

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 Immanuel 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.

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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>.