. Demonstrations of skill by admired players such as NoSkill, XoLeRaS, and Smight circulated widely. As BahdKo, a veteran of the *Doom* demo scene points out, "[u]se of demos for their educational value has been going on since almost the beginning" (Hermann). When individuals and regular teams of players joined together in clans, it was a way for them to establish collective reputations based on superior play. Demo movies put their exploits on display. After *Doom*, intense multiplayer competition, documentation of gameplay through demo movies, and watching others play were inextricably linked. Spectatorship and the desire to share skills were the cornerstones of the creation of a player community eager to create and distribute gameplay movies. The result was nothing less than the metamorphosis of the player into a performer.

Like the hackers' exploits, making movies with game software required a mixture of expertise and subversion. The subversive aspect, what Katie Salen has called "transformative play," is particularly important for machinima as playful performance. Salen insists that designers cannot fully anticipate "how the rules will play out" as players go beyond the formal structure of a game design.[10] Machinima can in part be understood as a replacement of one game structure with another, as the "free movement of play" alters the game from playing to win to playing to make a movie. The Rangers give us one example in their transformation of competitive play into the minimal theatrical play of *Diary of a Camper*; the simple storyline emphasizes the shift by including specific references to gameplay (the Camper, the headshot) that define the narrative.

Historically, another example of transformative, high-performance play that set the stage for machinima was the transformation of *Doom* and *Quake* into speedrunning—completing a game or game level as quickly as possible and documenting record runs via replay movies. This is neither deathmatch competition nor gladiatorial combat like Rocket Arena; rather, it is a single-player show that combines virtual gymnastics, game engine analysis, trickery, expert gameplay, and demo movie chops. In the words of one of the leaders of the "*Quake* done Quick" team, “speed-running offers another way to compete at *Quake*” (Bailey). Speedrun projects, particularly those executed by the *Quake* done Quick team, played an important role in the development of recamming techniques, that is, transforming the first-person view of the game into a floating third-person camera in order to make speedruns more viewable. These projects were thus particularly fruitful as dual performances of programming and transformative play.

Playing the Performer

The third important aspect of high-performance play is ironically the easiest and the most difficult to describe. It is perhaps the aspect that is most commonly associated with “performance,” that is, putting on a show for an audience. It is the movement from the arena of agonistic play to performing as if onstage or on the film screen, from “play is the thing” to “the play is the thing.” And yet, it will hardly do to describe performance as an aspect of play as performance. Machinima as multifaceted high-performance play (technology, gameplay, art/theater) meets the challenge to performance studies issued by performance theorist Jon McKenzie, “one that links the performances of artists and activists with those of workers and executives, as well as computers and missile systems” (*Perform or Else*). According to McKenzie, performance became the paradigm for the late 20th-century by entangling a multitude of domains in its net: cultural and artistic performance, organizational or financial performance, engineering performance, and sports performance. His own analysis of “hacker trading” in the PairGain hoax (1999) provides a striking example of the close linkage between the technical performance of coding or hacking, the “nomadic power of performance” within computer networks, and the creation of a performance “hoax” based in interactive media (“!nt3rh4ckt!v!ty”). Game-based moviemaking similarly has woven technology, virtual communities, play, and public performance together.

Richard Schechner, in his magisterial introduction to performance studies, segments the performance process into a series of steps, a “time-space sequence.” These steps are collected at the intuitive levels of “proto-performance” (training, rehearsal, etc.), “performance” (warm-up through public performance and related events) and “aftermath” (criticism, archives, memories). This model pertains to live performances (theater, sports, rituals, social interactions), though it can also be applied to recorded media of performance, such as film, by dividing pre-production, production, and post-production activities. Indeed, machinima-makers often think of their projects in these movie-making terms (e.g., Marino’s *3D Game-Based Filmmaking*). It is instructive to consider the relationship between gameplay and machinima in terms of Schechner’s performance process. Demonstration of play skills, and certainly the manipulation of game technology, would appear to be part of the proto-performance of the workshop and rehearsal, but there is an important difference. Schechner argues that “proto-p” is a “pretext” to performance, something hidden from the audience. This privacy of preparation is more than a strategy for hiding craft knowledge, because it also heightens the impact of performance by leaving the impression of hidden powers (Schechner 191-92). Technology and gameplay in machinima and other game movies, far from holding up in a private reserve of proto-p, instead are displayed openly. They are an integral part of the “p” of game-based performance. The player is the performer for a networked community of on-line gamers and meets McKenzie’s challenge to *Performance Studies* by openly engaging in multiple aspects of high-performance play. Machinima is only one form of game-based performance, but its significance for game studies lies in showing how game players can open up the performance process to technology and play.

Summing Up

The importance of machinima for game studies is that it exemplifies the three-fold, interlocking nature of high-performance play: as performance of technical exploits, as performance of game skills, and as public performance for an audience. Each of these aspects is intimately connected with the creation of on-line communities around competitive play, the remediation of familiar narrative media (film, music videos, animation) in gameplay, the appeal of extroverted play[11]—playing for others to see—in virtual spaces, and many other topics that game research will encounter as it focuses more intensively on the unlimited creativity of players.

The history of machinima illustrates a number of themes in the appropriation of game technology to create a new narrative, even artistic medium. I would identify these as technologies of modification, subversion, and community-developed content. id Software's decision to embrace and extend the player community's role in creating new *Doom* levels set the stage for the unprecedented degree to which it opened up access to the game engine inside *Quake*. Not only did providing an editor and scripting language stimulate modification and extension of the game, it encouraged the development of tools for unforeseen purposes, such as the editing of demo movies and, eventually, the making of animated movies using real-time techniques of gameplay as performance. While these modifications were sanctioned by id, they were also subversive. Salen's notion of transformative play applies to the underlying technology of computer games as well as to game design. Technology became a field of play, but not just in order to play the game of optimizing game performance; less than a year after *Quake*'s release, game software was used—playfully—as a technology for making movies. As speedrunning became a new game form within the structure of play provided by *Quake,* machinima-makers subverted the game system altogether, turning it into a performance technology. Machinima meant narrative or experimental movie-making, not competition. Just as important, machinima benefited from the strong social network spawned by multiplayer gaming. Knowledge of the capabilities built into *Quake* and access to independently-developed tools disseminated rapidly in the virtual community of *Quake* players. The clans and project members deploying this knowledge added to it in every one of the early machinima projects, in turn publicizing a body of work that consisted of movies, software tools, and techniques. Exploits of high-performance gameplay, programming, and storytelling were not isolated achievements or acts of creativity; performers crave spectators, and the existence of a gaming community engaged at every level of their work—clans of players, teams of movie-makers, or virtual networks of programmers and tool builders—cannot be underestimated as a factor in high-performance play. When a computer game is released today, it is as much a set of design tools as a finished game design. PC game developers routinely release their development tools for experimentation and play, that is, they encourage gamers to play with technology, animation, stories, graphics and movies just as much as they encourage play with the games themselves. Developers are putting impressive editing and cinematic tools in the hands of the player community, encouraging everything from the creation of new game levels to surprising forays into artistic and performative experimentation such as machinima. Yet, players and their communities still find ways to play that the developers never suspected were possible.

Endnotes

1 “Machinimation” is, in fact, the name of Fountainhead Software’s machinima software tool.

2 More recently, game movies have often been made from screen capture, rather than replay files, especially machinima based on console games (*Red vs. Blue*) and massively-multiplayer games (Tristan Pope).

3 Dellario is Ill Bixby of the machinima team known as the Ill Clan.

4 On the history of machinima, see Lowood. An outgrowth of this investigation of machinima’s history is the newly launched Machinima Archive, hosted by the Internet Archive, which can found at http://www.archive.org/movies/collection.php?collection=machinima.

5 I am indebted for this line of thinking to Galen Davis of the Stanford How They Got Game Project. On camera phones and the emergence of new content, see Okabe and Ito, as well as Justin Hall’s work on weblogging and camera phones in *The Feature*.

6 Cf. Jenkins and Sotamaa.

7 See the Internet Archive’s capture of id Software’s website <http://www.idsoftware.com>, dated of Dec. 20, 1996 at <http://web.archive.org/web/19961220085757/www.idsoftware.com/clans/index.html>.

8 Uwe Girlich, author of LMPC (Little Movie Processing Centre), and Anthony Bailey, author of the Remaic (“remake”) recamming program, were among the most well-known.

9 On the Spacewar! Olympics of the early 1970s, see Steward Brand.

10 To learn more about transformative or emergent play, see Salen and Zimmerman’s “Games as Open Culture,” in Salen and Zimmerman, *Rules of Play*: 537-53.

11 I am indebted to Jane McGonigal for the notion of “extroverted play.

Works Cited

Bailey, Anthony. “Zigzagging through a Strange Universe.” 12 Oct. 1997. Planet Quake. 19 Feb. 2005 <http://www.planetquake.com/qdq/zigzag>.

Brand, Steward. “SPACEWAR: Fanatic Life and Symbolic Death Among the Computer Bums.” *Rolling Stone* (7 December 1972).

Dellario, Frank. “What is Machinima?” Academy of Machinima Arts and Sciences. 19 Feb. 2005 <http://www.machinima.org>.

Hall, Justin. “Rehearsing the Future: First International Moblogging Conference Report.” 8 July 2003. *The Feature*. 19 Feb. 2005 <http://www.thefeature.com/article?articleid=24815&>.

Hancock, Hugh. “Ranger Gone AWOL.” 01 Jan. 2000. machinima.com. 19 Feb. 2005 <http://machinima.com/article.php?article=336>.

Hermann, Laura “BahdKo.” “*Doom* Demo Movies.” Email to the author. 28 Jan. 2004.

Lowood, Henry. “High-Performance Play: The Making of Machinima.” Forthcoming in *Videogames and Art: Intersections and Interactions*.,

Andy Clarke and Grethe Mitchell, eds. London: Intellect Books, 2005.
Jenkins, Henry. “Interactive Audiences? The ‘Collective Intelligence’ of Media Fans.” 19 Feb. 2005 <http://web.mit.edu/21fms/www/facutly/henry3/collective%20intelligence.html>.
“Machinima.” *The Word Spy*. 9 Aug. 2002. 19 Feb. 2005 <http://www.wordspy.com/words/machinima.asp>.
Manovich, Lev. “Navigable Space.” *The Language of New Media*. Cambridge: MIT Press, 2001: 244-53.
Marino, Paul. *3D Game-Based Filmmaking: The Art of Machinima*. Scottsdale, AZ: Paraglyph, 2004.
McKenzie, Jon. “!nt3rh4ckt!v!ty.” *Style* 33 (Summer 1999): 283-99.
——. *Perform or Else: From Discipline to Performance*. London and New York: Routledge, 2001.
Okabe, Daisuke and Mizuko Ito. “Camera Phones Changing the Definition of Picture-Worthy.” 29 Aug. 2003. *Japan Media Review*. 19 Feb. 2005 <http://www.ojr.org/japan/wireless/1062208524.php>.
Salen, Katie. “Quake! DOOM! Sims! Transforming Play: Family Albums and Monster Movies.” Exhibit. 19 October 2002. Walker Art Center (Minneapolis, MN). 19 Feb. 2005 <http://www.walkerart.org/gallery9/qds>.
Salen, Katie and Eric Zimmerman. *Rules of Play: Game Design Fundamentals*. Cambridge: MIT Press, 2004.
Schechner, Richard. *Performance Studies: An Introduction*. London: Routledge, 2002.
Sotamaa, Olli. “Computer Game Modding, Intermediality and Participatory Culture.” University of Aarhus. Publication date unknown. 19 Feb. 2005 <http://www.imv.au.dk/eng/academic/pdf_files/Sotamaa.pdf>.
Thomas, Douglas. *Hacker Culture*. Minneapolis: University of Minnesota Press, 2002.

Discovering a Lexicon for Video Games: New Research on Structured Vocabularies

Patrick Burkart, Texas A&M University

Introduction—The Value of a Lexicon

In knowledge-based industries, such as media and software, specialized languages have been developed to express technical and artistic concepts. Niche languages exist among groups who film and edit movies, build and compile software code, and package television program streams. Workers in computer software, media, and telecommunications typically learn the language of their work while in school or on the job, and they speak the same language (or dialects of the same language) to new collaborators as they move from project to project, and job to job. Biotechnology, medical publishing, geosciences, geography, and other theory-based academic disciplines and business practices use lexical information to guide practices and procedures (Heichler; Joselyn; Getty).

The situation is somewhat different in the video game industry. Video game software writing is experiencing rapid growth in relation to other media and software industries. Its workgroups include both artists and engineers, and these groups must interact frequently, translating concepts and descriptions from software engineering language to language about game play and animation. More successful translations improve productivity.

As a software-based, innovation-driven industry, the video game sector is driven by tight release schedules and continuing integration with other media markets such as animation, film, and telecommunications. The usefulness of an industry-standard vocabulary, with shared semantics and an agreement about common categories of knowledge, increases with organizational complexity, industry convergence, and the dispersion of practical and theoretical knowledge across organizations and electronic networks. The National Information Standards Organization develops formats and best practices for managing structured vocabularies, including thesauri (NISO).

In the process of sectoral consolidation, in which video game software companies have grown through mergers and acquisitions, many companies have experienced disruptions in markets for labor. Endemic high employee turnover rates incur search and training costs for the entire industry; "integration risks" in mergers and acquisitions also include culture clashes (Osur 32). The very languages spoken in video game shops exhibit a high degree of variance—vocabularies and concepts can correlate, but it takes time to learn the new cant. For example, designers argue about distinctions between concepts related to perspective, such as "3D" and "2.5 D," "tunnel vision" and "peripheral vision," and "person" and "first person camera." They also draw genre-based distinctions between games, such as "real world fantasy" versus "magical realism" and "complete fantasy." Industry executives complain that new employees spend extra time learning the new local language when they arrive, and they have even developed a formal curriculum for video game schools to adopt—to teach concepts consistently, if not a standardized vocabulary (IGDA).

Lexicon building puts the epistemologies of the video game "producer" and "consumer" under special scrutiny. The roles of both are united in a pursuit of improved game play, or playability, but designers must also put themselves in the position of the player while producing software code. While game designers are also players, not all players are designers. Designers write and manipulate the code base from which game play derives, and they produce natural language documents addressing the functionalities and capabilities of their software. Shared, player-and-tester roles exist in game shops and in the so-called “mod” community. Game testers share recommendations for fixes and improvements from the consumer’s perspectives. Members of fan communities collectively modify video games and develop plug-ins, expansion packs, and other integrated software tools for informal distribution through the Internet.

Knowledge management (“KM”) literature can capture organizational dynamics that enable and suppress diffusion of information within complex organizations (Flanagin; Contractor and Monge). The networked architecture of contemporary work environments and information repositories creates opportunities for using technology for capturing and codifying electronic documents, code bases, and other intellectual property circulating in game shops, such that information resources can be easily found and re-used in the firm. KM experts with exposure to software databases and enterprise content management software find complementarities between information sharing through organizational roles and the disseminating functions of information and communications technologies (Goodwin).

Knowledge Management for the Industry Proceeds From a Lexicon

Although librarians and cultural studies researchers have developed subject gateways to virtual libraries about media and art, including Cyberstacks, the Art, Design, Architecture and Media information gateway (“ADAM”), and the Getty Art and Architecture Thesaurus, these resources do not contain robust video game vocabularies (Cyberstacks; ADAM). A knowledge base for video game artists, designers, and other practitioners would benefit from a structured vocabulary because key words linked to unique concepts in the video game shops could be used to label documents consistently and with a high degree of accuracy (Church). Improved accuracy reduces erroneous interpretations and ambiguities of meaning, and in so doing, can promote better understanding and more effective communications within a game shop. The lexicon approach to knowledge management structures is designed to help game developers iteratively design a vocabulary and put it to use for classifying and categorizing documents, objects, and tools. A lexicon can be a heuristic, and lead to innovative solutions to recurring problems that designers experience: “While a lexicon on its own will never suffice as a tool, it is the indispensable complement to any conceptual tool or method” (Kreimeier).

Developing a smart portal or a similar KM system would permit rationalization of firm-level and industry-level production processes. Non-technological practices for articulating, capturing, and sharing knowledge in collaboration still persist, but corporate decision-makers justify information technology and software expenditures based on cost reduction and efficiency, improved accountability, knowledge management and collaboration. KM has become “an integral business function for many organizations as they realize that competitiveness hinges on effective management of intellectual resources” (Grover & Davenport). Leaders in video game development acknowledge that the basis for sharing knowledge is language:

> The primary inhibitor of design evolution is the lack of a common design vocabulary. Most professional disciplines have a fairly evolved language for discussion. Athletes know the language of their sport and of general physical conditioning, engineers know the technical jargon of their field, doctors know Latin names for body parts and how to scribble illegible prescriptions. In contrast, game designers can discuss 'fun' or 'not fun,' but often the analysis stops there. (Church)

For Doug Church, a seasoned professional in video game software design, feels a common vocabulary would enable game designers to improve their abilities to transpose a concept from one project to another, and from one medium to another:

> We should be able to play a side-scrolling shooter on a Game Boy, figure out one cool aspect of it, and apply that idea to the 3D simulation we're-building. Or take a game we'd love if it weren't for one annoying part, understand why that part is annoying, and make sure we don't make a similar mistake in our own games. If we reach this understanding, evolution of design across all genres will accelerate. But understanding requires that designers be able to communicate precisely and effectively with one another. In short, we need a shared language of game design. (Church)

As media conglomerates produce more and more cross-platform media products as part of a single "franchise"—such as the *Spider-Man* movies, video games, and action figures—game designers are called upon more frequently to translate aspects of design and game play from one medium to another, for other designers and for engineers as well.

Discovering and Expressing Agents, Artifacts, Art and Design, Genres, and Tools

Doug Church and developers associated with the International Game Developers Association (IGDA) promoted the idea of "game school" to the Digital Media Collaboratory, a research group at the University of Texas at Austin's IC^2 Institute in 2003. In the midst of the twin dot-com and telecom boom of the 1990s, Austin emerged as an important location where independent game shops opened and grew. In a call for projects, the IGDA group solicited research proposals that would help the industry with its unique knowledge management needs.

The lexicon team, led by this paper's author, proposed a prototype for an industry-standard, structured vocabulary for the video game industry. The vocabulary would function as a thesaurus, providing an easy structure for looking up terms for their definitions, synonyms, and antonyms. The vocabulary would conform to the ISO standard for thesauri (NISO), so that its data structure could be re-used in multiple applications useful for KM. The project is not intended to impose a vocabulary on practitioners in the video game industry, but instead, to discover and present commonly used terms that are labels for concepts shared by the larger community of game producers and developers. Compare art and film schools, on the other hand, which inculcate students in lexicons of art and technology practices specific to their trades, through training and an imposition of language conformity. There is a strong likelihood that multiple vocabularies exist in practice at this time, waiting for discovery. It is possible that these multiple vocabularies will converge and standardize in time, as industry consolidation and bureaucratic rationalization squeeze out heterodoxy, and as competing "schools" learn how to make their vocabularies work with each other, perhaps by devising video game "ontologies," or meta-vocabularies.

The Lexicon project identified XML as the best coding language for expressing hierarchical relationships among concepts, because it could be adapted to express metadata using the Dublin Core ("DC") format. DC is the XML encoding scheme of choice for cyber-librarians. Figure 1 presents the elements of every DC record:

Subject	Contributor	Source
Title	Date	Language
Creator	Type	Relation
Description	Format	Coverage
Publisher	Identifier	Rights

Figure 1: Dublin Core Metadata Elements
Source: ISO

Creating entries for each of these data fields requires identifying keywords and concepts from academic scholarship, video game design journals, and personal interviews with game developers.

Under the "subject" and "relation" nodes, lexicographers will be classifying entries as instances of concepts related to video game agents, artifacts, art and design, genres, and tools. The lexicon team derived the "artifacts" root node from the Getty Art and Architecture Thesaurus (or "AAT"), and the rest from Wolf. Online sources of information that were critical to the project included gamedeveloper.com and help wanted ads published by video game shops. Wherever possible, the team collected definitional information for each term from the source of the term. Definitions will be merged into the subsequent version of the video game lexicon. However, the AAT's structure is generally unsuitable for the video game lexicon. The AAT's location of Video Games is too constraining. Video games are listed under Activities > Physical and Mental Activities > Video Games, and the definition fits the perspective of an art historian, rather than a designer's or player's perspective. The AAT designation for "video game" is to be used "for any of various interactive computer games in which a player controls electronically generated images on a video display screen; usually restricted to those written after the late 1970s for microcomputers, arcade systems, or dedicated consoles" (Getty). The AAT stresses the play activity with video games, rather than other facets of the video game concept, such as attributes, styles, agents, or objects.

To build the hierarchy of nodes, the Lexicon team first created a flat list, or a "bag of words," for preliminary classification, and then transformed the "bag of words" into a structured vocabulary by sorting out the broadest terms first, then arranging these under each of our five vocabulary branches. Figure 2 illustrates some entries from a section of the vocabulary as displayed in the MetaTagger GUI.

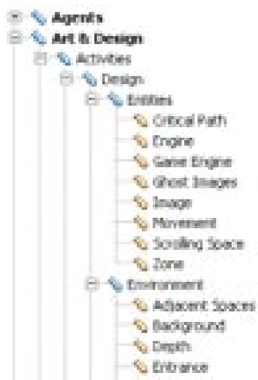

Figure 2: Art & Design > Activities > Design > Entities and Environment
Source: Author

In an effort to reduce complexity, the team took pains to avoid creating a polyhierarchy, in which the same term occurs in more than one location in the taxonomy. The team decided against using an "ontology" for the vocabulary, or a meta-schema for classifying the vocabulary consistently with other vocabularies, because ISO/NISO standards do not require integration with an ontology, and because the team discovered no consensus about the best ontology for commercial grade data sharing applications.

A Knowledge Base for the Video Game Industry?

Working together, the structured vocabulary, appropriate metadata schema, and a search engine can help gaming educators and researchers make the right searches and find the right documents (Lee-Smeltzer). A software package called the *MetaTagger Suite*, by Interwoven, Inc. of Sunnyvale, California, contains a Dublin Core compliant taxonomy builder and a classification engine, and can be used for future experiments with automatic document tagging for a prototype knowledge base for the Web. The Lexicon research team envisions the use of an industry-standard vocabulary for tagging documents, software tools, and code bases with Dublin Core compliant metadata for searching in an intelligent Web portal. Because every record for every resource will have a Subject descriptor, this element will be mapped back to the controlled vocabulary. The semantic approach to indexing for search and navigation "offers the potential for searcher and indexer to speak the same language, and for a user to be guided to fruitful terms when searching a particular collection for a particular purpose" (Tudhope).

An economic impetus drives most knowledge management needs, including those in the media industries. Sales of video games are approaching movie box office receipts in the US—$7.3 billion and $9.2 billion, respectively in 2004 (Weiss and Vargas)—and the market for product placement advertising in video games is already $200 million annually (Wong). Cross-ownership of video game companies by vertically integrated firms with film studios such as Sony and Viacom promotes an ongoing convergence among video games and film formats. Representing knowledge about the video game domain in a thesaurus can provide educational and organizational benefits for a young and growing industry. Contemporary work on that goal proceeds on the assumption that accessible, codified knowledge in a database provides the field with advantages for players, practitioners, researchers, and educators.

Acknowledgements
The author gratefully acknowledges the support of the Digital Media Collaboratory (“DMC”), IC^2 Institute, UT-Austin for research support.

Works Cited

ADAM [Art, Design, Architecture & Media Information Gateway]. *About ADAM*. 17 Feb. 2005 <http://www.adam.ac.uk/adam/index.html>.

Church, Doug. *Formal Abstract Design Tools*. 1999. Gamasutra.com. 17 Feb. 2005 <http://www.gamasutra.com/features/19990716/design_tools_01.htm>.

Contractor, Noshir, and Peter Monge. “Managing Knowledge Networks.” *Management Communication Quarterly* 16.2 (2003): 249-258.

Cyberstacks. 17 Feb. 2005 <http://www.public.iastate.edu/~CYBERSTACKS/>.

Davenport, Thomas H., and Varun Grover. “General Perspectives on Knowledge Management: Fostering a Research Agenda.” *Journal of Management Information Systems* 18 (2001): 5-21.

Flanagin, Andrew J. “The Elusive Benefits of the Technological Support of Knowledge Management.” *Management Communication Quarterly* 16.2 (2003): 242-248.

Getty. *Getty Thesaurus of Geographic Names Online*. 17 Feb. 2005 <http://www.getty.edu/research/conducting_research/vocabularies/tgn/>.

Goodwin, Phil. “Information Life-Cycle Management and Enterprise Content Management: The Confluence of Technology and Business.” *Content & Collaboration Stragtegies, Infrastructure Strategies, Server Infrastructure Strategies*. Stanford, CT: Meta Group, 2004.

Heichler, Elizabeth. “Biotech Targets Knowledge Management Tools.” 16 Apr. 2002. Infoworld. 17 Feb. 2005 <http://www.infoworld.com/articles/hn/xml/02/04/16/020416hnbiotech.html>.

IGDA [International Game Developers Association]. “Curriculum Framework.” 17 Feb. 2005 <http://www.igda.org/academia/curriculum_framework.php>.

ISO [International Organization for Standardization]. “Information and Documentation: The Dublin Core Metadata Element Set.” 2/26/2003. International Organization for Standardization. 17 Feb. 2005 <http://www.niso.org/international/SC4/n515.pdf>.

Joselyn, Mark. “Building a Geodatabase for Watershed Management.” 11 Jul. 2002. ESRI Annual Users’ Conference. 17 Feb. 2005 <http://gis.esri.com/library/userconf/proc02/pap0929/p0929.htm>.

Kreimeier, Bernd. “Game Design Methods: A Survey.” 3 Mar. 2003. Gamasutra.com. 17 Feb. 2005 <http://www.gamasutra.com/features/20030303/kreimeier_03.shtml>.

Lee-Smeltzer, Kuang-Hwei (Janet). “Finding the Needle: Controlled Vocabularies, Resource Discovery, and Dublin Core.” *Library Collections, Acquisitions, & Technical Services* 24 (2000): 205-215.

NISO [National Information Standards Organization]. *Guidelines for the Construction, Format, and Management of Monolingual Thesauri*. 2003. 17 Feb. 2005 <http://www.niso.org/standards/resources/Z39-19.html>.

Osur, Elizabeth. “Equity Research: United States Leisure Products.” Video Game Publisher Initiation. Citigroup Smith Barney. 22 Dec. 2004.

Tudhope, Douglas. “Thesauri and Classification Systems.” 2003. University of Glamorgan—School of Computing-Research. 17 Feb. 2005 <http://www.glam.ac.uk/soc/research/hypermedia/facet_proj/thesauri_class.php>.

Weiss, Eric M., and Jose Antonio Vargas. “Video Games’ Chaos Echoed in Streets, D.C. Leaders Say.” *The Washington Post*. 4 February 2005. A01. 17 Feb. 2005 <http://www.washingtonpost.com/wp-dyn/articles/A61945-2005Feb3.html>.

Wolf, Mark. *The Medium of the Video Game*. Austin: University of Texas Press, 2002.

Wong, May. “Video Game Ads Turn Pro.” *CBSNews.com*. 18 October 2004. SciTech Section. 17 Feb. 2005 <http://www.cbsnews.com/stories/2004/10/18/tech/main649832.shtml>.

Gaming's Non-Digital Predecessors

Laurie N. Taylor and Cathlena Martin, University of Florida

Introduction

While video games have been analyzed in comparison to other new media forms by scholars like Lev Manovich, and to older media like novels and plays by scholars like Janet Murray and Brenda Laurel, few studies have examined the influence of older toys on video games. Despite this neglect, however, the connections between older toys and video games point to several important issues in humanities-based game studies, including those that investigate the place of game studies in academia and the archiving and preservation of games. By connecting video games to a variety of non-electronic predecessors, this article raises several questions linked to video game classification, the hybridity of video games, and the problems that hybrid forms must negotiate. Toward this end, we specifically address movable books and toy theaters in relation to video games like *Paper Mario: The Thousand Year Door* (2004) to show how video games both draw on and change earlier interactive entertainment formats. Overall, this article explicates the relationship between games and older forms like movable books to show how comparative studies of older forms can elucidate and inform current scholarship.

Movable books (also sometimes referred to as "mechanical books" or "movables"), toy theaters, and video games all largely include works that are hybrids of image, text, and manipulation. They also all share an emphasis on the presentation of space and movement on or through that space. As Espen Aarseth notes, video games are fundamentally spatial ("Allegories of Space"). Movables are also fundamentally spatial; for instance, Lothar Meggendorfer's *The City Park* folds out into several stand-up pieces that can be positioned to create different physical arrangements of the park that lead to different possible games and narratives based on the positioning and relationship of the elements in the park. *The City Park* is like a video game because it is meant to be played with and read as a spatial narrative. Movables and toy theaters also serve as notable counterparts to game studies because of their formal similarities and because movables have been largely unstudied for the same reasons that game studies have proven difficult—including difficulties with classification, archiving and their precarious social placement as objects of children's play. Movables and toy theaters have been largely uncollected, unreprinted, and unclassified by academia because their strange and varied forms lead to difficulties in classification, archiving and preservation. Game studies faces similar problems in classification, placement, and preservation for many of the same reasons.

Movable Books, Toy Theaters, and Video Games

As hybrid works that bridge the traditional notions of books, toys, and games, movable books serve as early precursors to video games and to some of the problems now faced by game studies. Like video games, movables were considered advanced technology when they were first produced. Ann Montanaro, in her bibliography of movables, defines them as:

> Titles in which an action by the reader produces motion in the illustration. These are books

> with three-dimensional or pop-up pictures, and books with moving parts within the illustrations such as tab-operated mechanicals and transformational plates. (ix)

Because of the emphasis on the form of movables, classification terms often blend into one another in the same way that both genre and form-based divisions blend into one another for other works, including video games. The company that claims to have created movables, Dean and Son, defined them as works "in which characters can be made to move and act in accordance with the incidents described in each story"(Haining 20-21). Yet Dean and Son's definition of movables is limiting because they include a story or narrative component, which movables do not always require. Because movables do not always include a pre-scripted story component and instead allow readers to arrange the book elements to create a narrative, movables negotiate the borders between text, game, and toy. In the same manner, video games operate as games, toys, and narratives and have been studied from theories that focus on these different aspects. This diversity of academic analysis makes classification problematical, with some movables being classified as paper dolls, playbooks, playstreets, and other types of toy (rather than as books) in much the same way that video games are sometimes categorized as narratives, games, toys (especially in the case of handheld electronic, yet non-specific gaming systems), software and so on.

The definitions of toy and game also fail to elucidate video game and movable classifications because of the close association between games and toys, and because the key difference between games and toys lies in how the objects are used, not in how the objects are constructed. Chris Crawford's definition highlights this problem by noting that toys are playthings without goals, while games involve "conflicts in which the players directly interact in such a way as to foil each other's goals" (7-8). The formal definitions are further conflated by the emphasis on spatiality in both movables and video games, an emphasis that again foregrounds the hybrid structure and functioning of both movables and video games.

Movables are fundamentally spatial because they extend beyond the general definition of a book and physically break the confines of the two-dimensional plane of the page. Similarly, video games create three-dimensional visual representations within the two-dimensional frame of the screen. While non-movable picture books and films create the illusion of depth, movable books and video games allow the reader/player to experiment with and to manipulate objects within that spatial field. Further, movables require interaction from the reader in an often similar manner to how video games require interaction from players. The manner of play may also change, with some movables being narrativized play-books or toys, while others are more like landscapes for play in the same manner as video games like *The Sims* (2000).

In addition to video games' similarities to movables, there is the closely related form of toy theaters which also bear notable resemblances to video games. Toy theaters, or juvenile dramas, are small paper theaters used for performing plays and began as marketing supplements to major theaters. Noting the emphasis on movement and space in toy theaters, George Speaight notes that both movables and toy theaters include "movement—the very essence of the toy theater" (87). An exhibition at the University of Virginia reaffirmed the theatrical and user-involvement connection, stating in its catalog that movables: "Through the use of rivets, flaps, tabs, folds, and cut paper…perform before our eyes. Each page becomes a stage, inviting action and participation" ("Pop Goes the Page"). While Brenda Laurel has noted the similarities among new media, video game performances, and theater, many video games implicitly make these connections, especially edutainment games like animated readers and games based within book-frames. Games like *Super Mario Brothers 3* also use the literal form of the theater, presenting a stage and curtain for the opening character selection screens, and a raising curtain for level transitions. Other games explicitly make the connections like *Paper Mario,* which relies on the formal attributes of movables and toy theaters by being structured as a movable book or toy theater that is played through the screen.

Paper Mario begins like a game within a book frame, using the image of a codex book opening to reveal the story of a forgotten town and a magical door. The game then presents Mario as a paper creature within a paper-based world. Remediating movables, *Paper Mario* plays on the paper format with Mario folding up into a paper airplane to fly, turning sideways to slip through small cracks, or rolling himself up to bounce away from enemies. *Paper Mario*'s game world itself is formally and functionally structured as a movable or toy theater with each game area presenting multiple layers of paper. Parts of the screen act as pages and can fall or be manipulated to reveal hidden areas beneath those pages. For instance, when Mario enters the houses in the town, the 'flat' door opens and then the front structure falls forward to provide a complete view of the interior in the same way that a toy theater stage flat or movable page element would be shifted to reveal an interior space. Mario also manipulates the game space as if it were a movable book. In one segment, Mario jumps on a block to build a bridge and the bridge is built in sections as pieces of the bridge flip over one by one like pages in a movable book (see Academic-Gamers, "Screen Shots"). In both movables and *Paper Mario*'s bridge, the backgrounds are stationary and the segments are the only motion.

The turn-based battle scenes in *Paper Mario* further connect the game to toy theaters because the battles take place in a theater, which is separate from the main game space. The theater presents the player on one side of the stage, the enemies on the opposite side, and an audience in the lower portion of the screen below the stage apron. As the player fights the enemies, backdrops and scenery occasionally fall and injure the player and the enemies. The stage connects *Paper Mario* to toy theaters—where players would control the onstage action while playing to an audience—and to pantomime books, a form of movable framed within the image of a stage, with an audience at the bottom of the pages, and with the action taking place at the center of the pages. *Paper Mario*'s presentation is identical, with fighting taking place on the stage at the top of the screen, and audience sitting in front of the stage at the bottom of the screen.

The playfulness of movables, toy theaters, and video games has led to each form being considered child's play, despite the fact that their content is often directed to adults. Movables did not begin as toys for children because the early production costs made movables prohibitively expensive and so they were made largely as amusements for adults (Haining 9). Similarly, toy theaters began as souvenirs for theater attendees or as toys for "enthusiasts of the theatre, who were mainly young men and boys" (Speaight 93). Video games were not simply created as toys for children, but they quickly came to be viewed as such because of their iconographic, cartoon-like graphics and because toys and play are still viewed as domains of childhood. With their placement as toys, books, or games, movables are often not even classed as literature; however, they are also not quite classed as toys. In this precarious position, movables have often been neglected in terms of scholarship, archiving, and even within studies of popular culture. Video games also remain outside of traditional classifications of literature and toys, and only relatively recently have they begun to be documented and studied.

Conclusion

While *Paper Mario* is a very recent video game, its connections with earlier entertainment forms like toy theaters and movables are clear. Many older games frame the game stories within books because of the difficulty in animating the back-story information. Furthermore, video games add dimension and depth to the two-dimensional space of the computer or television screen by presenting three-dimensional images. In doing so, video games operate in the same manner as movables, both of which attempt to create three-dimensional spaces using two-dimensional formats. In perhaps the most famous case of *Myst*, the book serves as a visual frame and as the orienting game story and framework where the player seeks to avoid being trapped in a book: "Almost certainly without the conscious intent of its authors, *Myst* turns out to be an allegory about the remediation of the book in an age of digital graphics" (Bolter and Grusin 94). Other games use the visual metaphor of the movable book to frame game interaction by presenting a flat two-dimensional image in which the player can click on multiple two-dimensional sections to have those sections act in some manner, as in *The Book of Lulu*. In many ways, these uses of standard and movable book conventions are due to the limitations of earlier digital media. However, games like *Paper Mario* make clear the connections among movables, toy theaters, and the video games that draw on their precursors' visual, structural, and play elements.

Referencing earlier works like movables and toy theaters proves useful for groups like the Serious Games Initiative and the Learning Games Initiative, which are two of the many groups using games for practical applications—and for game studies as a whole—by situating game scholarship within a history of forms that are not solely narratives, toys, or games. However, game studies itself needs further development to support practical applications and other inquiries. Game studies can learn from movables' previous successes—like the presentation of dynamic three-dimensional space—and the problems—like the lack of archiving and the mis-representation of audience. In doing so, game studies can answer some of the questions concerning the division between games and narratives by resituating those questions within a context that also contains earlier examples of playthings that blend both narrative and game in unique formats.

Works Cited

Aarseth, Espen J. "Allegories of Space: The Question of Spatiality in Computer Games." *CyberText Yearbook 2000*. Eds. Markku Eskelinen and Raine Koskimaa. Jyvaskyla, Finland: Research Centre for Contemporary Culture, 2001: 152-71.

Academic-Gamers. "Screenshots: *Paper Mario*." Academic-Gamers Website. 17 Feb. 2005. 17 Feb. 2005 <http://www.academic-gamers.org/screens/papermario.shtml>.

Bolter, Jay David and Richard Grusin. *Remediation: Understanding New Media*. Cambridge, MA: MIT Press, 2000.

Crawford, Chris. *Chris Crawford on Game Design*. Boston: New Riders, 2003.

Haining, Peter. *Movable Books: An Illustrated History*. London: New English Library, 1979.

Laurel, Brenda. *Computers as Theater.* Boston: Addison-Welsey, 1993.

Manovich, Lev. *The Language of New Media*. Cambridge: MIT Press, 2001.

Maxis. *The Sims*. (PC). Redwood City, CA: Maxis, 2000.

Meggendorfer, Lothar. *The City Park: A Reproduction of an Antique Stand-up Book*. New York: Viking Press, 1981.

Montanaro, Ann R. *Pop-up and Movable Books: A Bibliography*. Metuchen, NJ: Scarecrow Press, 1993.

Murray, Janet. *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. Cambridge: MIT Press, 1998.

Nintendo. *Paper Mario: The Thousand Year Door.* (Nintendo GameCube). Redmond, WA: Nintendo of America, 2004.

Nintendo. Super Mario Brothers 3. (Nintendo Entertainment System). Redmond, WA: Nintendo of America: 1990.

"Pop Goes the Page: Movable and Mechanical Books from the Brenda Forman Collection." 2000. Rector and Visitors of the University of Virginia. Nov 8, 2004 <http://www.lib.virginia.edu/small/exhibits/popup/theme.html>.

Speaight, George. T*he History of the English Toy Theatre*. London: Studio Vista, 1969.

Victor-Pujebet, Romain. *Le Livre de Lulu*. (DVD). Thousand Oaks, CA: Ventura Distribution, 1999.

Poised to Play: the Evolution of Games on DVD Releases

John Reid Perkins-Buzo, Dominican University—Priory Campus

DVD technology has been a colossal success in delivering feature films and other long-format video, with figures for consumer purchasing showing that by the end of 2005 more than 80 percent of U.S. households will have at least one DVD player (DEG Press Release). The phenomenal market penetration of the DVD into the everyday world of millions of people has brought in its wake an unforeseen new locale for electronic games. A growing number of DVD releases include games playable on standard set-top players as special features. Although the majority of these games are found on releases aimed at children (e.g., family-oriented animation), others clearly have an adult audience in mind.

Parsing these games into a taxonomy could be done in a number of ways, for example according to genre/sub-genre of the accompanying film, gaming conventions (e.g., word games, spatial games, perceptual-motor coordination), or marketing age group. The last of these taxonomies highlights the evolution of the DVD game from simple visual concepts to more sophisticated ones, so this is the one I will be primarily using in this article. Of course, even some of the simplest early DVD games were quite sophisticated, deriving as they did from animated films with tremendously high levels of art direction. What they lacked was design that involved setting more challenging interactive goals for the gaming audience (Falstein "Paradigm" 47).

After examining the development of DVD games, three things stand out:

- Pattern matching, whether visual or semantic/syntactic (i.e., answering questions; Jurafsky and Martin 84), is the most common play strategy of all DVD games;
- Over the past five years, these games have developed an appearance of interactive complexity reminiscent of games rendered in real-time;
- The appearance of complexity relies primarily on the careful preparation of many small video segments that can be concatenated together rapidly by the DVD-apparatus.

These three linked observations imply that the current design trend placing interactivity at the center of game design has yielded better, more entertaining games with good replay value. The growing practice of providing two or more discs for major film DVD releases means that gaming content to fill them will increase. Will the new generation of DVD games continue to improve as they have over the last five years?

An early form of DVD game involved asking a series of questions that eventuated in a positive or negative outcome. The 2000 release of *The Cell*, for example, contained as a special feature an "Empathy Test" that first determined the viewer's "emotional IQ," and then ascertained how "empathic" the viewer was. The game's relation to the film was clear, but not belabored, "measuring" the viewer on an implied scale between the film's empathic protagonist and its un-empathic villain. Interestingly, whether the viewer was allowed to take the second part of the test depended on the "emotional IQ" obtained in the first part of the test. If the viewer fell too close to the villain in "emotional IQ," the game advised her to seek professional counseling and refused to proceed to the second part. Importantly, the "Empathy Test" is a good example of two of Faltein's 400 rules for game design: "Provide an Enticing Long Term Goal" and "Provide Clear Short-Term Goals" ("The 400 Project" 26). The individual questions of the test made up the short-term goals, while the long-term goal became the quest to finish the test and receive the final "diagnosis" revealing how empathic the test-taking viewer was.

Figure 1. The Cell's "Empathy Test" orients the viewer to the ultra-long-term goal of being an empathic person in its opening screen.

The Cell DVD is noteworthy for another reason: it was one of the first DVDs to contain a demo version of a PC-game based on the film. It also has product placement for the PC-games *Homeworld* (1999), and *Homeworld: Catacylsm* (2000), which are not directly related to the film but are included purely as advertisements. This sort of product placement has been common in film since the 1970s, but never directly positioned on an interactive vehicle like that made possible by the DVD-apparatus (Babin and Carder 33). The Cell DVD release was ahead of its time in both of these commercial strategies, strategies that are now quite common in new DVD releases. The *Van Helsing* DVD, for example, includes a one-level demo of the XBox game, while *Spider-Man 2* has links to online games via MSN-Microsoft Online Gaming Network.

One of the earliest DVD releases to include video-based games was the Disney release of the Pixar film, *Monsters, Inc.* (2001). Two of these games were created for the Japanese animated series " Ponkickies 21" and are merely short video clips depicting the host, "Go-Go" Connie-chan, introducing a simple "guessing game." One of these games is the Japanese version of Paper-Rock-Scissors called Janken, while the other is the Lucky Door Game where the object is to guess which one of the animated characters will come out of the door. Neither of these games is genuinely interactive, because the player simply makes a personal guess or gesture while the clip runs to the end, eventually revealing the outcome (with no input from the player). The game Peek-a-Boo: Boo's Door Game, required true interactivity from the viewer and therefore had real gameplay through the DVD apparatus (i.e., the formal specification of the DVD format plus the physical hardware reifying the specification) (Baudry 346-347). It required the player to explore the six rooms behind closet doors looking for pieces of Boo's door in each room. This was essentially a guessing game as well, but with the difference that the DVD apparatus waited for the viewer to choose one location in each room that might hide the door piece. The video segments between the choices were primarily designed to segue from one choice-making opportunity to another.

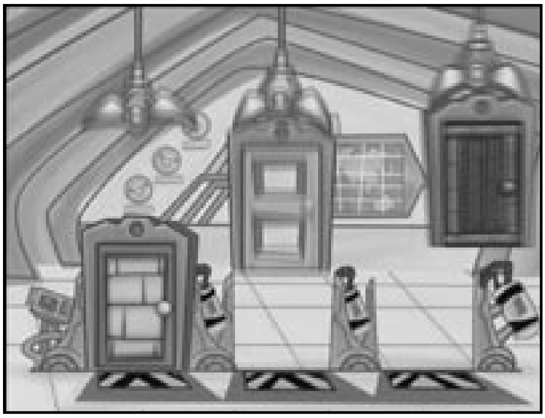

Figure 2. A view of *Monsters, Inc.'s* interactive *Peek-a-Boo: Boo's Door* Game as the first set of doors arrives. The 2-D art of the game is reminiscent of the movie's storyboards, of which a selection is included on the DVD.

The subsequent release of *Lilo and Stitch* in 2002 brought a greater complexity to DVD gameplay by breaking the included game into two interactively distinctive styles of play that combine the ideas of *The Cell* with *Monsters, Inc*. Dr. Jumba Jookiba, the evil mad scientist who created Stitch, first poses a series of questions which, when answered correctly, activate an "injector." After activating all three injectors, the viewer must correctly choose the order of the chemical ingredients to create a new life form. The creature creation game requires both memory skill and pattern-matching to succeed. Critically, the video elements take on a new role in the gameplay, working as particular responses to the viewer's actions and not simply as transitional elements between choices. They provide a sense of real-time interactivity missing in *The Cell* and only partly employed in *Monsters, Inc*. The creature creation game marks a definite evolution from these earlier examples.

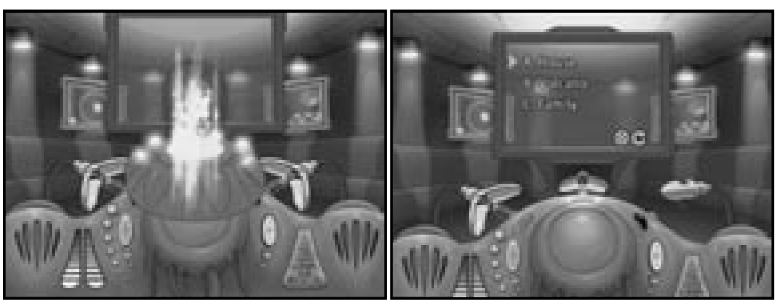

Figure 3. The question-and-answer segment and the create-a-new-creature segment in the Lilo and Stitch DVD game.

One of the most sophisticated DVD games is *Mega-Race*, included on the 2003 release of *Spykids 3D: Game Over*. The DVD race matches the race in the film very closely, even reusing some of the film's race-game segments and the racetrack layouts found there. As the player takes the place of Juni Cortez in the driver's seat of the mega-bike, she experiences to a great extent what the film portrays as Juni's ride. This close reproduction makes the game appealing to those who enjoyed the film because they get the chance to become the hero and pursue the goal of defeating the Toymaker themselves, albeit within a smaller compass.

The advance between the relatively simple games discussed earlier and *MegaRace* is the result of a much more fluid use of pre-rendered video clips. In *MegaRace*, the clips have been designed to fit together around segments actually taken from the film in such a way that the movement on the racetrack approaches the visual look of real-time rendering. However, the racetrack never varies; the obstacles and accidents remain the same each time the game is played. After a few tries, it becomes relatively easy to win the race repeatedly.

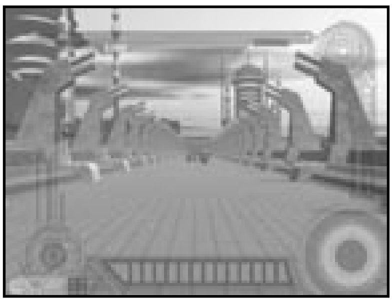

Figure 4. The starting line of MegaRace

Figure 5. A crash sequence taken directly from the film.

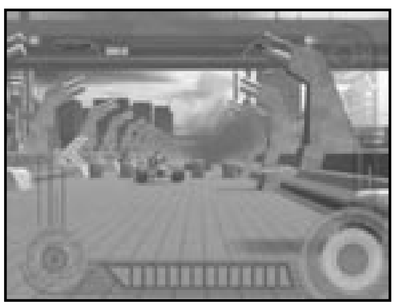

Figure 6. Somewhere near the middle of the race.

In 2004, New Line Entertainment released the DVD for *Elf* which contained four different games: *Fix Santa's Sleigh* (a question-and-answer game), *Elf in the City* (a maze game), *Snowball Fight* (a first-person shooter game), and *The Race Down Mt. Icing* (a driving game of sorts). The last three of these games take the use of interactive video elements to new levels. The maze game uses video segments of moving streams of traffic to block off sections of the maze, while the snowball fight shows video of snowballs both incoming to and thrown by the viewer. *The Race Down Mt. Icing* most fully exploits the use of video segments to present a simulation of a luge-style run down a candy-cane strewn course. Each portion of the course appears as if it were displayed by a real-time render engine, but is actually pre-rendered video. As the viewer passes from one area to another, an obstacle (giant candy canes or a rolling snow boulder) intervenes giving a choice to move right or left, duck down, or jump over by pressing the appropriate keys on the DVD remote. If the viewer chooses the correct direction, the video element for the next portion of the course is played and the game progresses. If the viewer makes an error, a video element of a wipeout plays and the viewer begins descending again at the portion of the course prior to her wipeout.

To increase the sense of real-time rendering, the DVD-apparatus randomly changes the course in small ways by using different video elements for the same stretch of the course. The wipeout elements are also varied among three different crashes so that each spill looks somewhat unique when occurring over different portions of the course. The various combinations of the video elements produce a deeper sense of real-time interactivity which is at the heart of all electronic gaming (Crawford 78-79).

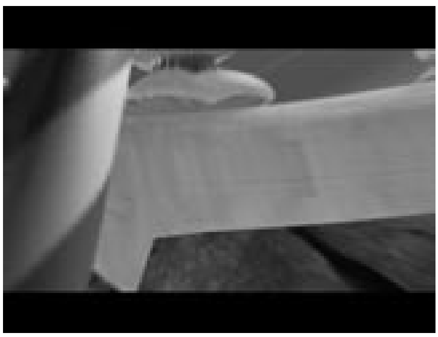

Figure 7. A wipeout in progress from *The Race Down Mt. Icing*

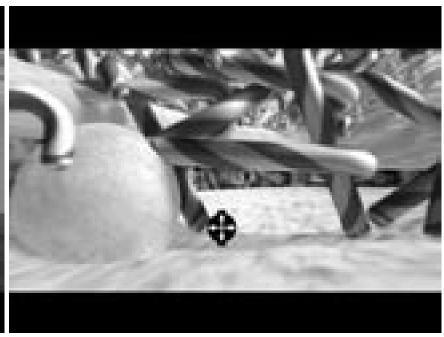

Figure 8. A giant candy cane obstacle from *The Race Down Mt. Icing*

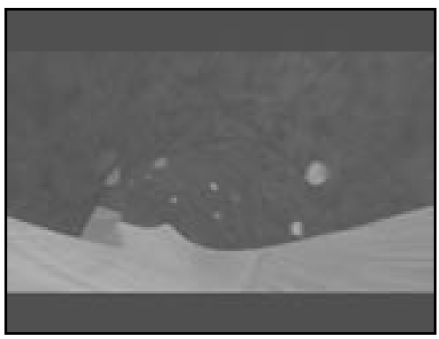

Figure 9. Inside Mt. Icing from *The Race Down Mt. Icing*

Given the limited capabilities of the present DVD- apparatus (i.e., the rudimentary scripting language plus the underpowered processors of most players), other play strategies (e.g., simulation, first or third-person shooter, tactical, difficult tests of perceptual and motor skills, etc.) are much more difficult to implement. Because the complexity of DVD games relies on the preparation of many small video segments that are played rapidly in succession depending on the viewer's interaction with the game scripts, the speed of the script-processing engine, the video decoders, and the reading speed from the disc all directly impact the performance of the game. As in console gaming, fixed capability hardware provides both a stable delivery platform and a troublesome bottleneck for newer game designs ("Brave New Worlds" 30-31). Moreover, moving toward game styles such as 3D simulation, which requires indeterminate interactivity that would be very difficult to pre-render, may well be beyond present DVD game design.

On the other hand, the inclusion of games playable on consoles could be seen as an alternative to this hardware bottleneck. An example would be the one-level version of the XBox game on the *Van Helsing* DVD mentioned above. Since both the Microsoft XBox and the Sony PS2 also act as DVD players, this supplementation of one technology with another would enable designers to position games in tandem with films on the same interactive device. However, because only demo versions of console games have appeared this way, it seems as if designers have yet to take full advantage of this approach. Including game demos on DVDs is more like product placement (advertising the full version of the game to a special "gamer's" segment of the film audience) rather than an attempt to truly synergize the two media on a single device.

More promising is the advent of high-definition video on DVD, which will provide a more fully featured scripting language and more powerful processors for the next generation of DVD-players (Heiland 17-19). Currently, the contenders for the delivery technology (BD-ROM discs from the Sony-led Blu-Ray Disc Association and the DVD-Forum's HD-DVD discs) are incompatible. However, just as the rival pre-DVD camps came together to develop the present DVD specification, it is likely that through negotiation a common delivery technology will be created. No matter what the delivery technology, it will certainly surpass the present DVD-apparatus by providing more internal bandwidth for the video segments, higher-level programming strategies (using Java if the Blu-Ray specification succeeds), and network communications capability (Dixon 60-61). An HD DVD-apparatus might well give the current generation of gaming consoles a run for their money, allowing some real-time rendering of graphics and more sophisticated interactivity. Perhaps the development of games on DVD is poised to hurdle to the next level via the "Blue Highway" of the emerging generation of DVD-players. It would undeniably yield better quality game play for everyone.

Works cited

Babin, Laurie A., and Sheri Thompson Carder. "Advertising via the Box Office: Is Product Placement Effective?" *Journal of Promotion Management* 3.1-2 (1996): 31-51.

Baudry, Jean-Louis. "Ideological Effects of the Basic Cinematographic Apparatus," *Film Quarterly* 28.2 (Winter 1974-75). Reprinted in Film *Theory and Criticism* (5th edition). Leo Braudy and Marshall Cohen, eds. Oxford: Oxford University Press, 1999.

"Brave New Worlds." *GameState* (Summer 2003): 28-33.

Crawford, Chris. *Chris Crawford on Game Design*. Berkeley, CA: New Riders, 2003.

Digital Entertainment Group Press Release 1/06/05. "Industry Boosted By $21.2 Billion In Annual DVD Sales And Rentals." 20 Feb. 2005 <http://www.digitalentertainmentinfo.com/News/press/CES010605.htm>.

Dixon, Douglas. “Next Generation DVD Authoring.” *DV* (February 2005): 58-64.
Falstein, Noah. “The 400 Project.” *Game Developer* (March 2002): 26.
—–. “Paradigm Shifts.” *Game Developer* (November 2004): 47.
Heiland, Victoria. “Blue Highways.” *eMedia* (December 2004): 16-22.
Jurafsky, Daniel, and James H. Martin. *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition*. New York: Prentice-Hall, 2000.

Video Games, Mind, and Learning

James Paul Gee, University of Wisconsin-Madison

In this essay, I will stress the contribution Game Studies can make to our thinking about learning, knowledge, and the human mind. Video games are a relatively new technology replete with important, and not yet fully understood, implications (Gee, *What Video Games Have to Teach Us About Learning and Literacy*).

Scholars have often viewed the human mind through the lens of a technology they thought worked like the mind. Locke and Hume, for example, argued that the mind was like a blank slate on which experience wrote ideas, taking the technology of literacy as their guide. Much later, modern cognitive scientists argued that the mind worked like a digital computer, calculating generalizations and deductions via a logic-like rule system (Newell and Simon). More recently, some cognitive scientists, inspired by distributed parallel-processing computers and complex adaptive networks, have argued that the mind works by storing records of actual experiences and constructing intricate patterns of connections among them (Clark, *Microcognition*; Gee, *The Social Mind*). So we get different pictures of the mind: mind as a slate waiting to be written on, mind as software, mind as a network of connections.

Human societies get better through history at building technologies that more closely capture some of what the human mind can do, and get better at getting these technologies to do mental work publicly. Writing, digital computers, and networks each allow us to externalize some functions of the mind.

Though they are not commonly thought of in these terms, video games are a new technology in this same line. They are a new tool with which to think about the mind and through which we can externalize some of its functions. Video games of the sort I am concerned with—games like *Half-Life 2* (2004), *Rise of Nations* (2003), *Full Spectrum Warrior* (2004), *The Elder Scrolls III*: *Morrowind* (2003), and *World of WarCraft* (2004)—are what I would call “action-and-goal-directed preparations for, and simulations of, embodied experience.” A mouthful, indeed, but an important one.

To make clear what I mean by the claim that games act like the human mind and are a good place to study and produce human thinking and learning, let me first briefly summarize some recent research in cognitive science, the science that studies how the mind works (Bransford, Brown, and Cocking). Consider, for instance, the remarks below (in the quotes below, the word “comprehension” means “understanding words, actions, events, or things”):

> …comprehension is grounded in perceptual simulations that prepare agents for situated action. (Barsalou, “Language Comprehension” 77)

> …to a particular person, the meaning of an object, event, or sentence is what that person can do with the object, event, or sentence. (Glenberg 3)

What these remarks mean is this: human understanding is not primarily a matter of storing general concepts in the head or applying abstract rules to experience. Rather, humans think and understand best when they can imagine (simulate) an experience in such a way that the simulation prepares them for actions they need and want to take in order to accomplish their goals (Barsalou, “Perceptual Symbol Systems”; Clark, *Being There*; Glenberg and Robertson).

Let’s take weddings as an example, though we could just as well have taken war, love, inertia, democracy, or anything. You don’t understand the word or the idea of weddings by meditating on some general definition of weddings. Rather, you have had experiences of weddings, in real life and through texts and media. On the basis of these experiences, you can simulate different wedding scenarios in your mind. You construct these simulations differently for different occasions, based on what actions you need to take to accomplish specific goals in specific situations. You can move around as a character in the mental simulation as yourself, imagining your role in the wedding, or you can “play” other characters at the wedding (e.g., the minister), imagining what it is like to be that person.

You build your simulations to understand and make sense of things, but also to help you prepare for action in the world. You can act in the simulation and test out what consequences follow, before you act in the real world. You can role-play another person in the model and try to see what motivates their actions or might follow from them before you respond in the real world. So, I am arguing that the mind is a simulator, but one that builds simulations to purposely prepare for specific actions and to achieve specific goals (i.e., they are built around win states).

Video games turn out to be the perfect metaphor for what this view of the mind amounts to, just as slates and computers were good metaphors for earlier views of the mind. To see this, let me now turn to a characterization of video games, and then I will put my remarks about the mind and games together.

Video games usually involve a visual and auditory world in which the player manipulates a virtual character (or characters). They often come with editors or other sorts of software with which the player can make changes to the game world or even build a new game world. The player can make a new landscape, a new set of buildings, or new characters. The player can set up the world so that certain sorts of actions are allowed or disallowed. The player is building a new world, but is doing so by using and modifying the original visual images (really the code for them) that came with the game. One simple example of this is the way in which players can build new skateboard parks in a game like *Tony Hawk’s Pro Skater 4* (2002). The player must place ramps, trees, grass, poles, and other things in space in such a way that players can manipulate their virtual characters to skate the park in a fun and challenging way.

Even when players are not modifying games, they play them with goals in mind, the achievement of which counts as their “win state” (and it is the existence of such win states that, in part, distinguishes games from simulations). These goals are set by the player, but, of course, in collaboration with the world the game designers have created (and, at least in more open-ended games, players don’t just accept developer’s goals, they make real choices of their own). Players must carefully consider the design of the world and consider how it will or will not facilitate specific actions they want to take to accomplish their goals.

One technical way that psychologists have talked about this sort of situation is through the notion of “affordances” (Gibson). An “affordance” is a feature of the world (real or virtual) that will allow for a certain action to be taken, but only if it is matched by an ability in an actor who has the wherewithal to carry out such an action. For example, in the massive multiplayer game *World of WarCraft* stags can be killed and skinned (for making leather), but only by characters who have learned the Skinning skill. So a stag is an affordance for skinning for such a player, but not for one who has no such skill. The large spiders in the game are not an affordance for skinning for any players, since they cannot be skinned at all. Affordances are relationships between the world and actors.

Playing *World of WarCraft*, or any other video game, is all about such affordances. The player must learn to see the game world—designed by the developers, but set in motion in particular directions by the players, and, thus, co-designed by them—in terms of such affordances (Gee, *Why Video Games Are Good For Your Soul*). Broadly speaking, players must think in terms of “What are the features of this world that can enable the actions I am capable of carrying out and that I want to carry out in order to achieve my goals?”

So now, after our brief bit about the mind and about games, let’s put the two together. The view of the mind I have sketched, in fact, argues, as far as I am concerned, that the mind works rather like a video game. For humans, effective thinking is more like running a simulation than it is about forming abstract generalizations cut off from experiential realities. Effective thinking is about perceiving the world such that the human actor sees how the world, at a specific time and place (as it is given, but also modifiable), can afford the opportunity for actions that will lead to a successful accomplishment of the actor’s goals. Generalizations are formed, when they are, bottom up from experience and imagination of experience. Video games externalize the search for affordances, for a match between character (actor) and world, but this is just the heart and soul of effective human thinking and learning in any situation.

As a game player you learn to see the world of each different game you play in a quite different way. In each case, however, you see the world in terms of how it will afford the sorts of embodied actions you (and your virtual character, your surrogate body in the game) need to take to accomplish your goals (to win in the short and long run). For example, you see the world in *Full Spectrum Warrior* as routes (for your squad) between cover (e.g., corner to corner, house to house) because this prepares you for the actions you need to take, namely attacking without being vulnerable to attack yourself. You see the world of *Thief: Deadly Shadows* (2004) in terms of light and dark, illumination and shadows, because this prepares you for the different actions you need to take in this world, namely hiding, disappearing into the shadows, sneaking, and otherwise moving unseen to your goal.

When we sense such a match, in a virtual world or the real world, between our way of seeing the world, at a particular time and place, and our action goals—and we have the skills to carry these actions out—then we feel great power and satisfaction. Things click, the world looks as if it were made for us. While commercial games often stress a match between worlds and characters such as soldiers or thieves, there is no reason why other games could not let players experience such a match between the world and the way a particular type of scientist, for instance, sees and acts on the world (Gee, *Situated Language and Learning*). Such games would involve facing the sorts of problems and challenges that type of scientist does, and living and playing by the rules that type of scientist uses. Wining would mean just what it does to a scientist: feeling a sense of accomplishment through the production of knowledge to solve deep problems.

I have argued for the importance of video games as "action-and-goal-directed preparations for, and simulations of, embodied experience." They are the new technological arena—just as were literacy and computers earlier—around which we can study the mind and externalize some of its most important features to improve human thinking and learning. However, games have two other features that make them good models for human thinking and learning externalized out in the world. These two additional features are: a) they distribute intelligence via the creation of smart tools, and b) they allow for the creation of "cross functional affiliation," a particularly important form of collaboration in the modern world.

Consider first how good games distribute intelligence (Brown, Collins, and Dugid). In *Full Spectrum Warrior*, the player uses the buttons on the controller to give orders to two squads of soldiers. The instruction manual that comes with the game makes it clear from the outset that players, in order to play the game successfully, must take on the values, identities, and ways of thinking of a professional soldier: "Everything about your squad," the manual explains, "is the result of careful planning and years of experience on the battlefield. Respect that experience, soldier, since it's what will keep your soldiers alive" (2). In the game, that experience—the skills and knowledge of professional military expertise—is distributed between the virtual soldiers and the real-world player. The soldiers in the player's squads have been trained in movement formations; the role of the player is to select the best position for them on the field. The virtual characters (the soldiers) know part of the task (various movement formations) and the player must come to know another part (when and where to engage in such formations). This kind of distribution holds for every aspect of military knowledge in the game.

By distributing knowledge and skills this way—between the virtual characters (smart tools) and the real-world player—the player is guided and supported by the knowledge built into the virtual soldiers. This offloads some of the cognitive burden from the learner, placing it in smart tools that can do more than the learner is currently capable of doing by him or herself. It allows the player to begin to act, with some degree of effectiveness, before being really competent—"performance before competence." The player thereby eventually comes to gain competence through trial, error, and feedback, not by wading through a lot of text before being able to engage in activity. Such distribution also allows players to internalize not only the knowledge and skills of a professional (a professional soldier in this case), but also the concomitant values ("doctrine" as the military says) that shape and explain how and why that knowledge is developed and applied in the world. There is no reason why other professions—scientists, doctors, government officials, urban planners (Shaffer)—could not be modeled and distributed in this fashion as a deep form of value-laden learning (and, in turn, learners could compare and contrast different value systems as they play different games).

Finally, let me turn to the creation of "cross-functional affiliation." Consider a small group partying (hunting and questing) together in a massive multiplayer game like *World of WarCraft*. The group might well be composed of a Hunter, Warrior, Druid, and Priest. Each of these types of characters has quite different skills and plays the game in a different way. Each group member (player) must learn to be good at his or her special skills and also learn to integrate these skills as a team member within the group as a whole. Each team member must also share some common knowledge about the game and game play with all the other members of the group—including some understanding of the specialist skills of other player types—in order to achieve a successful integration. So each member of the group must have specialist knowledge (intensive knowledge) and general common knowledge (extensive knowledge), including knowledge of the other members' functions.

Players—who are interacting with each other, in the game and via a chat system—orient to each other not in terms of their real-world race, class, culture, or gender (these may very well be unknown, or if communicated, be made up as fictions). They must orient to each other, first and foremost, through their identities as game players and players of *World of WarCraft* in particular. They can, in turn, use their real-world race, class, culture, and gender as strategic resources if and when they please, and the group can draw on the differential real-world resources of each player, but in ways that do not force anyone into pre-set racial, gender, cultural, or class categories.

This form of affiliation—what I will call cross-functional affiliation—has been argued as crucial for the workplace teams in modern "new capitalist" workplaces, as well as in modern forms of social activism (Beck; Gee, *Situated Language and Learning*; Gee, Hull, and Lankshear). People specialize, but integrate and share, organized around a primary affiliation to their common goals and using their cultural and social differences as strategic resources, not as barriers.

So video games, though a part of popular culture, are, like literacy and computers, sites where we can study and exercise the human mind in ways that may give us deeper insights into human thinking and learning, as well as new ways to engage learners in deep and engaged learning. While in other work (Gee, *What Video Games Have to Teach Us About Learning and Literacy*; Gee, *Situated Language and Learning*) I have discussed the ways in which good games recruit deep learning, here I have wanted to suggest that Games Studies could have an important contribution to make beyond the study of games as part of research on media. Indeed, the field of Games Studies could serve as an interaction point for a variety of different interests and disciplines, bringing together entertainment, art, media, cognitive science, society, technology, education, and learning. At the very least, I hope I've suggested that good video games are not a trivial phenomenon.

Works cited

Barsalou, Lawrence W. "Language Comprehension: Archival Memory or Preparation for Situated Action." *Discourse Processes 28* (1999): 61-80.

—."Perceptual Symbol Systems." *Behavioral and Brain Sciences 22* (1999): 577-660.

Beck, Ulrich. *World Risk Society*. Oxford: Blackwell Publishing, 1999.

Bransford, John D., Ann L. Brown, and Rodney R. Cocking. *How People Learn: Brain, Mind, Experience, and School: Expanded Edition.*

Washington, DC: National Academy Press, 2000.
Brown, John Seely, Allan Collins, and Paul Duguid. "Situated Cognition and the Culture of Learning." *Educational Researcher* 18.1 (Jan.-Feb.): 32-42.
Clark, Andy. *Microcognition: Philosophy, Cognitive Science, and Parallel distributed Processing*. Cambridge, MA: MIT Press, 1989.
—–. *Being There: Putting Brain, Body, and World Together Again*. Cambridge, MA: MIT Press, 1997.
Gee, James Paul. The Social Mind: Language, Ideology, and Social Practice. New York: Bergin & Garvey, 1992.
—– .*What Video Games Have to Teach Us About Learning and Literacy*. New York: Palgrave/Macmillan, 2003.
—–. *Situated Language and Learning: A Critique of Traditional Schooling*. London: Routledge, 2004.
—–. *Why Video Games Are Good For Your Soul: Pleasure and Learning*. Melbourne: Common Ground, 2005.
Gee, James Paul, Glynda Hull, and Collin Lankshear. *The New Work Order: Behind the Language of the New Capitalism*. Boulder, CO: Westview, 1996.
Gibson, James J. *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin, 1979.
Glenberg, Arthur M. "*What is Memory For." Behavioral and Brain Sciences 20.1* (1997): 1-55.
Glenberg, Arthur M. and David A Robertson. *"Indexical Understanding of Instructions." Discourse Processes 28.1* (1999): 1-26.
Newell, Allen, and Herbert A. Simon. *Human Problem Solving*. Englewood Cliffs, NJ: Prentice-Hall, 1972.
Shaffer, David Williamson. "Pedagogical Praxis: The Professions as Models for Postindustrial Education." *Teachers College Record* 106.7 (July 2004): 1401-1421.

Games for the Thinking Person: Teaching Computer Game Development in an Academic Environment

Monica Evans, University of Texas-Dallas

When I tell people I teach a course in computer game development, they usually ask me two questions: what programming language do I use, and can I get them into the industry? These questions illustrate the two misconceptions about games and gaming: that the design of a good computer game is more dependent on code and graphics than on actual content, and that the creation of computer games is as glamorous and entertaining as playing the games themselves. Like music, film, writing, or any other creative and popular endeavor, the world at large seems to think that game development about having fun, a misconception fueled partially by the flashy, rock star nature of the industry itself. However, commercial game development, like any other business, is more concerned with selling a product than with stretching the medium or taking creative risks. For the most part, commercial game development is not glamorous, nor groundbreaking, and it certainly is not going to change the way we think about games in an academic sense.

The course I teach is called Computer Game Development, and is part of the new Arts and Technology program and the Institute for Interactive Arts and Engineering at the University of Texas at Dallas. Game design and development is one of the biggest draws for our students, especially now that computer games are a part of mainstream popular culture. There are video game award shows hosted by rappers and movie stars (http://www.spiketv.com/events/vga2004/), a cable TV channel dedicated completely to the coverage of games (http://www.g4tv.com), and a Cyber Athlete Professional League bent on turning the first-person shooter into a professional sport (http://www.thecpl.com/league). However, the computer game as an art form does not seem to be progressing as rapidly, partially because there are few places for artists and innovators to safely experiment with the medium. At the moment, academia seems to be no exception. My course in particular has been taught by a number of different instructors, many of them actual game developers, and most of the time the course has focused on preparing students to enter the game industry it teaches them to use the proper programming tools, animation software, and business strategies. Other schools are treating a degree in game studies as a technical certificate, and boast only of their placement programs in game design studios in the area.

My feeling is that this is not enough. I believe that the purpose of an academic course in computer game design is to investigate games as potential and mostly untapped artistic media, and to allow students the opportunity to test the limits of those media. Games have grown up from their eight-bit roots into an adolescence that includes ultra-violence and gore, scantily-clad women, and occasionally a moral choice or two. Now they need to grow up again into truly adult experiences, including meaningful interactivity and choices, graphics that are aesthetically as well as technologically excellent, morally ambiguous situations; and eventually compelling, worthwhile experiences with as much depth and meaning as works of art in other media. In the fast-paced, highly competitive commercial industry, however, there is little room for experimentation, creative risk, or growing pains along these lines. For the computer game is to be taken seriously as a medium for expression, the transformation must start in the academy, where students have the time and intellectual freedom to take risks of innovation with gameplay and content. For this to occur, academic courses in game development should focus more on the design and meaning of games, and less on the specific technical skills required by the current industry. The course I teach is centered on three areas of study: theory, practice, and individual design, and might serve as a model academic courses in game studies that analyze what games are now, and what they might become in the future.

The first thing students in my course are surprised to learn is that there is as computer game theory, and that they will have to read. From Huizinga to the most recent offerings in the ongoing argument, about the effects of violent games on children, the students are exposed to a wide range of writing. We look at classic science fiction stories, interactive narrative theory, articles on character and level design, soundscapes and sound effects, artificial intelligence, and internet fan sites about common game clichés, including “The One Hundred Things I’ll Never Do If I Become an Evil Overlord” (http://www.eviloverlord.com/lists/overlord.html) and “The Grand List of Console RPG Clichés” (http://project-apollo.net/text/rpg.htnl). I use Rouse’s *Game Design: Theory and Practice* as a foundational text to cover most of the basics of computer game design, the insightful interviews with working game designers and the suggested structure for writing design documentation.

By the second half of the semester, the course moves past the “hows” of design and our discussion gets well into the “whys,” covering as many issues as deeply as possible: implied morality and violence, game addiction, socialization and politics in persistent world design, games that cover current events, educational gaming, serious gaming, crossovers between games and other media, and the structure of the game industry itself. Firsthand analysis of current breakthrough titles as well as seriously flawed releases is just as important for analysis, and although many of my students are familiar with a particular type of game, few have ventured outside their chosen genre. By the end of the course, students have a wider understanding of theory and the structure of all types of games, and the problems and issues inherent in each.

Once students are familiar with game theory and analysis, they need to put their ideas into practice as literally as possible. When I took the course myself a few years ago, it was taught by Tom Hall, who with John Carmack and John Romero created the breakthrough game *Doom* (1993). At the end of that course, those of us who were interested met one weekend and attempted to build a working prototype of an original computer game in forty-eight hours, using a 2D tile-set and engine from the Monkeystone title *Hyperspace Delivery Boy!* (2002). In terms of educational value, those forty-eight hours were more instructive than every lecture that came beforehand. Unfortunately, very few people in the class chose to take part in the exercise, and it came so late in the semester that there was no time for a postmortem or evaluation of the experience.

In my course, I have expanded the design weekend to more closely match the students’ progress over the course of the semester. This past fall, my class of thirty students modified the *Unreal Tournament 2004* engine to create a top-down shooter called *Pyramid Scheme*, which included original, student-designed levels, weapons, and enemies. This semester, the class will be modifying the *Halflife 2* (2004) engine to create a prototype game over three separate design weekends, working from a scenario that was randomly generated by the class as a whole. This prototype will be presented at the department's Spring Arts Festival. I have also dedicated class time to game development, as many students are unable to participate in extracurricular weekends and would otherwise miss out on this hands-on experience.

One of the most important lessons learned in the development weekends is the limitation of speed. Designing even a prototype computer game in forty-eight hours is no easy task, and when time is of the essence it is very tempting to stick with familiar, even cliché approaches to design, particularly level and character design. It is difficult enough to create a seamless, challenging, and above all entertaining experience for someone else; creating a substantially original and unique experience can feel impossible. While these weekends might seem discouraging, I believe that each of my students is capable of creating and fleshing out an original, interesting, even groundbreaking game if given the chance. To that end, each student finishes the course by completing a design document for a new computer game of his or her own invention. This document contains all the specifications for actual game development, everything from interface menus and item lists to the level progression and flow (although for our purposes, the length and size is shortened, as actual design documents can be hundreds of pages long). In principle, this document should merge the ideal, "holy grail" game, culled from theory and analysis, with the practical development process, experienced in the design weekends. For me, this document is the true focus of the course, as it crystallizes all the ideas, theories, problems, and desires each student has about current games while encouraging them to stretch the game medium as much as possible. Students are given the chance to design without the physical limitations of cost, experience, and limited creative control, allowing them to take artistic leaps of faith that commercial game development companies are unwilling to risk.

Sometimes, however, the opportunity to think creatively is not enough. While imitation may be the sincerest form of flattery, it can be extremely counterproductive in a game development course. Many students are tempted to write a "new game plus," simply delineating the structure of their favorite game and adding one or two superficial changes. To encourage more innovative design, I assign the document with specific limitations meant to undermine students' dependence on rehashed, worn-out game ideas. In the fall, students were required to design games that depended on a technology that did not exist, encouraging them to invent unique and interesting new ways for players to interact with digital game systems. Holographic projections, motion-detecting body suits, true artificial intelligence, dream-affected games, and fully-interactive mobile technology were a few of the new technologies my students included, changing the ways even the simplest games were played. This semester, the students are allowed current commercial software, but have been denied clichés; their design must follow a set of rules encouraging new gameplay developments, and discouraging such overused devices as coincidental portals to Hell, Tolkien-based races and classes, elemental magic systems, and anything even remotely related to saving the world. As an assignment, the design document is meant to be more than the culmination of a course. Some of my students are already a part of the game industry, and more will find their way there, as beta testers, programmers, artists, or even designers. Regardless of how close or far they are from the bottom of the heap, they will have the seeds of at least one innovative game in them, which will help them not only to succeed in the industry, but possibly to begin changing it.

Janet Murray's *Hamlet on the Holodeck* maintains that computer games, like most forms of digital media, are in an incunabular state, products of a technology that is still well within its infancy (28). However, the medium will not stay in its infancy for long. Technologically, games are maturing so fast that simply training students to enter the current industry does them a disservice; every six months, it seems, graphics are more detailed, physics engines are more realistic, and players are able to affect more and more of the game world. Gameplay, on the other hand, has mostly remained the same. Players are still casting spells, killing monsters, and exploring worlds that are high in entertainment value but low in meaning and worthwhile content. Meanwhile, the amount of published research on game studies from both industry developers and academics continues to grow—and while little of it is reflected in the current commercial industry at large, an academic course in game design should take advantage of as much of this research as possible. As the next generation of game designers, creative directors, and studio heads, students need to see that there is more to game design than fast cars and flashy deaths, and more to game studies than learning how to pander to a particular demographic. Perhaps the commercial game industry is not ready for adult or serious games, games for the thinking person, but academia most certainly is. I believe the course that I teach, while certainly not the only structural model, can serve as an example for other programs in game studies to introduce the idea of serious, artistic games to students. A single course cannot change the system, but it might change a few students, who hopefully years from now will understand that it takes more than programming to build a worthwhile game, and that breaking into the game industry is not nearly as much fun as changing it.

Works Cited

Huizinga, Johan. Homo Ludens: *A Study of the Play Element in Culture*. Boston: Beacon Press, 1971.

Murray, Janet H. *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. Cambridge: MIT Press, 2001.

Rouse, Richard. *Game Design: Theory and Practice*. 2nd Ed. Plano, TX: Wordware Publishing, 2004.

The Generation Gap: Bridging Learners and Educators

Linda L. Baer, Minnesota State Colleges and Universities

No matter what the generation, there is likely to be a gap between learners and educators. Learners and educators often have different styles within the classroom, including those that hinge upon introversion and extroversion, as well as varying levels of comfort with informational abstraction. Many educators today perceive a gap between their technological expertise and that of their students. Children raised with computers think differently than those raised without. The challenge for educators and educational institutions is to incorporate the tools and media of the information-age to maximize the learning opportunities for today's learners.

Research on children who have grown up with video games indicates that game technology changes the way they think. Kids play the most games between the ages of five and fifteen, often averaging 13 hours a week. This is also the age when the basic neural pathways of the brain are being formed (Beck and Wade 1), and extensive brain research shows that long term experience and use of games and other digital technologies alters the brain—a phenomenon known as "neuroplasticity."

In this article, I will describe the characteristics of what seems to be a new generation of learners, that is, those who have grown up with video games and other digital technologies. Given the different life experiences between the Next Generation learners and the Baby Boomers who represent the majority of educators, a potential paradox of learning styles and preferences has developed. I will explore these differences, and discuss the role games and simulations can play in learning environments. I will conclude by calling for a new model of learning.

Characteristics of this generation

There is a new generation of learners. Drolly called the "Millennials" or "Net Generation," they were born after 1982 and exhibit many learning characteristics that are different than previous generations of students. As Diana Oblinger notes, "these students' attitudes and aptitudes have been shaped by technology and the media rich environment" ("The Next Generation of Educational Engagement"). Millennials are, in part, products of the World Wide Web, mobile devices, instant messaging, online communities, and, of course, video games. By comparison, Baby Boomers were raised on television, typewriters, and communication by memos.

According to a recent study by The Pew Internet & American Life Project, Millenials continue to game, even after they enter college. According to the 2003 study, seventy percent of college students surveyed reported playing video, computer or online games at least once in awhile, while sixty-five percent reported being regular or occasional game players (Jones). As Mark Prensky explains, however, this time spent gaming has not been wasted:

> Since their earliest years the workers now coming in to our schools and companies have solved daily mysteries (*Blue Clues, Sherlock Holmes*); built and run cities (*Sim City*), theme parks (*Roller Coaster Tycoon*), and businesses (*Zillionaire, CEO,*

> *Risky Business, Start-Up*); built civilizations from the ground up (*Civilization, Age of Empires*); piloted countless airplanes, helicopters and tanks (Microsoft's *Flight Simulator, Apache, Abrams M-1*); fought close hand-to-hand combat (*Doom, Quake, Unreal Tournament*); and conducted strategic warfare (*Warcraft, Command and Conquer*)—not once or twice, but over and over and over again, for countless hours, weeks and months until they were really good at it. (*Digital Game-Based Learning 38*)

Academics are just now starting to try to harness this kind of "stealth learning."

The paradox of learning in the 21st century

One way to understand the potential generation gap between educators and learners is to view the difference between "digital natives" and "digital immigrants." Members of the Net Generation are digital natives, that is, they are born into a culture that speaks the digital language of computers. Digital immigrants, by contrast, are those to whom computer-ese is foreign. As the chart below suggests, the differences in characteristics present a potential generation gap in education and learning.

Immigrants	Natives
Conventional Speed	Twitch speed
Linear processing	Parallel processing
Step-by-step	Random access
Text first	Graphics first
Work-oriented	Play-oriented
Stand-alone	Connected
Patience	Payoff
Technology as foe	Technology as friend
Reality	Fantasy
Passive	Active

Table 1. Ten Ways the Games Generation is Different (Prensky 52).

These differences set the stage for discussions about how the Net Generation operates, learns, and lives today. The Net Generation is keyed to immediate responses supported by access to multiple media devices. They operate in parallel contexts, multitasking in several venues at once. Many in this generation talk on the phone while online, and listen to the radio or CDs while sending instant messages. The Net Generation is also "play-oriented," meaning they have extensive experience with computer games. Play actually becomes work for many in this generation; they expect active environments and respond more to graphic or visual portrayals of material (Prensky 51-65).

Oblinger takes Prensky's digital native/digital immigrant model a step further, transposing it onto students and faculty.

Faculty	Students
Single task	Multi-task
Text	Pictures, sounds, video
Logical sequencing	Random access
Independent & individual	Interactive & networked
Disciplined	Engaging
Deliberate	Spontaneous

Table 2. Comparison of student and faculty characteristics (Adapted from Oblinger, "Next Generation Learner")

Oblinger asserts that if educators can better understand the learning styles and preferences of their students, they can better devise appropriate teaching styles and learning environments. Ultimately, says Oblinger, it is not about whether you are a digital native but whether you can adapt to those whose style does not match your own.

Bridging the Gap

To bridge the potential generation gap, educators need to develop new learning tools, and in essence see teaching and learning in new ways. Indeed, "today's students are no longer the people our educational system was designed to teach" (Prensky 2001). As a result, many faculty are starting to consider using games to enhance their courses. Bransford and Schwartz have studied a number of courses that incorporate challenge-based environments that are game-like in nature ("Rethinking Transfer"). They argue such environments increase attentiveness and help students learn how to operate as real-world professionals. According to Bransford:

> Classrooms tend to be much less interactive than games and simulations. This limits students' abilities to receive feedback and revise their thinking – a critical part of the learning process. By the time students realize they need to revise their thinking, the class has already moved on to another topic. Yet much of learning involves opportunities to engage in increasingly complex, just-manageable difficulties, and games are built on that kind of structure. Games offer the self-pacing and feedback that make the student want to go back and master the experience. In fact, a key benefit of gaming lies in acquiring massive amounts of time on task. (Rickart and Oblinger, 2003)

Foreman agrees, noting that

> learning through performance requires active discovery, analysis, interpretation, problem-solving, memory, and physical activity and results in the sort of extensive cognitive processing that deeply roots learning in a well-developed neural network. (14)

He argues that technologies that can support such immersive learning environments are converging and maturing in the mass market and the feasibility of using them in higher education is increasing. A critical component of maximizing the potential of learning through games is the connection to sound learning pedagogy. In order to consider games as potential learning environments, the design, structure and practice of games must have useful parallels to sound pedagogy. Oblinger offers the following comparison:

Principles	Description	Application in Games
Individualization	Learning is tailored to the needs of the individual	Games adapt to the level of the individual
Feedback	Immediate and contextual feedback improves learning and reduces uncertainty	Games provide immediate and conceptualized feedback
Active learning	Leaning should engage the learner in active discovery and construction of new knowledge	Games provide an active environment which leads to discovery
Motivation	Students are motivated when presented with meaningful and rewarding activities	Games engage users for hours of engagement in pursuit of a goal
Social	Learning is a social and participatory process	Games can be played with others (e.g. multiplayer games) or involved communities of users interested in the same game
Scaffolding	Learners are gradually challenged with greater levels of difficulty in a progression that allows them to be successful in incremental steps	Games are built with multiple levels; players cannot move to a higher level until competence is displayed at the current level
Transfer	Learners develop the ability to transfer learning from one situation to another	Games allow users to transfer information from an existing context to a novel one
Assessment	Individuals have the opportunity to assess their own learning and/or compare it to that of others	Games allow users to evaluate their skill and compare themselves to others

Table 3. Some principles of good pedagogy and parallels in a game environment (Oblinger 14).

As the table suggests, the benefits of games in educational settings are multiple: motivation, engagement, critical thinking, scenario development, and risk taking. Games can build on an individual's existing capacity, and in a more customizable way, move the learner to next levels of learning as appropriate:

Learning through performance requires active discovery, analysis, interpretation, problem-solving, memory and physical activity which results in the sort of extensive cognitive processing that deeply roots learning in a well-developed neural network. One of the limitations of many learning situations is that they stimulate rote learning or learning that cannot be applied to new situations. The learning-by-doing approach of games encourages transfer to future learning activities–or life. (Oblinger 9)

In this knowledge age, more employers are calling for more skills and competencies in higher order critical thinking, communications, and technology. Games and simulations can provide learners with opportunities to explore decision making and the consequences in a less risky environment.

A Call for a New Model of Learning

Higher education needs to heed the call for a new learning ecology where educators understand the life experiences of today's students and incorporate these understandings into more personalized learning opportunities. Technology is at a level where scholars can meet students' learning styles, and capture the powerful imagination within all learners. Among the tools in this "new learning ecology" as John Seely Brown calls it, are educational games and simulations. However, scholars need to develop a deeper understanding of how games can allow educators to move away from lectures, test taking, and classrooms into fun, immersive interactive learning environments. The problem is that

> to move educational gaming to the next level will require hard work and a real commitment of resources. It will require strong collaboration between educators and game designers. It is of critical importance to realize that games and simulations will not substitute of all traditional learning practices. Research continues to refine the thinking of where the uses of games and simulations are best aligned with targeted learning environments and needs. (Squire and Jenkins 30)

The incorporation of games into the learning environment will require commitment, focus, resources and a realistic assessment of the current structure of education. Squire and Jenkins relate that

> using games to create rich learning environments in schools may mean changing the "game" of school itself so that routinized knowledge of facts or higher performance on standardized tests are not the ultimate end goal. Instead, students' ability to participate in complex social practices; learn new knowledge; and perform well in novel, changing situations needs to be considered valuable learning. (31)

Games and simulations are one way to teach this Net Generation in their own language. Games can present content in ways that were previously unavailable, thus facilitating new understandings of traditional and new learning materials, creating innovative avenues for research and assessment, and energizing discussions about the future of higher education.

Works Cited

Beck, John C. and Mitchell Wade. "The Generation Lap: Video Games Put the Young Way Ahead." *Boston.com*. January 2, 2005. *The Boston Globe*. 20 Feb. <2005 http://www.boston.com/ae/games/articles/2005/01/01/the_generation_lap?mode=PF>.

Bransford, John D. and Daniel Schwartz. “Rethinking Transfer: A Simple Proposal with Multiple Implications.” *Review of Research in Education 24* (1999): 61-100.

Brown, John Seely. “Growing Up Digital: How the Web Changes Work, Education, and the Ways People Learn.” *USDLA Journal* 16.2 (February 2002). 20 Feb. 2005 <http://www.usdla.org/html/journal/FEB02_Issue/article01.html>.

Foreman, Joel. “Next Generation Educational Technology versus the Lecture.” *EDUCAUSE Review* (July/August 2003): 12–22.

Jones, Steve. “Let the Games Begin: Game Technology and Entertainment Among College Students.” *Pew Internet & American Life Project* (July 6, 2003). 20 Feb. 2005 <http://www.pewinternet.org/reprot_display.asp?r=93>.

Oblinger, Diana. “The Next Generation of Educational Engagement.” *Journal of Interactive Media in Education 8*. May 2004. JIME. 20 Feb. 2005 <http://www-jime.open.ac.uk>.

—–. “Next Generation Learner.” *National Learning Infrastructure Initiative Spring Board Meeting*. *MS-PowerPoint* presentation. 20 Feb. 2005 <http://www.nwacc.org/conferences/2004_Spring_Board_mtg?oblinger.pdf>.

Prensky, Marc. “Digital Natives, Digital Immigrants.” *On the Horizon*. NCB University Press 9. No. 5, October 2001.

—–. *Digital Game-Based Learning*. New York: McGraw-Hill, 2001.

Squire, Kurt and Henry Jenkins. “Harnessing the Power of Games in Education.” *Insight 3* (2003). 20 Feb. 2005 <http://www.ael.org/snaps/inSight%5F3%2D1%5Fvision%2Epdf>.

Rickart, Wendy and Diana Oblinger. “Microsoft Higher Education Leaders Symposium: Unlocking the Potential of Gaming Technology.” Redmond, Washington. September, 2003.

Teaching Media Culture with Computer Games

Judd Ethan Ruggill, University of Arizona
Ryan Moeller, Utah State University
Bryan Pearce, Pearcing Sounds, Ltd.
Ken S. McAllister, University of Arizona

Introduction

A common complaint among those who teach in wired classrooms is that students often become immersed in games of *MS-Solitaire* or *Minesweeper* instead of their class work. Pew Senior Research Fellow Steve Jones' recent report found, in fact, that 32% of the college students he surveyed (sample size=1,162) "admitted playing games that were not part of the instructional activities during classes" (2). Despite students' best efforts to hide their play, in-class gaming is rarely clandestine; the phenomenon is easily detectable from across the room by the "game glaze" on players' faces. The intensity and ubiquity of this play, as well as the proliferation of personal computers, cell phones, PDAs and other gaming devices in college classrooms, prompted us to ask how we might use games to our pedagogical advantage. This article describes several strategies we have developed over the past several years for teaching media culture—that is, teaching students about the socio-cultural, economic and ideological elements of the mass media—with the most recent addition to the media stable, computer games.

Despite the fact that computer game development is still relatively immature, at least as an art form (cf. Rollins & Morris 261-66; Koster), games are already exceptional educational tools. They simulate, borrow from and hybridize the rich media sensorium of modern life into engaging, immersive, interactive environments. What makes the game experience unique from other mediated experiences—and thus a powerful heuristic—is its kinesthesis. Gaming requires players to use their bodies as well as their minds to help create and advance narratives by performing specific yet changeable actions. While all media prompt their audiences to think and feel, games prepare players for a future and then make them *do* something to enact that future: investigate a particular area, draw a weapon, jump over an obstacle, and so on. That games often impel such actions awkwardly—a clear sign of the medium's nascence—is a boon for teachers because it helps make visible the mechanisms of technical, cultural, economic, and ideological representation that are normally elided in more mature media such as film, television and radio.

Though computer games have thus far developed into a predominantly visual medium, it is a medium that nonetheless relies on a variety of other elements to create meaning. These elements, or "prompts" as we will call them because they prompt players to act and react, may be ambient, mood-based or even directly connected to players' kinesthetic choices. We have found that sound and interface prompts are especially useful in teaching students about media culture.

Sound Prompts

Game sound refers to every audible aspect of a game, from the tinny electronic theme of *Galaga* (1981) and the symphonic scoring of *The Lord of the Rings: The Two Towers* (2002), to the droplets of water echoing through the mines in *Red Faction* (2001) and the great humming dynamos in *Half-Life* (1998), to Abe's monkish chants in *Munch's Oddysee* (2001) and the air-slicing "whoosh" of a bloody butcher knife in *Alice* (2000). Game sounds dramatically enrich and vivify the visual landscapes and action sequences they accompany. Creating unique and innovative sonic environments is among the most complex and difficult tasks in game development, and game sound innovation is what becomes mass media convention. It is now commonplace for composers such as Michiko Naruke, Michael McCuistion and Bill Brown to have their game-based musical scores released on CD, performed live by major orchestras, and even excerpted for use in advertisements and casino slot machines.

Among the pedagogical opportunities listening to games afford is that in today's media-driven culture, people depend on sound prompts to make everyday decisions—how to feel, what to think, and even what to do. Games expose the power of these prompts by reducing decisions to "play behaviors"; game sounds sometimes elicit expectation (e.g. when the background music is punctuated by a driving, ominous drumbeat) and other times motivate action (e.g. when the distant wail of a banshee causes a player-character to unsheathe her sword). When games are riveting, funny, scary, or thought-provoking, they inspire hour upon hour of connection between game and gamer, a connection founded largely on sound prompts. Film, television and radio too utilize sound prompts, but do so in a way that prompts reaction rather than action. By asking students to actively listen to game sound, media studies teachers can help students uncover how sounds motivate responses within gameplay, and by extension how similar techniques are used in other, less kinesthetic media. This is key to understanding the importance of sound in the construction of mass media artifacts, and thus denaturalizing the effects of sound in old and new media alike.

A variation of this pedagogical technique can be employed to help students interrogate their knowledge of how sounds "mean." Several recent games derive their gameplay specifically from audio prompts. *Rez* (2001), *Mad Maestro* (2002), and *Amplitude* (2003), for example, all encourage players to integrate action (e.g. pressing button combinations on the controller, performing complex steps on a dance pad, etc.) with culturally conditioned understandings of rhythm, chord structure, and musical arrangement. When asked to play these games, students realize that although they know what a song "should" sound like, they are at a loss to explain the source of this knowledge. By structuring game play around multi-tracking, audio mixing and other elements of music creation, audio-centric games serve as interactive laboratories that familiarize students with the tools and lexicon to explain how music works theoretically as well as to inspire moods, memories, and actions.

Despite remarkable developments in computer technology and game design over the last thirty years, games are still noticeably "unrealistic." They do not yet approach the photorealism of film and television. One of the ways game developers have sought to address this lack of "realism" is through the use of digital sound. As extremely life-like elements of an interactive world that is so obviously artificial, digital-quality game sounds stand out and are therefore readily interpretable by students as intentionally placed devices designed to elicit particular player responses. Listening to games such as *Tropico* (2001) or *Prince of Persia* (2003), both of which have distinctive and distinctively stereotyped music and linguistic accents, provides a rich opportunity for teachers and students to deconstruct the sonic bath of contemporary media culture.

Interface Prompts

Sound prompts would be largely ineffective if players were unable to respond to them. Gaming requires human/computer interaction, and game controllers, keyboards, light guns, cameras, dance pads and other interface devices facilitate that interaction. In addition to allowing input, game interfaces also prompt input through the industrial and mechanical design of game systems themselves. Gaming thus requires a form of literacy. To play, one must not only be able to interpret a game's prompts, but respond to them in the game system's language.

Game literacy comes at a cost, however: game developers must balance the unique elements they create against a standardized interface that allows players to learn games easily. The three major console systems—PlayStation 2 (PS2), GameCube and Xbox—have nearly identical controllers, and most PC games use a standard key map for player input. Coin-operated arcade games likewise tend to use control layouts that differ little from machine to machine, and handheld game devices (e.g., PSP, Game Boy Advance, N-Gage, Tapwave Zodiac) rarely require players to make radical readjustments in the way they interface with different games. Input variations in games are usually akin to idiomatical differences within the more or less universal language that constitutes game interface design. PS2 players can adapt to the different controllers of the Microsoft and Nintendo consoles, while players of *Neverwinter Nights* (2003) will similarly find themselves quickly comfortable with games such as *.hack/Infection* (2002) and *Xenosaga* (2002) despite slight interface differences. This is not to say that any game interface is inherently intuitive. Rather, once a player learns the "language" of one system, that knowledge makes it easy to adapt to another.

As a consequence of the need for game play to be unique (in order to entice players) and standard (to facilitate ease of use), players frequently become trapped by their level of interface literacy and struggle when their fluency does not match developers' designs. Developers, on the other hand (the most innovative ones, at least), feel similarly trapped by established interface literacy standards, standards that naturally constrain aesthetic, narrative and thematic design choices. And yet, both players and developers benefit from these standards because they prompt a range of well-established behaviors almost intuitively among practiced gamers, a phenomenon that maximizes the fluidity between real and game experiences (cf. Rouse, 401-2; Rollings and Adams, 4-8; Bates 32-33, 56). This interface literacy provides an excellent starting point for teachers interested in showing students how media culture often stimulates particular and premeditated behaviors.

There are other ways to examine interface prompts, as well. In recent years, game controllers have become noticeably active in the way they prompt player behaviors. "Force feedback" controllers, for example, give players tactile cues that something is happening in the game. As with sound, these cues can elicit expectation (e.g. the controller rumbles in *Ghost Recon* (2001) as tanks roll through nearby streets) or motivate action (e.g. the joystick goes slack after players pilot an A-10 into a stall in *Jane's USAF* (2000)). These kinds of kinesthetic experiences, mediated by the controller interface, prompt players in immediate ways about changes in the game environment and their role within it. Interface prompts, then, facilitate game narrativity and—when done well—heighten players' sense of immersion. Here again, though, the kinesthetic prompts conveyed by "DualShock Controllers," "Rumble Force Pads," and "Trance Vibrators" facilitate immersive experiences only after players have developed the literacy to make sense of the prompts. The awkward stage that leads to this literacy is a nuisance to developers but can be a boon to media educators.

Interface prompts are also clearly evident in the industrial design of game system housings. The colors, shapes and logos of game consoles and peripherals reveal a great deal about players, their desires and how these desires are manufactured and marketed. Nintendo's Game Boy and GameCube, for example, are sold in a variety of colors designed to evoke a sense of magic, fantasy and wonder in the youth market (e.g. "Glacier," "Flame," etc.). Other systems are geared toward older audiences: Alienware's computers come in such enigmatic colors as "Conspiracy Blue" and "Alien Green," while the Sony PS2 and Microsoft Xbox are dressed in the matte black that appeals to image-conscious teens and young adults. These prompts are not intended to elicit gaming responses so much as consumer responses. Among the best examples of this kind of prompt is the X-Arcade controller, a massive, expensive piece of equipment that allows home gamers to play on a full-size coin-op arcade panel. This interface is specifically marketed to gamers who long to play the arcade games they grew up on in the coin-op heyday of the 1980s and early 90s. The X-Arcade controller, in other words, prompts not just play behaviors, but nostalgia, another powerful media trope that students can readily connect to such trends as feature-length movie remakes of old television shows (*Starsky & Hutch*; *Scooby Doo*; *Shaft*) and retro-look television programs and movies such as *That '70s Show* and *Austin Powers: International Man of Mystery*.

Conclusion

Researchers have long recognized that games—electronic and otherwise—are at some level always educational. Dutch historian Johan Huizinga argues, for example, that play is not merely an important element of civilization, but that "civilization arises and unfolds in and as play" (i). Culture, in other words, "arises in the form of play" and play is "almost completely hidden behind [all] cultural phenomena" (46-7). Media theorist Marshall McLuhan likewise takes the relationship between education and play as self-evident, brusquely noting that "Anyone who makes a distinction between games and education clearly does not know the first thing about either one" (149). Games teach people social skills, enhance their mental processes, and develop their physical prowess, all without players' conscious awareness (cf. Phillips, et al.; Sakamoto; Thomas and Macredie; Malone; Malone and Lepper; Rivers). In short, games perform edificatory work in ways that are both fun and transparent.

Computer games are a particularly rich instructional resource, and not just because of the ways game sounds and interfaces prompt action and learning. Computer game developers are well-known for their attention to detail in modeling such things as architecture, geo-physical phenomena, economic systems, philosophical approaches, social interactions, and historical events. Games such as *True Crime: Streets of L.A.* (2003), *Medal of Honor: Rising Sun*

(2003), and *Spider-Man 2* (2004) rely on precise measurements—geological surveys, photographs, and GPS data among other sources—to render buildings and cityscapes as close to scale as possible. Computer games also draw on numerous media metaphors and analogies, from transition cinematics that emulate Vietnam-era frontline reportage, to cel-shaded graphics that index old cartoons and comic books. Such astounding levels of technical and intertextual detail provide teachers with an array of thought provoking entry points for helping students learn about media culture.

Some Tips for Getting Started

The best way to begin using computer games in the classroom is to first identify your pedagogical objectives. What specifically about the mass media and media culture do you want to teach your students? Second, play some games. If you are not sure which games to play, check out internet game sites such as http://mobygames.com (a searchable database of thousands of games), http://gamasutra.com (a website for game developers), and http://www.gamespot.com (a website full of information on computer games and gamer culture). Once you have played a range of games, return to your list of pedagogical objectives and begin to make connections between them and your play experiences. You may find it helpful to remind yourself that computer games are not just interactive movies or hypersensory board games, but unique media.

In addition to the general suggestions above, here are some practical tips for your foray into game studies:

1. Pre-owned game software and hardware can be purchased at greatly reduced prices at used bookstores, video stores, and through online auctions.
2. Contact your system or computer lab administrator regarding technical needs and complications that could arise from the game(s) you select.
3. Look over articles in http://gamestudies.org, http://www.digra.org, and http://ludology.org for other prompts and ways of thinking about games.
4. Visit http://gametrailers.com, http://machinima.com, and http://gamemusic.com for a look at the peripheral industries and cultures generated by computer games, as well as examples of the convergence of games with other media.
5. See http://www.mesmernet.org/lgi for more detailed information on using games in the classroom, on building educational games, and on game studies in general.

Ultimately, let fun as well as pedagogy be your guide. As we say in the Learning Games Initiative, “game to learn, game to teach.”

Acknowledgements

The authors are grateful to Melanie Sethney and her family for providing the space for the 2003 Academic Game Summit where this article was drafted. Many thanks also to Caren Deming, whose feedback was invaluable during the preparation of this manuscript.

Works Cited

Bates, Bob. *Game Design: The Art & Business of Creating Games*. Indianapolis, IN: Premier Press, Inc., 2001.

Huizinga, Johan. *Homo Ludens: A Study of the Play Elements in Culture*. Originally published: 1938. Boston: Beacon, 1986.

Jones, Steve. "Let the Games Begin: Game Technology and Entertainment Among College Students." *Pew Internet & American Life Project*. July 6, 2003. 7/1/2004. <http://www.pewinternet.org/pdfs/ PIP_College_ Gaming_Reporta.pdf>.

Koster, Raph. "Video Games and Online Worlds as Art." GIGnews.com. July 2, 2004. Get In the Game: News, Interviews, Inside Information, and More for Game Industry Professionals. 7/1/2004. <http://www.gignews.com/raph1.htm>.

Malone, Thomas W. "Heuristics for Designing Enjoyable User Interfaces: Lessons from Computer Games." *Human Factors in Computer Systems*. Ed. J. C. Thomas and M. L. Schneider. Norwood, NJ: blex, 1984.

Malone, Thomas W., and Mark R. Lepper. "Making Learning Fun: A Taxonomy of Intrinsic Motivations for Learning." Aptitude, Learning, and Instruction Iii: *Cognitive and Affective Process Analysis*. Ed. R. E. Snow and M. J. Farr. Hillsdale, NJ: Erlbaum, 1987.

McLuhan, Marshall, and Quentin Fiore. *War and Peace in the Global Village*. New York: Bantam, 1968.

Phillips, Carol A., Susan Rolls, Andrew Rouse, and Mark Griffiths. "Home Video Game Playing in School Children: A Study of Incidence and Patterns of Play." *Journal of Adolescence 18* (1995): 687-91.

Rollings, Andrew, and Ernest Adams. *On Game Design*. Indianapolis, IN: New Riders, 2003.

Rivers, Rod. "The Role of Games and Cognitive Models in the Understanding of Complex Dynamic Systems." *Human Computer Interaction-- Proceedings of Interact* '90. Ed. Dan Diaper, David J. Gilmore, Gilbert Cockton, and Brian Shackel. North Holland: Elsevier, 1990. 87-92.

Sakamoto, Akira. "Video Game Use and the Development of Sociocognitive Abilities in Children: Three Surveys of Elementary School Students." *Journal of Applied Social Psychology* 24.1 (1994): 21-42

Thomas, Peter, and Robert Macredie. "Games and the Design of Human-Computer Interfaces." *ETTI* 31, 2 (1994): 134-142.

Asking What Is Possible: The Georgia Tech Approach to Game Research and Education

Ian Bogost, Michael Mateas, Janet Murray, and Michael Nitsche
Georgia Institute of Technology

Game Studies is a new field of education and research, and occupies many disciplinary territories within the academy. At Georgia Tech, as at other institutions, games are a subject of serious investigation in multiple academic units. Unlike many other places, however, Georgia Tech has a group of practitioner/theorists of digital media all in a single academic unit: the School of Literature, Communication, and Culture (LCC), which offers one of the first Ph.D.'s in Digital Media, as well as one of the oldest related academic MS degrees, in Information Design and Technology. In addition, LCC faculty participate in the interdisciplinary GVU Center with digital media faculty in Computer Science, Architecture, Psychology, and Systems Engineering, and offer a new joint bachelor's degree in Computational Media with Computer Science, and a joint MS degree in Human Computer Interaction with Computer Science and Psychology. Game Design is a field of concentration within all of these degrees from B.S. to M.S. to Ph.D.

The approach to Game Design within the Georgia Tech Digital Media programs emphasizes the expressive potential of games as a new genre for art, entertainment, and information design. Will Wright, the developer of *Sim City 2000* (1993) and *The Sims* (2000), calls games "a prosthesis for the imagination," similar to eyeglasses or a hearing aid. The practitioner/theorists in our program feel similarly that games can shape experience and represent the world in ways that go beyond our current capacities. Our approach is historical in that we link videogames with older traditions of gaming and cultural expression. It is also practically and critically engaged with the current gaming environment; we provide students with the skills to work in the games industry and help them to find internships and full-time jobs with game companies. We study games as media texts and critique them from multiple perspectives. Most importantly, however, we are engaged in exploring new forms of gameplay, in bringing greater computational power and greater expressive breadth to the practice of game design.

The Academic Landscape

Emerging academic games programs fall into two main categories: Game Production and Game Studies. The first is oriented toward feeding the industry; it values an understanding of the skills and processes that game developers and publishers rely on to bring games to market. This is not an insignificant enterprise; bringing commercial, AAA title games from concept to retail is a daunting task. The largest games demand teams of over 200 professionals working sometimes unreasonable hours to complete a project on deadline. Game Production programs are typically very conscientious in building their ties with industry, seeking detailed and up-to-date information about current practices and relying on industry executives to inform their curricula—or in some cases even to teach their students.

While Game Production programs provide the worthwhile and important service of training skilled workers, they necessarily must reinforce the current practices of the industry. Indeed, the success of a Game Production program lies in how well it understands and responds to the industry's needs. The best programs insert themselves into one or more major studios' practices in order to get first-hand knowledge of their particular processes. Such attention to detail creates valuable opportunities for post-graduation employment, but risks turning an institution of higher learning into little more than a head shop for a fast-growing, rapidly changing industry. If the fit is too narrow and the program too short-sighted in serving the immediate hiring needs, its graduates may find their skills losing value when the needs of the industry shift in response to new technologies.

Game Studies programs, on the other hand, are oriented toward analyzing the current game landscape in a variety of traditional disciplinary contexts. They are often interdisciplinary associations of scholars from multiple parts of the university, such as English, Design, Film, Communications, Industrial Design, and Art History. Such programs are usually research oriented and theoretical. This is the domain of the humanities and social sciences, which strive to engender fundamental approaches to questions of human experience that transcend peculiar fads. The name "Game Studies" provides legitimacy (we're not playing games or making anything commercial: we're studying here), an interdisciplinary umbrella (not a single mode of study but several) and aligns the enterprise with earlier critical fields such as American Studies, Film Studies, Women's Studies, and Afro-American Studies.

We at Georgia Tech want to challenge both of these categories. If the Game Production programs rally around the cry "You play games, now learn to make them"; and if the Game Studies programs declare, "You play games, now learn to study them," then we might respond, "You must make games to study them, and you must study games to make them."

Unlike trade schools, whose job it is to train for immediately marketable skills, it has long been recognized that the role of the modern university is to provide a place for what Immanual Kant identified in *Conflict of the Faculties* (which served as the blueprint for the University of Berlin) as both the "high" and "low" faculties. The high faculties such as medicine, law, and theology serve external ends. The low faculties such as philosophy and literature include "historical" and "pure rational knowledge." Contemporary philosopher Mark C. Taylor marks this distinction as the basis for the contemporary division between professional schools and schools of the "arts and sciences." The two fundamental assumptions of the modern university's low faculties are those adopted by Wilhelm von Humboldt, the founder of the University of Berlin: *Wissenschaft* (the pursuit of knowledge) and *Bildung* (educational development), which together refer to the disinterested pursuit of broadening knowledge, of knowledge for its own sake. Taylor argues that this assumption is the foundation of contemporary satisfaction with a concept of the university that is over two centuries old. As Bill Readings puts it in his influential work, *The University in Ruins*: "Thought is non-productive labor, and hence does not show up as such on balance sheets except as waste." The pursuit of learning for its own sake, which as Readings notes, also served the nationalist political and ideological agendas of the nineteenth and twentieth century, is increasingly challenged by the political and ideological agendas of twenty-first century globalization. In a landscape of competing cultural values, academics are hard-pressed to identify which bodies of knowledge are intrinsically worthy of study, and which methodologies represent disinterested pursuit.

The split in the landscape of game education between Production and Study reflects this philosophical split in the modern university, inscribed at the birth of modern curricula at the end of the 18th century. For those who want to defend the values of the liberal university, engagement with industry is a form of corruption. For those who are identified with the traditions of professional education, the discourse of the liberal arts can seem like a quagmire of useless bickering. The commercial success of digital games, the violence and sexism of much of the content, and, of course, the essential frivolity of games intensify the anxiety surrounding the emergence of games as part of academic curricula, making it more likely that the split between studying games and producing games will widen.

Engineering schools, such as MIT and Georgia Tech, founded in the mid-nineteenth century, inherit the traditions of the modern university, but offer a third approach: the prioritizing of invention. The practice of engineering, as Henry Petroski has most eloquently pointed out, is not the mere application of an existing body of knowledge to a practical purpose. Engineering is invention, the bringing into the world of something that was not there before; the creation of new knowledge through the discipline of making things.

As practitioner/theorists of Game Design at an Institute of Technology, we recognize all three traditional functions of the university: the service to the needs of the outside world through the articulation of clear professional practices, the protection of the search for knowledge from the pursuit of the immediately useful, and the experimental, iterative, disciplined exploration of possibilities through making things. We also recognize a fourth avenue of exploration, which is the artistic exploration of materials for their own sake and for the sake of their pure expressive power. We think of computation itself as an expressive material, and digital media research as an aesthetic as well as technical practice.

The Georgia Tech Approach

The Georgia Tech approach to Games, like our approach to Digital Media, combines practice and theory. By practice we do not mean just production skills but a craft practice anchored in long-term principles of design, and aimed at exploring the expressive boundaries of digital games.

Like programs focused on Game Studies, we are research-oriented. In our case, however, we see research questions arising from the intersection of theory and practice. In our work, critical practice is a form of investigation that generates theory, and theoretical investigation is often focused through practical implementation. Like Game Production programs, and unlike most Game Studies programs, we actively foster relationships with major game studios and publishers. However, we do so not to reinforce their current needs and current practices. Instead, we foster a forward-looking conversation to build a critical, sustained investigation into the question: what do games do, and what can they become?

In setting ourselves this question we are asserting that we do not believe that the answer will come from the evolving practices of the game industry itself, or even from the game design practices of the most forward-thinking, artistically experimental independent game designers, though we are intensely interested and often admiring of these product-oriented practices. Research is its own practice, with its own disinterested goals. It focuses on long-term knowledge, not short-term products. Research is based on a time span beyond what is needed to develop a single game, and on shared, collaborative resources beyond any single individual's practice. It rests upon the collective definition and clarification of the terms of investigation.

The game industry currently does not believe in "game research." You're either working on a shippable product, or you're doing nothing. Shipability implies minimizing risk; minimizing risk implies minimizing innovation. However, there are regions of design space that cannot be reached incrementally. That is, there exist new game genres, like interactive drama, that cannot be invented through a sequence of incremental, shippable products. Trying to reach one of these distant regions of design space through an incremental series of shippable products is like trying to get to the moon by climbing trees. When you climb a tree it does get you closer to the moon. As your tree-climbing skills improve you can climb even taller trees. No matter how good your tree climbing skills are, however, only a radically different approach, like building a rocket, will get you to the moon. Of course, the first few times you build a rocket, it will explode on the launch pad, or dive into the ocean, but if no one builds rockets, then nobody gets to go to the moon.

Academic programs such as Georgia Tech's are an ideal home for long term game research that invents game genres, and often, along the way, solves hard, first-class technical problems. In this style of research there is by necessity a feedback loop between design and technology; design suggests new directions for technical research, while new engines and infrastructures suggest new directions for design.

Here are some examples of the research questions of faculty in our program, illustrating the focus on long-term questions and on creating knowledge by making things.

Ian Bogost: Procedural Rhetoric

For the most part, videogames have been confined to the realm of entertainment. Industry products and revenues are often compared to the Hollywood film industry. The industry's organizing body, the Entertainment Software Association (ESA), even brands itself as a lobbying group for entertainment.

Such an attitude toward videogames makes a fundamental assumption: that the purpose of games is for leisure, with fun as a first principle. As an expressive medium in their own right, there is no reason videogames need to elicit one and only one response. Emerging fields of games strive to do more than simply be fun: they want to make a point, share knowledge, and change opinions. Including genres such as advergaming, newsgaming, political games, and educational games, I collectively call these "videogames with an agenda." To create such games, we must ask some fundamental questions about the medium in general.

Videogames play an increasingly major role in our social experience. Even though the commercial game industry has sometimes fought to segregate games from any role of social responsibility, as human artifacts they are unavoidably bound up in ideology. We need to investigate the ways in which games affect and alter people's perceptions about the world. Central to this process is an understanding of *procedural rhetoric*—the way that a videogame embodies ideology in its computational structure. By understanding how games embody rhetoric in their rules, we not only gain a critical vantage point on videogame artifacts, but also we can begin to consider how to design games whose primary purpose is to editorialize, teach, and make political statements.

Michael Mateas: Expressive AI

Artificial Intelligence (AI) is commonly understood as the quest to endow machines with human-level intelligence, and to understand human intelligence through the construction of computational models. Such work often focuses on rational problem-solving and efficient task accomplishment as the essence of intelligence, as if this is all there is to being human. AI can be recast, however, as a *representational practice*, one that takes AI as a procedurally intensive medium for the creation of interactive art and entertainment. When recast in this way, the fundamental technical research goals of AI change. The research focus shifts to the creation of systems and architectures that combine authorial control with the generative capability to respond autonomously to player interaction. Additionally, new interactive art and entertainment experiences are enabled that would be impossible to conceive of or build unless making art in the context of an AI research practice. I call this simultaneous engagement in AI research and art making *expressive AI*.

In the context of videogames, my expressive AI work focuses on believable agents and interactive drama. Believable agents are autonomous characters with rich personalities, emotions and social interactions. Unlike characters in contemporary games, which typically exhibit only a small range of canned, repetitive responses to player interaction, believable agents have their own goals and desires, change and grow in response to the entire history of interaction with a player, and express their personalities through all of their actions. In an interactive drama, the player enters a story world in which the evolving storyline is deeply influenced by her interaction—not through sparse (and typically fairly obvious) branch points, but rather through the entire detailed history of her interaction. Narratives in contemporary games are typically either tightly structured, cohesive, but non-interactive stories communicated as a linear sequence of cut-scenes "unlocked" through gameplay, or loosely structured, episodic micro-stories that emerge out of the details of gameplay. Work in interactive drama seeks to create deeply interactive, tightly structured, globally cohesive stories. Believable agents and interactive drama illustrate the feedback loop between AI research and design practice; procedurally intensive AI techniques open up experiences that are impossible to create otherwise (i.e. manual authoring approaches suffer from exponential blowup), while novel and deep AI research questions arise that wouldn't be posed otherwise.

Janet Murray: Replay Story Worlds

One of the most compelling qualities of digital games is replay. In computer games, we can walk through the same situation over and over again making different choices. We can go on the same quest as different characters with different strengths and weaknesses. We can save the game, try something that gets us killed, resurrect ourselves by returning to the saved state, and try again. This affordance is pleasurable. It lets us see things with enhanced cognitive power. We can see a complex situation in multiple instantiations, run through all the possible outcomes, and juxtapose them in our mind. The structure of games—which limits our moves (e.g., limiting the set of tokens and establishing rules for what they can do), focuses us on a limited set of parameters (e.g., our state relative to that of our opponent), and provides some way of calibrating one outcome against another (e.g., a score, a winning condition) that helps us to keep multiple possibilities in our mind.

Games, like stories, are ancient forms of human communication, connected to the earliest human experiences of culture-making and part of our basic cognitive apparatus for making sense of the world. The advent of digital technology is driving a fusion of story and game, from both sides. From *Grand Theft Auto* (1997) and *The Sims* in the game world, to gamelike and interactive television experiences such as *Survivor* and *American Idol*, popular entertainment is exploring the merger of game structures with story structures. The promise of this fusion lies in the added ability it gives us to imagine the world as a set of alternate choices, alternate perspectives, alternate destinies.

A university-based research program on story-games can identify the strategies of gaming and storytelling that link digital games to the larger traditions of human culture. It explore the unique affordances of the digital medium for expanding the repertoire of game and story patterns, and for maximizing the intersection of stories and games. These are the premises of my research, which is focused on the power of replay, a game-like quality that is now available for storytelling, and on the interfaces, interaction patterns, data structures, procedural strategies, and narrative strategies that support and enhance replay. By studying replay in existing games and creating story and game worlds that invite and reward replay, we expand the representational power of the digital medium, and expand our cognitive and imaginative reach, our sense of the depth of human experience and the possibilities of human relatedness.

Michael Nitsche: Experimental Game Spaces

Videogames let us participate in predominantly audio-visual spectacles. Sound and moving images generate specific game spaces—these game spaces are the core of my interest in games research. They present us with fascinating challenges that continue from the earliest prophecies of Cyberspace such as our “reading” of these spaces, the notion of “place-ness” in virtual worlds, and the principles of effective design of game worlds.

I believe that these questions are closely interconnected with two fundamental issues of videogames: one being the presentation of virtual space as always mediated through the computer; the second includes the notion of structured interactive access to these environments. Consequently, I am interested in effective moving image work and sound design for game spaces, as well as in the ways we interact with these environments when playing games and their responsiveness to our actions. From this perspective, my work tackles the wider questions that include “place-ness,” understanding, and design. In order to develop the potential of videogames, any work in this area needs an experimental part that sidesteps the limitations of commercial game development. We cannot limit ourselves to the analysis of existing game spaces, but instead have to encourage the creation of new possibilities in this area. That is why my courses, as well as my own research, always include practical experiments.

Curriculum and Student Work

The curriculum of the Georgia Tech Digital Media programs reflects our commitment to the integration of media traditions with digital technology, theory with practice, and the pursuit of knowledge through the discipline of making things. The core courses of the undergraduate and graduate programs integrate critical reading and writing with the creation and critique of digital artifacts. A key text across the curriculum is the *New Media Reader*, edited by Noah Wardrip-Fruin and Nick Montfort, which includes computational pioneers with innovators in the interactive arts.

The introductory course in Computational Media, for example, surveys the achievements of pioneers such as Vannevar Bush and Joseph Weizenbaum, and engages students in making interactive spaces and Eliza-like characters. Michael Mateas defines the core computational course at the graduate level, Computing as an Expressive Medium, such that it includes expressive projects like these two:

- *Display the progress of time in a non-traditional way.* The goal of this project is to start students thinking about the procedural generation of imagery as well as responsiveness to input, in this case both the system clock, and potentially, mouse input.
- *Create your own drawing tool, emphasizing algorithmic generation/modification/ manipulation*. The students in this course have all had experience with tools such as *Photoshop, Premier or Director*. The goal of this project is to explore the notion of a tool. Tools are not neutral, but rather bear the marks of the historical process of their creation, literally encoding the biases, dreams, and political realities of its creators, offering affordances for some interactions while making other interactions difficult or impossible to perform or even conceive. While the ability to program does not bring absolute freedom (you can never step outside of culture, and of course programming languages are themselves tools embedded in culture), it does open up a region of free play, allowing the artist to climb up and down the dizzying tower of abstraction and encode her own biases, dreams and political realities.

These courses are part of a larger commitment to finding ways to teach what Mateas has identified as procedural literacy, which is essential to everyone engaged in digital media, and especially in game design. Just as literary scholars would not dream of reading translated glosses of a work instead of reading the full work in its original language, so game scholars and game designers must read code, not just at the simple level of primitive operations and control flow, but at the level of the procedural rhetoric, aesthetics, and poetics encoded in a work. We do not believe in teaching a narrow facility with particular tools, although our students also learn all of the usual applications for 2D, 3D, web design, database, and video work. Instead, we emphasize computational structures and the computational methodology of abstraction so that students learn to think in the language of the medium.

We also require that students study visual culture, graphic design, moving images, information design, and interaction design. We offer electives in legacy media and in multiple genres of digital media including Experimental Media, Expressive Virtual Spaces, Interactive Narrative, and Mixed Reality Environments. We have multiple game-specific courses at the undergraduate and graduate level, including Game Design as a Cultural Practice, Game AI, and

Game Programming. We continue to refine and expand these offerings. Although our graduate students serve a required internship and our undergraduates are in demand as well, we do not believe in sending students to game companies as a substitute for a curriculum. We are focused on giving them a breadth and depth of learning that will equip them for a career that will see many changes in technologies and techniques, but a continued need for an understanding of the underlying principles of digital design.

Student work within the program is both directed and autonomous. At the graduate level, the Project Studio course, required of all students, involves them in faculty-directed research projects that have a past and a future, ensuring that even those students who are only in the program for the two years of Masters Study get experience in well-formed research questions and sophisticated practices of investigation. Project Studios involve a wide range of technologies, from interactive television to augmented or virtual reality. Several of them focus on game design, game spaces, and interactive storytelling. Some project studio groups include undergraduate researchers, a practice we expect to expand as our Computational Media B.S. degree, inaugurated in Fall 2004, grows.

In addition, graduate students are required to conceive and execute an original project or to write a single-authored masters thesis. This gives them the opportunity to explore design questions in depth. Among the notable recent masters theses were Gonzalo Frasca's on "Videogames of the Oppressed,"[3] and Chaim Gingold's "Miniature Gardens and Magic Crayons: Games, Spaces, World."[4] Both of these theses link the creation of actual games and authoring environments with a theoretical perspective on what games are and could be. Gingold's thesis is a significant model of the productive relationship between the games industry and a university. Gingold worked as an intern for Will Wright at Maxis, between his first and second year of graduate school, and Wright, the designer of Sim City and The Sims, served as one of the readers on his thesis. Although the issues Gingold was grappling with echoed some of Wright's concerns, the thesis had no commercial value to Maxis. It was part of a common effort to think through questions of game structure and procedural authorship.

The Experimental Game Lab

Because the study of games involves multiple faculty members and students at the undergraduate, masters, and Ph.D. level, and because one must play and make games in an atmosphere that supports serious investigation, Georgia Tech established the Experimental Game Lab, founded and currently directed by Michael Mateas.[5] Here is its mission statement:

> The Experimental Game Lab explores the frontiers of gaming. In this interdisciplinary lab, computer scientists, designers and artists work together to push the boundaries of existing genres and create new genres of electronic games. To accomplish this mission, the EGL pursues three interwoven strands:
>
> • novel game designs that create new player experiences;
> • new technologies, particularly AI technologies, that enable previously impossible designs;
> • investigations of how games function as a medium, including social, cultural and representational aspects of games. While we're excited by all the activity and energy in the game scene, we're impatient with the current state-of-the-art and eager to see the future of

gaming. At the EGL we're helping to create that future.

The EGL is a home for many game-related activities in the department, including the weekly EGL Seminar. Each week a student presents a different game, and leads a group discussion on the analysis and design questions related to the game. It is also home to the Game Ontology Project, which is aimed at describing the design space of games by identifying the abstract commonalities and differences in design elements across a wide range of concrete examples, clarifying what is meant by the common language used to describe games, terms such as “level,” “shooting,” “game world,” etc. The Game Ontology Project is part of the larger enterprise of articulating a common language for critical discourse about games. The need for a more precise and expressive design language is a recognized need of the professional game design community, and one of the most important ways in which academia and industry can learn from one another (cf. Murray’s “The More We Talk”).

Future Issues

As we write this, we are in the spring semester of 2005, about two-thirds of the way through a year that has brought the inauguration of a new undergraduate program in Computational Media and a new Ph.D. program in Digital Media. Several members of the faculty are writing text books as they teach, and teaching courses that have never been offered before at Georgia Tech or anywhere else. As we grow and seek to hire new faculty members, we face the problem that there are no other programs producing Ph.D.s in this field, and we cannot train our own students fast enough to hire them. We feel a bit alone at the edge of a frontier, a heady feeling coupled with exhaustion and disorientation. We expect this situation to change drastically over the next five years, and to discover more and more neighbors. As programs in digital media and games proliferate, we hope that the Georgia Tech program can serve as a useful model, and we look forward to learning from the experiences of others.

In other parts of the academy, study and practice are sadly closed off from one another. Film Production is often divorced from Film Study, Art Studio from Art History, Writing from Literature. Such divisions weaken both sides. Because of the power of digital media itself, which lets us organize and present information with more flexibility and power, we have an opportunity to avoid these divisions in Digital Media programs. We can aim at producing students who are procedurally literate, visually literate, and literate in print culture. Since we, who are teaching in the field, were all trained in narrower traditional disciplines, perhaps the first step in doing so is to turn to our colleagues not merely to form interdisciplinary teams, but to explore more deeply what we can learn from one another.

Works Cited

Frasca, Gonzalo. “Videogames of the Oppressed.” Masters Thesis. 2001. Georgia Institute of Technology. 19 Feb. 2005 <http://www.ludology.org/articles/thesis>.

Gingold, Chaim. “Miniature Gardens & Magic Crayons: Games, Spaces, and Worlds.” Masters Thesis. 2003. Georgia Institute of Technology. 19 Feb. 2005 <http://www.slackworks.com/~cog/writing/thesis>.

Kant, Immanuel. *The Conflict of the Faculties*. Mary J. Gregor, trans. Omaha: University of Nebraska Press, 1992.

Mateas, Michael. “Expressive AI: Games and Artificial Intelligence.” In *Proceedings of Level Up: Digital Games Research Conference*. Utrecht, Netherlands: University of Utrecht, 2003.

Mateas, Michael and Phoebe Sengers, eds. *Narrative Intelligence*. Amsterdam: John Benjamins, 2003.

Mateas, Michael and Andrew Stern. “Beyond Finite State Machines. A Language for Authoring Higher-Level Character Behavior.” Paper presented at the 2004 Game Developers Conference in San Jose, CA.

Murray, Janet H. “Is There a Story-Game?” In *First Person: New Media as Story, Performance, and Game*. P. Harrington and N. Wardrip-Fruin, eds. Cambridge, MA: MIT Press, 2003.

“The More We Talk, the Smarter We Get: The Conversation Between Game Designers and Researchers.” *IGDA Journal* (June 2003). 19 Feb. 2005 <http://www.igda.org/columns/ivorytower/ivory_Jun03.php>.

Hamlet on the Holodeck: The Future of Narrative in Cyberspace. New York: Simon & Schuster/Free Press, 1997.

Petroski, Henry. *The Pencil*. New York: Knopf, 1990.

Readings, Bill. The *University in Ruins*. Cambridge, MA: Harvard University Press, 1996.

Taylor, Mark C. *The Moment of Complexity: Emerging Network Culture*. Chicago: University of Chicago Press, 2003.

Endnotes

1 See, for example, Mateas and Sengers; Mateas; and Mateas and Stern.

2 To read more about the relationship between play and narrative, see Murray (1997) and Murray (2003).

3 Available at http://www.ludology.org/articles/thesis.

4 Available at http://www.slackworks.com/~cog/writing/thesis.

5 For more on the EGL, please visit http://egl.gatech.edu.

'Modding' Education: Engaging Today's Learners

Nora Paul, University of Minnesota
Kathleen A. Hansen, University of Minnesota
Matt Taylor, Dunwoody College of Technology

Educators are poised to fail the next generation of learners. Students are showing educators by their entertainment choices and information seeking behaviors (and sources) the way they want to learn and engage with media. There is now, and will continue to be, a dissonance between the ways current and coming generations of learners *prefer* to learn, and the tools used to teach them.

The Pew Center for Internet & American Life recently confirmed what parents and teachers know from observation—game playing is a common and consuming activity for the majority of college students. A 2003 Pew study reported that all of the respondents had played a computer or console game, 70% said they played "at least once in a while," and 65% described themselves as regular or occasional game players (Jones 2). The study also found that:

- Students integrate gaming into their day, taking time between classes to play a game, play a game while visiting friends or instant messaging, or play games as a brief distraction from writing papers or doing other work;
- Close to half (48%) of college student gamers agreed that gaming keeps them from studying "some" or "a lot." In addition, about one in ten (9%) admitted that their main motivation for playing games was to avoid studying;
- One third (32%) of students surveyed admitted playing games that were not part of instructional activities during classes. (Jones)

These data make it clear that college students live comfortably within game environments. It is essential, therefore, that educators explore how these immersive media experiences can be harnessed in the creation of educational tools for the next and even more media-savvy generation of learners.

Games in Education

Video and computer games have been around for more than thirty years. However, scholars have focused most of their attention on the social, psychological, and physiological consequences of game playing (see research summarized in MediaScope). The educational potential of interactive games and simulations for college-age students has been largely ignored until recently.

Making games with the level of sophistication in design and function that game players have come to expect is difficult, time-consuming, and expensive. Game developers spend years getting some of the most commercially successful (and heavily played) titles published, but few of these games could be classified as strictly educational or seen as having value in the classroom. The lack of marketability of "educational games" provides little incentive for game publishers to create them. According to the Entertainment Software Association, educational game sales make up only seven percent of the software market for console games, and computer titles have yet to generate enough sales to even be ranked (King).

In *What Video Games Have to Teach Us About Learning and Literacy*, James Gee describes ways games could aid educational engagement and effectiveness. He discusses the ideas of:

- Just-in-Time Learning: games can provide the opportunity to learn something and immediately apply it within a scenario;
- Empowering Learners: games can allow learners to take on a new identities and, though experimentation with new roles, better learn concepts;
- Problem-Solving: building expertise by creating 'pleasantly frustrating' experiences, gamers learn to apply critical thinking processes to problem solving. (Gee)

His thinking has provided the rationale for developing a vanguard of information-rich game experiences for university-level learning.

Kurt Squire and his colleagues in the Comparative Media Studies Department at the Massachusetts Institute of Technology are among the emerging voices examining the educational possibilities of gaming. Squire and other educators argue that computer simulations can be powerful tools for learning because they:

- Allow learners to manipulate otherwise unalterable variables (as in *SimEarth*, 1991)
- Enable students to view phenomena from new perspectives (as in *Hidden Agenda*, 1989)
- Enable students to observe systems behavior over time (as in *Civilization III*, 2001)
- Allow students to pose hypothetical questions (as in *Antietam*, 1999)
- Encourage students to compare simulations with their understanding of a system.

In the past, educators interested in testing the potential of complex game environments for educating and engaging students with "serious" material were frustrated. They rarely had the time, money, or talent to create such games. Over the past several years, however, professional game developers have made available to consumers the tools to modify game environments. This development in the marketing of game technology has spawned a number of experiments in creating educationally-rich gaming experiences. The potential to quickly and cost-effectively create tailored, scenario-based educational tools that reinforce both informational content and problem-solving processes for specific courses or education tasks has been inspiring educators from a variety of disciplines.

Let the Games Begin

At the University of Advancing Technology in Tempe, Arizona, students are using modification toolsets and level editor software from games such as *Starcraft* (1999), *Unreal* (2002), *Battlefield 1942* (2002), and *Age of Mythology* (2002) to create new game scenarios (University of Advancing Technology). At the Digital Media Collaboratory at the University of Texas, Austin, faculty, staff, and students have started a "Games for Learning" project:

> "From massive multiplayer game environments to complex response algorithms that generate dynamic interactive experiences, the game industry's tools and techniques are applied to create engaging and adaptive training content." (Digital Media Collaboratory)

At MIT's Education Arcade, developers are creating an American history game called *Revolution* using the *Aurora Neverwinter Toolset* bundled with the role-playing game *Neverwinter Nights* (2002). Their ambitious project involves not only populating the game with characters and interactions appropriate to learning more about revolutionary-era America, but also re-drawing the current medieval era setting of the game to reflect period buildings, environments, and costumes (Education Arcade).

A somewhat less ambitious but still complex simulation is being developed at the University of Minnesota. The project goal is to create an educational simulation in support of a class on information gathering for communicators. In collaboration with the Institute for New Media Studies' Game Research and Virtual Environment Lab, the School of Journalism and Mass Communication, and Dunwoody College of Technology, the goal is to demonstrate that commercial off-the-shelf software can be modified for specific learning goals. We believe that the greatest potential for creating engaging educational simulations is to team content experts with software development experts to create interactive educational simulation experiences. The modification tools provided by many off-the-shelf games allow educators to create a rich graphical space with complex functions at a fraction of the cost and time commitment necessary to create a simulation from scratch.

To this end, we are building a journalistic reporting simulation using the *Aurora Neverwinter Toolset* that will be used as a learning supplement for a course entitled Information for Mass Communication. The set-up, involving a railroad accident resulting in an anhydrous ammonia spill and evacuation, will require the player/reporter to move through the stages of the "information strategy model" that is at the core of the course's textbook, *Behind the Message: Information Strategies for Communicators* (Hansen and Paul). These stages—analyzing the message task, identifying potential contributors, selecting methods for gleaning information, evaluating and selecting the gathered information, synthesizing the information, crafting the message—will be reflected and reinforced in the simulation.

The course in which this simulation will be used is designed to expand the range of information sources that journalism students consider when approaching a message task. The simulation will require students to carefully define the focus of their story, use a variety of print and electronic information sources in the news library before they leave the newsroom, and then go out and conduct interviews with a large number of characters who represent a wide range of perspectives and institutional agendas. We have already constructed a complex network of possible dialogs between the reporter/player and a cast of characters, all of whose information must be assessed by the reporter/player for its biases, perspectives, and usefulness for the story as it has been defined. The intention is that the student/player will move through a deadline reporting scenario that will simulate the kinds of information gathering experiences a reporter can expect in covering a complex story. Our interest is in discovering whether "playing" through a journalistic information gathering simulation is a valuable reinforcement to the information gathering stages outlined in the book.

Some of the information players will be required to report will be gathered from sources found in the simulation's newsroom library. Other information will be gathered through appropriate interviewing techniques with officials or experts. If the player fails to (1) gather the necessary background information from library sources, (2) identify the appropriate interviewees, or (3) conduct the interview appropriately, the player will not get the required information. The effectiveness of the student's information gathering play will be reflected in the final outcome, a news story written from the information gathered during the simulation. The simulation will generate a "reporter's notebook" with all of the information the player has gathered so students can write their stories "offline" with the material provided during the simulation.

Klabbers argues that games provide a variety of methods for learning. "Rigid-rule games," for example, provide a goal, players receive specific role instructions, and actions are goal-oriented. These types of games are useful for training and assessing managerial skills in business settings. "Free-form games," by contrast, create self-organizing learning environments that show that knowledge is context dependent, which requires players to engage in a process of problem framing as the game proceeds (Klabbers).

The simulation we are developing at the University of Minnesota provides a combination of the characteristics of a rigid-rule game and a free-form game. This ensures that certain situations will be experienced by all players, but that players will have "free will" in selecting information tools to consult and sources to interview. Players will be assigned the role of reporter; and other characters in the simulation will adopt the perspectives a reporter might encounter, in essence representing aspects of a rigid-rule game. For instance, the public relations official from the railroad company whose train has derailed will adopt a perspective designed to protect the railroad company's exposure to liability. The police chief, by comparison, will adopt a public safety stance. The goal of the simulation will be clearly stated—generate enough background information to report the story.

The free-form game aspects of the simulation will include the ways the different non-player characters (NPCs) challenge the player's perceptions of disciplinary knowledge. In other words, players will have to understand how to adjust their information gathering and interviewing strategies as they encounter different perspectives on the accident and its aftermath. The issues that arise in the simulation will stem from the content of the material provided. Thus, students will have the opportunity to examine complex interrelationships in a non-threatening environment that allows them to experiment.

Challenges and Opportunities

One of the great advantages of using a role-playing game such as *Neverwinter Nights* is that the complexity of the game play, interaction with characters, and ability to collect and record information is a part of the existing software. The challenge for us is to re-program some of the play characteristics appropriate for a game which involves killing dragons and finding gold, but not appropriate to a journalism simulation. For example, in an early version of the game, encounters by the player with a group of NPCs always resulted in a mob attack. This obviously needed to be revised. Also, using the medieval setting for a game involving a contemporary issue has required some creative use of game objects (such as the use of medieval buildings to represent a modern town). Some existing hak paks have provided game objects, but others need to be created by working with the software's tile sets.

The biggest challenge so far has been creating the complex dialog trees that are core to the information gathering process we intend to reinforce in the game play. We need to build conversations complex and rich enough to impart information but still have a realistic exchange. One of the powerful features of the *Aurora Neverwinter Toolset* is its capacity to manage multiple layers of exchange among characters based on their preceding actions. Unfortunately, this is not always an easy feature to implement.

Students in the Information for Mass Communication class will have access to the simulation at the beginning of the course with the intention that they will move through the simulation throughout the semester. In nearly 25 years of teaching this course, we know that the information-gathering and assessment process is complex and difficult for students to master piecemeal. Another computer-assisted instruction game that has been used in the course (and evaluated by students) for 21 years has demonstrated that students get a much better grasp of the conceptual skills involved in the information process through the use of a self-contained environment that models a much larger, messier process in the real world. The challenge we face with our new simulation is to reinforce students’ mastery of the skills of (1) defining the information problem, (2) identifying the appropriate information sources (print, electronic and human), and (3) knowing how to evaluate what they find. Students’ work will be assessed through their production of a short news story based on the information they gathered. The built-in tools in the simulation will allow us to see which characters they interact with and what information they place in their notebook.

Reaction to the development of this simulation has been very positive at the university level. The College of Liberal Arts Information Technology Fees committee has provided a grant for development of the concept. Professors in the Educational Psychology department are consulting with us on how to assess the effectiveness of concept acquisition during game play. Perhaps most importantly, students are lining up to help with the input of dialogs that have been scripted for the 28 characters in the simulation.

However, there has been some negative reaction. When discussing this project with a group of students and professors, one of the professors reacted to the fact that students would be required to buy a copy of the *Neverwinter Nights* game for the class. “What if,” he asked, “a student hates to play computer games?” One of the students said, “They make us buy textbooks for a lot more—and I know a lot of students who hate reading books.” Educators seeking to use computer simulations as educational tools need to consider the instructional theory underlying the technology in order to be sure the simulations are accomplishing the desired goals (Reigeluth). In addition, the cross-cultural considerations in designing the simulations are critical to successfully using them in a classroom setting (Morgan).

The potential of modifying off-the-shelf games for educational purposes is exciting, complex, and, as yet, untested. As development of these kinds of “ed-mods” continues, the opportunity for a quick turnaround of game scenarios with course-relevant and compelling information and interactions grows. If the process for building environments, conversation settings, and characters with whom the student must interact becomes more streamlined, there is great opportunity to quickly build special teaching units based on current events or contemporary situations. The challenge is determining when, how, and for whom the use of role-playing simulation scenarios is an effective medium for learning concepts and information. The opportunity is to succeed in engaging the next generation of learners.

Works Cited

Digital Media Collaboratory. January 30, 2005. <http://dmc.ic2.org/projects.php?b=10>.

Education Arcade. January 30, 2005 <http://www.educationarcade.org>.

Gee, James. *What Video Games Have to Teach Us About Learning and Literacy.* New York, NY: Palgrave MacMillan, 2003.

Hansen, Kathleen A. & Nora Paul. *Behind the Message: Information Strategies for Communicators*. Boston, MA: Allyn & Bacon, 2004.

Jones, Steve. "Let the Games Begin: Gaming Technology and Entertainment Among College Students." Washington, DC: Pew Internet & American Life Project, 2003. January 30, 2005 <http://www.pewinternet.org/pdfs/PIP_College_Gaming_Reporta.pdf>.

King, Brad. "Educators Turn to Games for Help." *Wired News*. August 2, 2003. January 30, 2005. <http://www.wired.com/news/games/0,2101,59855,00>.

Klabbers, Jan H.G. "Problem Framing Through Gaming: Learning to Manage Complexity, Uncertainty, and Value Adjustment." *Simulation & Gaming* 27.1 (1996): 74-92.

MediaScope. *The Social Effects of Electronic Interactive Games: An Annotated Bibliography.* Studio City, CA: MediaScope, 1996.

Morgan, Konrad. "Cross-cultural Considerations for Simulation-Based Learning Environments." *Simulation & Gaming 31.4* (2000): 491-508.

Reigeluth, Charles M, ed.. *Instructional-Design Theories and Models Volume II.* Mahwah, NJ: Lawrence Erlbaum Associates, 1999.

Squire, Kurt. "Video Games in Education." *International Journal of Intelligent Simulations and Gaming 2.1* (2003): 49-62. University of Advancing Technology. January 30. 2005 <http://www.gamedegree.com/characters_Projects.asp>.

Preventing Piracy within the Video Game Industry

Ginger Myles, IBM Almaden Research Center

Introduction

According to many analysts, the video game industry generates more revenue than Hollywood each year. However, little public research and attention is directed toward video game piracy. This is not because piracy does not occur, however. The Business Software Alliance (BSA) estimated that in 2003, $29 billion worth of illegal software was installed on computers worldwide, an estimate that does include console games (BSA). If we look specifically at the game industry, in 2004 sales of video games in the U.S. set a record at $7.3 billion (ESA), while the industry lost more than $1.8 billion to global piracy (IIPA). As both the industry and piracy rates continue to grow, game producers and researchers are increasingly interested in addressing the issues surrounding piracy.

The term "video game piracy" covers a variety of different attacks that unfortunately are routinely conducted. These attacks include illegal copying, counterfeiting, and distribution. Preventing piracy is of equal interest to game developers and hardware manufacturers. It is common practice for console producers to sell their devices for a loss and instead draw profit from software sales. In an attempt to prevent piracy, the video game industry has utilized a variety of hardware and software-based protection techniques. These techniques often rely on proprietary information, however once that information is discovered by a pirate, it can be easily exploited to circumvent the protection mechanism. In this article, I will describe both past and present techniques for protecting video games, including the legal aspects of protecting game software through patents and copyright laws. Although no single solution will ever be able to prevent piracy completely, the best chance for protecting the video game industry is to try to devise a combination of software and hardware protection techniques stealthy enough to deter hackers.

Understanding Piracy

The issues associated with video game piracy are not obvious to everyone, which is due in part to the non-exclusionary nature of games. To illustrate, suppose Alice has a copy of a popular game on her computer. Alice can make a copy of the game and give it to Bob so he can play it on his computer. Now both Alice and Bob own copies of the game, which means that the game is non-exclusionary. On the other hand, Alice and Bob's computers are exclusionary objects because only one of them can own each computer at a time. In legal terms, the exclusionary nature of the physical computer makes it clear to whom the property belongs. This is not the case with intellectual property such as video games.

Piracy affects the entire gaming community. The obvious victims are game publishers, however, there are peripheral victims as well. For example, in September of 2003 a significant portion of the source code for *Half-Life 2* (2004) was stolen. The theft occurred prior to the release of the game, and subsequently further delayed the title's release. This delay likely caused graphics card company ATI to lose money. ATI had planned to distribute free versions of the game with their latest graphics cards as a marketing scheme. Since the game was not ready when ATI released their product, they were unable to use it to entice consumers to upgrade. Hardware producers such as ATI rely on video game players to consistently buy the newest, fastest, and most expensive products to play the newest games.

Due to rampant piracy, the video game industry must also contend with retailers who feel a lack of incentive to sell legitimate copies of games. Unscrupulous retailers are able to significantly increase their profit margin by producing and selling illegal copies. While a legitimate copy of a game may cost a retailer $42, they can only competitively sell it for $49—a profit of $7 per unit sold. By contrast, that same retailer could simply buy one hundred blank CDs for $20, and then create one hundred illegal copies of the $42 game, selling each one for $10 to $20 a piece. Such a strategy would not only allow the retailer to more than double her or his per-unit profit margin, but would also likely increase sales volume because consumers would be attracted to the lower prices.

The question of how software should be protected under the law has been debated for many years. For a body of work to be protected under copyright law, it must be original, nonfunctional, and fixed in a tangible medium. In other words, an inventor cannot copyright an idea; s/he can only copyright the tangible expression of that idea. Unfortunately, computer software is not exactly fixed in a tangible medium like literary works, for example. Computer software is written using programming languages that can be easily interpreted by people. To make a program understandable to a computer, the program's source code is compiled to a machine-readable format, which is often called a "binary" or "executable." In 1909, U.S. copyright law was amended to address the newly developed technology of the player piano. The amendment specified that for an idea to be copyrighted, it must be expressed in a form that was visually readable by people. Since the music roll was only readable by the piano, it did not violate the song's copyright. Because software is often distributed in executable format, which is not visually readable by humans, the application of copyright to software is problematical, and originally meant that software was ineligible for copyright protection.

In contrast to copyright, patents are used to protect an invention, which software appears to be. However, a program is also similar to an algorithm, which is a series of steps and thus not typically eligible for patent protection. For many years, it was unclear whether software should be protected by copyright, patent, or trademark, and thus was not protected at all. Today, there are various ways software can be protected under these laws. However, because the application of the laws is inconsistent, it is still unclear whether those protections are viable for software. In addition, since games and other personal computer software run on personal systems (which are not monitored by an external entity), detecting that copyright, patent, and trademark violation is difficult. To aid the enforcement of intellectual property laws, a variety of technology-based solutions have been developed. The goals of these solutions range from making software more difficult to reverse engineer, to enabling the tracing of piracy after it has occurred.

Hardware-Based Prevention Techniques

Historically, the game industry has used a variety of hardware-based techniques in piracy prevention. These techniques typically provide a higher level of protection than software-based techniques; however, they are more cumbersome for the user and more expensive for the software vendor.

A common hardware-based technique used to be the dongle. A dongle is a device distributed with a piece of software, and possession of the device proves ownership. A dongle typically connects to an input/output port and computes the output of a secret function. Periodically, the software queries the dongle. If the result of the query is incorrect, the software reacts by producing incorrect results or causing the program to fail entirely.

Dongles have several drawbacks, one of the most important being cost. Each dongle costs around $10, which increases the per-unit cost of the software it is bundled with. Second, dongles limit innovative distribution techniques. For example, when a game is sold and distributed over the Internet, including a dongle is not feasible. Furthermore, dongles are often "cracked" shortly after they are released. This is generally accomplished by first disassembling a game's code, identifying the calls it makes to the dongle, and then bypassing those calls. Once the dongle's code has been broken, a patch can be distributed so that any user can play the game without the dongle. This is precisely what happened with *Robocop 3* (1992) for the Amiga. The anti-piracy dongle had to be connected to one of the joystick ports for the game to run. A few days after its release in April of 1992, the dongle was cracked.

Another privacy prevention technique is "tamperproof hardware." Tamperproof hardware involves securing a part or parts of the computer's hardware (such as a computer chip) from being observed by a hacker, creating what is called a secure context or secure data storage. Executing software in a secure context prevents a would-be pirate from gaining access to the software's code. This technique prevents the attacker from observing the behavior of the software, which means that s/he cannot identify the right portions of the software to remove. Tamperproof hardware is a feasible protection technique for console-based systems, since a user must purchase a console to even play the game. Tamperproofing is not particularly viable for PC game development, however, because of the additional cost of requiring all PC game users to run the same hardware.

One of the ways hackers violate tamperproof hardware is by "modding" it. Modding is the process of adding special chips to a game console that modifies or disables the console's security mechanisms; this is one of the most popular ways to attack the Xbox and PlayStation2. As a matter of fact, Microsoft has taken action to prevent modded consoles from engaging in Xbox Live online play. When an Xbox Live user logs on, their system is checked for the presence of mod chips. If mod chips are detected, the unit's serial number is recorded, and the device is permanently banned from the network.

Software-Based Prevention Techniques

The success of online games has led to a new set of concerns for the game industry. These concerns revolve around maintaining a fair and consistent gaming environment so that players will participate. If players are able to modify their games—for example, by making their characters immortal—the gaming experience of other players can suffer. One technique that has been explored by researchers and that could be used to aid in the prevention of game modifications is "code obfuscation." Code obfuscation is a technique used to protect a secret in the software's code. The secret can vary from the design of the software, special algorithms embedded within the software, or important data such as cryptographic keys. Obfuscation works by transforming yet preserving the original functionality of software code in order to make it more difficult to read, understand, and reverse engineer. The idea is to make the protected program so difficult to read that it is more costly for the attacker to reverse engineer the program than to simply purchase or recreate it. There are three general classifications of obfuscations:

- Layout obfuscations alter information that is unnecessary to the execution of the application such as identifier names and source code formatting.
- Data obfuscations alter data structures used by the program. For example, a two-dimensional array could be folded into a one-dimensional array.
- Control flow obfuscations are used to disguise the true control flow of the application, for example, by inserting dead or irrelevant code, or merging functions.[1]

The level of protection provided by code obfuscation varies with program size and structure. Additionally, obfuscation increases a program's overhead, which can have adverse effects on performance. Since performance is critical in most video games, the degree to which a game can be obfuscated is probably limited. Furthermore, code obfuscation does not provide complete protection. Given enough time, a determined adversary will be able to "see through" the obfuscation. However, code obfuscation can be used to extend the period of time before the software is pirated. Because the majority of video games have an extremely short shelf life, extending that shelf life would increase profit potential.

One of the real challenges in preventing video game piracy is being able to enforce intellectual property laws. Not only can it be difficult for small game developers to prove authorship if their intellectual property is stolen, but it is also extremely difficult to trace the source of an illegal distribution. Software watermarking makes it possible to address these difficulties (Qu and Potkonjak; Collberg and Thomborson; Stern et al.; Venkatesan et al.; Collberg et al.). Watermarking works to discourage piracy by attaching an identificatory mark to a piece of software. An authorship mark, for example, is embedded in every copy of a given program, and can be used by a developer to prove ownership of pirated software. A fingerprint mark, by contrast, is unique to each copy of a program, and can thus be used to trace a specific act of piracy. Like obfuscation, watermarking functions by transforming a program's code. To illustrate, a very simple watermarking technique would be to add a new variable to a program whose value is a string of characters such as "Copyright 2005, ABC Software Corporation." By embedding this particular authorship mark, a developer would be asserting ownership. A watermark might also be added when a consumer purchases the software. The developer could embed into the software a unique identifier—such as a credit card number—that would effectively fingerprint that particular program. Piracy could be confirmed by proving that a suspected copy is marked with the fingerprint. Of course, in order for watermarking to be a viable form of copy protection, the watermark must be able to ward off a variety of attacks. The simple watermarking technique described above is not robust enough to prevent piracy because an attacker could simply reverse engineer the program and identify and remove the mark.

A common security feature in many video games is the inclusion of a license check. License checks can be used to verify the validity of a game, or to prevent the use of a game after a specific date. Tamperproofing techniques can be used to prevent a dishonest player from removing the license check, though they must be able to detect that the software has been altered, and there must be a mechanism that causes the protected program to fail. For the tamperproofing to be successful, the software failure must be stealthy and not alert the attacker to the location of the failure-inducing code. This can be accomplished by separating the detection and response mechanisms in both space and time (Aucsmith; Chang and Atallah).

Currently, many video game console systems make use of their own proprietary CD or DVD format. When new console systems are released, software for them is written on CD or DVD formats that standard burners cannot copy. For example, the Xbox uses DVD-9 format which is a single-sided, dual layer media format. Nintendo also took this approach with the GameCube, using a unique, smaller-than-normal disc. This type of protection technique is usually effective against the occasional copier, but it is not normally unbreakable for long. In fact, when these sorts of protection mechanisms are broken, it can be fatal to a company. One famous example was the proprietary CD format used by the Sega Dreamcast, GD-ROM. The GD-ROM format was designed so that it could not be copied using standard CD or DVD burners. In 2000, a German hacker group found a back door inside the Dreamcast's mask-ROM BIOS that allowed the Dreamcast to boot from a standard CD-ROM. This hack turned out to be one of the fatal blows that forced Sega out of the console business.

Conclusion

Legal deterrents to piracy, such as patents and copyright laws are only effective when enforceable, and detecting and isolating pirates is very difficult. Most piracy occurs within players' homes, making it extremely costly to investigate and enforce intellectual property laws, and many of the current technological anti-piracy solutions rely on proprietary information that once broken can easily be exploited by all. However, new protection techniques such as fingerprinting promise to identify pirates faster, thereby helping hold hackers accountable for their actions. Piracy is a problem that has plagued the game industry for years. Software watermarking, code obfuscation, and other techniques that do not draw their strength from proprietary information may yet help cure that plague

Endnotes

1 For further details regarding obfuscation techniques, see Collberg, et al. (1998).

Works Cited

Aucsmith, David. "Tamper Resistant Software: An Implementation." Information Hiding Workshop (May 1996): 317-333.

Business Software Alliance (BSA). "First Annual BSA and IDC Global Software Piracy Study." July 2004. BSA. 21 Feb. 2005 <http://www.bsa.org/globalstudy/loader.cfm?url=/commonspot/security/getfile.cfm&pageid=

16947&hitboxdone=yes>.
Chang, Hoi, and Mikhail Atallah. "Protecting Software Code by Guards." Digital Rights Media Workshop (November 2001): 160-175.
Collberg, Christian, Ed Carter, Saumya Debry, Andrew Huntwork, John Kececioglu, Cullen Linn, and Mike Stepp. "Dynamic Path-Based Software Watermarking." *Conference on Programming Language Design and Implementation*. ACM SIGPLAN. Fairmont Hotel, Washington, DC. June 2004.
Collberg, Christian, and Clark Thomborson. "Software Watermarking: Models and Dynamic Embeddings." *Proceedings for the 1999 Symposium on Principles of Programming Languages*. ACM SIGPLAN-SIGACT. Menger Hotel, San Antonio, TX. January 1999. 311-324.
Collberg, Christian, Clark Thomborson, and Douglas Low. "Breaking Abstractions and Unstructuring Data Structures." *Proceedings for the IEEE International Conference on Computer Languages*. IEEE Computer Society. Loyola University, Chicago. May 1998. 28-38.
Entertainment Software Association (ESA). "Computer and Video Game Software Sales Reach Record $7.3 Billion in 2004." January 2005. TheESA.com. 21 Feb. 2005 <http://www.theesa.com/pressroom.html>.
International Intellectual Property Alliance (*IIPA*). "2005 Special 301 Report on Global Copyright Protection and Enforcement." 10 February 2005. Special 301. 21 Feb. 2005.< http://www.iipa.com/special301.html>.
Qu, Gang and Miodrag Potkonjak. "Hiding Signatures in Graph Coloring Solutions." *Proceedings from the 1999 Information Hiding Workshop*. Hotel Elbflorenz, Dresden, Germany. September 1999. 348-367.
Stern, Julian P., Gael Hachez, Francois Koeune, and Jean-Jacques Quisquater. "Robust Object Watermarking: Application to Code." *Proceedings from the 1999 Information Hiding Workshop*. Hotel Elbflorenz, Dresden, Germany. September 1999. 368-378.
Venkatesan, Ramarathnam, Vijay Vazirani, and Saurabh Sinha. "A Graph Theoretic Approach to Software Watermarking." *Proceedings from the 2001 Information Hiding Workshop*. Pittsburg, PA. April 2001. 157-168.

Contributor Bios

Espen Aarseth works as Associate Professor and Principal Researcher at the Center for Computer Games Research at the IT-University of Copenhagen, and also holds an adjunct professorship in Media Studies at the University of Oslo. He is currently working on an ontological understanding of games: what they are, what they are made of, and how they are different from each other. Prior to coming to ITU in 2003, Aarseth was professor at the Department of Humanistic Informatics at the University of Bergen, which he co-founded in 1996. He is also co-founder and Editor-in-Chief of *Gamestudies.org*—the first academic journal of computer game research, and author of *Cybertext: Perspectives on Ergodic Literature* (Johns Hopkins UP 1997), a comparative media theory of games and other aesthetic forms. Email: aarseth@itu.dk

Linda Baer is the Senior Vice Chancellor for Academic and Student Affairs in the Minnesota State Colleges and Universities System. Prior to coming to the Office of the Chancellor, she was the Sr. Vice President for Academic and Student Affairs at Bemidji State University and the Interim President. She has assumed leadership in the state and country in the area of online learning and services, transformational change, and development of partnerships and alliances. Email: Linda.Baer@so.mnscu.edu

Ian Bogost is an academic game researcher and game designer. He is Assistant Professor of Literature Communication and Culture at Georgia Institute of Technology, where his current research interests include videogame criticism (the subject of a forthcoming book, *Unit Operations: An Approach to Videogame Criticism*) and videogame rhetoric (including the function of ideology, politics, advertising, and education in games). Bogost is co-editor (with Gonzalo Frasca) of Water Cooler Games (**www.watercoolergames.org**), a website about videogames with an agenda, and Founding Partner of Persuasive Games, a game studio that designs, builds, and distributes electronic games for persuasion, instruction, and activism. Boogst holds a BA in Comparative Literature and Philosophy from the University of Southern California, and an MA and Ph.D. in Comparative Literature from UCLA. Email: ian.bogost@lcc.gatech.edu

Patrick Burkart is an Assistant Professor of Communication at Texas A&M University. He researches and teaches in the area of telecommunications and media studies. Email: pburkart@tamu.edu

Chris Crawford has been a cutting-edge game designer since he led Atari Games Research in the early 1980s. He has published fourteen games and five books on game design, and founded the Game Developers' Conference. For the last ten years he has been working on a new technology for interactive storytelling.
Email: christophercrawford@direcwway.com

Monica Evans is a Ph.D. student in Arts and Humanities at the University of Texas-Dallas. She earned an M.A. in Arts and Technology there, and a B.A. in Plan II Honors from the University of Texas-Austin. She worked as a project lead on *DIG—The Maya Project*, an educational game developed with the Dallas Museum of Art, and on the interactive narrative *A Teacup Full of Sand*. She has presented at numerous national conferences, and is currently the lead writer and designer for an experimental computer game based on the *Half-Life 2* engine. Email: mevans@utdallas.edu

James Paul Gee is the Tashia Morgridge Professor of Reading at the University of Wisconsin-Madison. He received his Ph.D. in linguistics in 1975 from Stanford University and has published widely in linguistics and education. His book *Sociolinguistics and Literacies* (1990) was one of the founding documents in the formation of the "New Literacies Studies," an interdisciplinary field devoted to studying language, learning, and literacy in an integrated way in the full range of their cognitive, social, and cultural contexts. His book *An Introduction to Discourse Analysis* (1999) brings together his work on a methodology for studying communication in its cultural settings, an approach that has been widely influential over the last two decades. His most recent books both deal with video games, language, and learning. *What Video Games Have to Teach Us About Learning and Literacy* (2003) offers 36 reasons why good video games produce better learning conditions than many of today's schools. *Situated Language and Learning* (2004) places video games within an overall theory of learning and literacy, and shows how they can help us in thinking about the reform of schools. His new book, *Why Video Games Are Good for Your Soul*, shows how good video games marry pleasure and learning and have the capacity to empower people. Email: jgee@education.wisc.edu

Kathleen A. Hansen is Professor in the University of Minnesota School of Journalism and Mass Communication and director of the School's outreach unit, the Minnesota Journalism Center (MJC). In addition to her book with Nora Paul, she is co-author of *Newspapers of Record in a Digital Age* with Shannon E. Martin. As director of the MJC, Hansen has organized numerous professional-development workshops for journalists and news librarians in the U.S. and internationally. Hansen's work has been published in *Journalism and Mass Communication Quarterly*, *Journalism and Mass Communication Educator*, *Newspaper Research Journal*, *Editor and Publisher*, *Library Journal*, and other scholarly and professional publications. Hansen has a Masters degree in Library Science and a Masters degree in English, both from the University of Wisconsin-Madison. Email: k-hans@umn.edu

Henry Lowood is curator for History of Science & Technology Collections at Stanford University and a historian of technology. He has led Stanford's Silicon Valley Archives since its inception. He is also co-principal investigator of "How They Got Game: The History and Culture of Interactive Simulations and Videogames," a project funded by the Stanford Humanities Laboratory. He is co-curator of the Machinima Archive, hosted by the Internet Archive, and his Stanford course—The History of Computer Game Design: Business, Culture, Technology—was one of the first devoted to the history of the medium. Email: lowood@stanford.edu

Cathlena Martin is a Ph.D. student at the University of Florida researching children's literature and new media. She has presented at the Children's Literature Association Conference on celebrity-authored children's literature, at the Southwest/Texas Popular Culture Conference on revisionist Little Red Riding Hood tales, and at the Conference on Modern Critical Approaches to Children's Literature on revisionist and award-winning tales of the Three Little Pigs. She also writes about children's cultural events for the radio program *Recess!* Email: cmartin@english.ufl.edu

Michael Mateas explores the intersection between art and artificial intelligence, forging a new art practice and research discipline called Expressive AI. He is currently a faculty member at the Georgia Institute of Technology, where he holds a joint appointment in the College of Computing and the school of Literature, Communication and Culture. At Georgia Tech, Michael founded the Experimental Game Lab, whose mission is to push the technological and cultural frontiers of computer-based games. With Andrew Stern he developed the interactive drama *Façade*, an AI-based first-person, real-time, interactive story. Michael received his BS in Engineering Physics from the University of the Pacific, his MS in Computer Science from Portland State University, and his Ph.D. in Computer Science from Carnegie Mellon University. Email: michaelm@cc.gatech.edu

Ken S. McAllister is Co-Director of the Learning Games Initiative (**www.mesmernet.org/lgi**) and Associate Professor of Rhetoric, Composition, and the Teaching of English at the University of Arizona. His book *Game Work: Language, Power, and Computer Game Culture* (U. of Alabama Press) investigates the kinds of work games do in society, and outlines a practical method for extending such analyses as the unique medium of the computer game continues to develop. Email: mesmer@u.arizona.edu

Ginger Myles is a research scientist at IBM's Almaden Research Center, and a Ph.D. candidate in Computer Science at the University of Arizona. She received her B.A. in Mathematics from Beloit College in Beloit, Wisconsin, and her M.S. in Computer Science from the University of Arizona. Her research focuses on all aspects of content protection. Email: gmyles@us.ibm.com

Ryan Moeller is Assistant Professor of English at Utah State University where he teaches courses on rhetorical theory, rhetorics of technology and professional communication, and game studies. His research focuses on the rhetoric of consumer electronics and virtual environment prototyping. Email: rylish@english.usu.edu

Janet H. Murray is Professor and Director of Graduate Studies in Digital Media at Georgia Institute of Technology. She holds a Ph.D. in English from Harvard University, is the author of *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*, and is the internationally recognized designer of numerous interactive projects, including, most recently, interactive television applications for PBS and ABC. Murray initiated courses in Interactive Fiction at MIT and Georgia Tech, and a course in Game Design as a Cultural Practice at Georgia Tech. She is currently working on a textbook for MIT Press entitled *Inventing the Medium: A Principled Approach to Interactive Design*. Email: janet.murray@lcc.gatech.edu

Michael Nitsche is Assistant Professor of Literature, Communication, and Culture at Georgia Institute of Technology. Email: Michael.nitsche@lcc.gatech.edu

Nora Paul is the Director of the University of Minnesota School of Journalism and Mass Communication's Institute for New Media Studies, and a former faculty member of the Poynter Institute for Media Studies. She is co-author, with Kathleen A. Hansen, of *Behind the Message: Information Strategies for Communicators* and author of *Computer Assisted Research: A Guide to Tapping Online Information*. She was editor for information services at the *Miami Herald* from 1979-1991. Paul has a Masters degree in Library Science from Texas Women's University. Email: npaul@tc.umn.edu

Bryan Pearce is a professional software developer with Avanade, Inc. He studied computer science and jazz at the University of Kansas. When not in the studio or gigging around town, he composes music for commercial and educational games. Email: wbpearce@hotmail.com

John Reid Perkins-Buzo, O.P. has produced short films, CD-ROMS, DVDs, museum installation pieces and telematic art. He received the Center for Interdisciplinary Research in the Arts (CIRA) Fellowship at Northwestern University (2001), and the Graduate Certificate in Art and Technology from the Center for Art and Technology also at Northwestern University. Perkins-Buzo has a Master of Fine Arts in Film and Media Arts from Northwestern University and a Master of Science in Applied Mathematics/ Computer Science from Oakland University. He is also the Executive Director of Lumen Multimedia Associates in Chicago, a multimedia studio developing materials on spirituality and New Media (**http://www.lumen-media.com**). Email: reid@opfuture.org

Judd Ethan Ruggill teaches for the Department of Media Arts at the University of Arizona. He also co-directs the Learning Games Initiative, an interdisciplinary, inter-institutional research collective that studies, teaches with, and builds computer games. His scholarly work has been published in a variety of books, journals, and periodicals, including *Communication and Critical/Cultural Studies*, *TEXT Technology*, *The Journal of Popular Culture*, and *The Chronicle of Higher Education*. Email: jruggill@email.arizona.edu

Laurie N. Taylor is a Ph.D. candidate at the University of Florida researching video games and interface issues. She has published articles in *Games Studies*, *ImageTexT: Interdisciplinary Comics Studies*, and *Media/Culture*, and has forthcoming articles on video games and visual rhetoric. She has also presented on video games at several conferences, and writes about video games and digital media for the radio program *Recess!* Email: ltaylor@english.ufl.edu

Matt Taylor has worked as a web designer, programmer, corporate trainer, and consultant (at one point, simultaneously). Currently he is a Computer Science Instructor at Dunwoody College of Technology and is the co-manager of the recently founded Twin Cities chapter of the IGDA (International Game Developers Association). He is at work on several educational game projects with the University of Minnesota, the University of St. Thomas, and privately. He is working toward his Masters degree in Software Engineering at the University of St. Thomas. Email: mtaylor@dunwoody.edu

Special Thanks for Cover Design

Jennifer deWinter is a graduate student at the University of Arizona where she studies the mechanisms of ideologies, looking specifically at the importation of Japanese popular culture (such as anime and videogames). She is also the co-project manager and art director of *Aristotle's Assassins*, an educational videogame that is currently being developed by the Learning Games Initiative (LGI) at the University of Arizona.

Aaron McGaffey joined the Learning Games Initiative (LGI) in 2002 as an interested member of the community. He is specifically interested in 3D modeling and computer-human interaction, which he studied at the University of Alberta before graduating in 2001. Additionally, Aaron is concerned with the ethics concerning interpreting and presenting data for decision-making.