ArchiGaming: finding the overlap

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Archi-Gaming: Finding the Overlap

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Abstract

In academic settings, students and researchers are often encouraged to participate in interdisciplinary collaboration. In practice, one of the challenges that these groups face is the ostensibly disparate set of expectations of project goals and outcomes. To be successful, collaborators must be both aware and sensitive to these needs of those outside their discipline. One example of such collaboration is the integration of gaming elements into different disciplines, commonly known as *gamification*. This topic is relatively new in academia - as is awarding university degrees in computer game design; the discipline of game design has largely been an investigation within the discipline itself. Likewise, architecture, though much older as a degree-granting discipline, has also used, primarily, conventional architectural projections of orthographic projection and perspective and, more recently, animation. The underlying argument of this paper is that a collaborative, cross-disciplinary approach to a design and presentation project - specifically, architecture and game design - has a synergistic value in the "overlap" or common area of the process and goals of the respective disciplines.

This paper reports the concept, process, and results of a student and faculty university collaborative to explore the potential synergy of digital game design capstone projects and architectural thesis projects. The research intent of the collaboration was two-fold: establishing a process that allowed interdepartmental student and faculty exchange and, more importantly, the manifestation and analysis of a new area where the two disciplines cross-pollinate - what the collaborators referred to as "the overlap". It was this interstitial piece between the two disciplines, the zone of intellectual inquiry and application, that added value to each discipline's goals. The contributions of this paper include an analysis and discussion of this overlap, a description of the process, as well as the collaborative outcome and perceived value of the exercise. The challenges of communication, meeting the goals of each discipline, sharing information, team organization, and workflow between two distinct disciplines are discussed as well. The presentation of this paper will benefit others who desire to advance the knowledge of gamification of applicable aspects of a discipline through a thorough review of a collaborative process with clear articulation of discipline-specific project goals, design of processes, and best practices.

Introduction

It is a natural phenomenon for people to gravitate towards those with similar backgrounds and interests. Like-minded groups typically share the similar ideas, education, terminology, and processes for completing tasks. This behavior is seen in academia as well; as such, faculty research often remains confined within schools or departments while student projects seldom inte-

grate concepts outside of a specific discipline. While within-discipline activities are certainly appropriate, they often limit creativity, constrain the range of possibilities, and fail to expose students to new ways of thinking; over extended periods of time, there is also the potential to create detrimental academic silos.

In contrast, the "real world" requires individuals to apply knowledge to a variety of disciplines outside their area of expertise while working with others with diverse backgrounds. For example, a computer science graduate may find herself developing applications for an insurance company or financial institution; to create such software, she must have at least rudimentary understanding of her employer's business. Similarly, mathematicians can apply their knowledge to other domains, including scientific research or actuarial endeavors. The field of computer game design and development is perhaps one of the best exemplars of the need for cross-discipline collaboration. The production of a computer game requires programmers, artists, sound designers, and businessmen to communicate and work together towards a common goal.

In this paper, we describe a collaborative effort between faculty members and students from two distinct academic units computer game design and architecture - with ostensibly opposing requirements. Specifically, computer game design is focused on the digital code implementation of animation and game logic, whereas architecture deals far more in the physical world of space, form, function and human needs. The goal of this work is the establishment of a process for such collaborations as well as the identification and development of the overlap between these two disciplines. Our contributions include a discussion and analysis of this overlap, the refined process, as well as a description of the initial and long-term challenges that faced both groups.

The Perspective of Architecture

The Architectural Thesis is the last major step toward graduation with a first professional degree from the Architecture Program and our institution. It is composed of three interrelated components, Thesis Prep, Thesis Research and Thesis Studio, all providing an opportunity for the student to explore and investigate a relevant issue in the field of architecture. The process starts as a student enters the last semester of senior year and runs over three semesters. The final two semesters comprise the fifth year of the 5-year, professionally accredited Bachelor of Architecture program. Each component presents the student with different intentions and goals that collectively contribute to the overall Thesis.

Thesis Prep provides a mix of different modes of research and creative interpretation, with the intention of getting the student to learn and think independently and critically. Its goal is to develop an understanding that research is a mode of inquiry that implies not only the gathering of factual information, but also the explanation and interpretation of the implicit and explicit values, conventions and assumptions embedded in the built environment. Thesis Prep guides the student through a process of self-discovery and concludes with the establishment of the Thesis Statement.

The Thesis Research phase of the project involves the construction of a critical context in which the student investigates the ideas established. Its goal is a well-researched, clearly articulated written and illustrated examination of the topic. The research work is intended to develop the

student's individual architectural voice and serve as the intellectual grounding of the project to be undertaken the following semester in the Thesis Studio.

The goal of the Thesis is a demonstration of the Student's ability to apply critical thinking and design research skills to the development of a design solution. The student directs the proposal developing the project as it moves through conceptual, schematic, development and technical stages. Throughout the process the student is required to articulate their findings and ideas with representations and presentations. While the Thesis originates in a determinate intellectual position, it culminates in a designed artifact. Often times these projects set the trajectory for a student's future.

Largely an independent exercise, the Thesis structure allows the student to explore their specific interests and to develop a unique voice. Students who wish can engage in a collaborative exercise with the approval of their faculty advisors. Though those who engage in collaboration do not relinquish any requirements of the Thesis and must fulfill the requirements for graduation.

In general, our research seeks out projects that are place-based with a firm notion of architectural design that can be tested through construction. Though this potential for construction does not inherently lead to pragmatism, it is an understanding or acceptance that the student will try to develop the tectonics or details behind the ideas.

Over the years our interests have focused on projects that have a sense of place or critical regionalism. We encourage specific design responses that answer to the notion of what "makes a place a place" designing in accordance with local conditions (context, materials, technology) and culture (demographics and symbols) so as to make an architecture that is uniquely of its place.

Students pursue design ideas and test design solutions through a series of physical and virtual models. The process is one of discovery. At each stage they are required to document decisions and provide visualization to represent the formal and experiential qualities of their designs. Spatial relationships are typically shown through conventional orthographic projections of plan, section and elevation. For instance the student may develop a floor plan to articulate the circulation patterns within the design while simultaneously illustrating the spatial layout of the program components. The experience of the space may be represented through a series of perspective drawings. Architectural detailing and constructability of the tectonic details are required and developed through drawings and models. The student must show the relationship of building skin or enclosure with structural systems and systems integration. Final design solutions must address the built environment and include some understanding of how the project will integrate into the site and context.

With the heavy use of digital technologies available there has been a real interest in using virtual models as design tools and how these tools establish a predominate position in the realm of creating, documenting and delivering decisions about space and professional communications. Can immersion provide the environment for revealing more about design and design decisions? The collaboration with the game designers provides the opportunity for visualization moving beyond static animation sequences to virtual interaction. Moving from abstract drawings to first person

perspective immersion allows the design and participant alike to engage in the role of discovery or revealing more about the architecture and design decisions.

A successful Thesis Studio investigation must document the design process and demonstrate the evolution of the proposal into a comprehensive and convincing potential reality. Final requirements culminate with a final thesis review and the submission of all research, findings and design documented in a Thesis Book.

Notwithstanding, the technical and procedural aspects involved in successful completion of the Thesis project, its genuine value lies in exploration. The fifth-year, commonly known as the Thesis year is full academic year for students to explore their individual passion for architecture. This goes well beyond stylistic preference and gets at the nexus of the student's intellectual and critical reasoning processes as those relate to physical and virtual design. Students enter the Thesis year with a prerequisite course (Thesis Research) that is focused on discovering what type of Thesis pursuit will be most beneficial to their individual 5th-year effort and will, subsequently, help define them as a young architectural intern in practice, or in graduate school. It really is the first time in the curriculum that students have this degree of freedom. The ability to shape their Thesis year is crucial to the collaborative potential with the Game Design and Development students and instructors.

The Perspective of Gaming

The game development program at our university is taught as an applied form of computer science. In addition to requiring several "core" computer science courses, students are required to complete 14 courses that are specific to game development and gaming algorithms. As a culmination of this coursework, students are required to complete a two-semester sequence of studio and capstone courses in which they exercise their design and development skills through the implementation a full game prototype. Students self-organize into groups, which typically range in size from 1 to 3 members. Groups are encouraged to pursue the genre of gaming they would most prefer to work in professionally. While some students elect to develop mobile and casual (2D) games, a majority choose to work in 3D environments. This likely stems from previous coursework with one or more 3D gaming engines, such as Unity3D or the Unreal Development Kit (UDK). Though some students begin the sequence with preconceived game ideas, many do not and are open-minded about working on various projects. After a concept document is created, students are expected to iterate on the current version of their game each week by identifying high-priority tasks, implementing those modifications in the following week, and presenting them during the next class. Finally, students can choose to continue their game into their second semester (enabling a more comprehensive game to be created) or choose to begin a new project to demonstrate their diverse skillsets.

The Studio and Capstone experience is important to gaming students not only from an academic perspective, but to their careers as well. In addition to a résumé, game developers are often required to show a visually impressive portfolio that provides evidence to future employers of their development skills. Students understand this and therefore take the class seriously. However, they have had notorious difficulties with finding professional-looking assets for their games. While our university contains degrees in new media, few students possess skills in 3D animation.

Previously, the program established relationships with art departments in other universities. However, this process was plagued with problems that were attributed not only to distance, but scheduling conflicts as well (e.g. semesters vs. quarter system). Thus, students resorted to scavenging the Web for models and textures, resulting in a non-cohesive collection of assets for their games. In some cases, students tried creating the assets themselves. Not only did these assets typically look poor, this approach wasted valuable coding and design time and ultimately contributed to a visually unimpressive game and occasionally mediocre game mechanics.

While game developers want to create games that are visually appealing, they prioritize *interactivity* and *entertainment*, and are often willing to sacrifice aesthetics for playability. This can be seen in early game systems, which could not render high-quality graphics while maintaining a reasonable "frames per second" (i.e. how animation is performed); examples of this can be seen in the successful games of the 1980s, including Tetris and Super Mario Bros.. Instead, designers overcame limitations in graphics hardware by designing games that provided immediate feedback and were highly playable. When extrapolating to modern game development, while more polygons might support a visually impressive scene, developers continue to find ways to *reduce* the number of polygons in exchange for an interactive framerate.

Background and Related Work

Though the origin of the term *gamification* is difficult to trace, many believe it was coined in 2002 by the British computer scientist Nick Peller. Since then, the use of the term has increased significantly, but was defined in 2011 as "*the use of game design elements in non-game contexts*".[1] There is also evidence that the term "gamification" was first used by Richard Bartle in his design of MUD (Multi-User Dungeon) as early as 1978.[7] However, in its broadest sense, gamification is simply the use of game-like thinking and elements in situations that are not traditionally approached as games.[5] Gamification has been investigated in a variety of contexts, such as the preservation of historical experiences.[2] It has been used as a way to reduce the overhead cost of teaching the strength of materials.[3] Recently, gamification has been applied socially in a K-6 educational environment.[4] There are a number of game devices such as badges, actions and leaderboards that, deployed properly, can help extrinsically motivate the player or players to understand a problem more clearly. In the case of the Archi-Gaming initiative, gamification provides information, intrigue and familiarity of conventional architectural projection drawings of plans, elevations, sections and perspectives.

Gamification is relatively new to education but has its foundation in American business in the first decade of the twentieth century. In 1910, Kellogg offered a "premium" to customers purchasing two boxes of cereal - the Funny Jungleland Moving-Pictures book. In 1912, Cracker Jack featured "a prize in every box."[6] These, and other similar consumer incentives weren't games, but combining fun, surprise and incentive to repeat the process - even if the process was purchasing - was an important first step in the journey to gamification. More games followed. Car Bingo kept kids quiet on trips while resolving the real-world observation of differing car makes, and the 1960 debut of "The Game of Life" mirrored life events of college, family, mortgages, employment and retirement. These games featured rules, rewards, winners, losers in an entertaining simulation of real-life. These were analog games and, as with prizes in cereal, imagining real events in a game scenario was common.

With the accessibility of the personal computer in the late 1970s and the "edutainment" decade of the 1980s, with computer games such as "The Oregon Trail" and "Where in the World in Carmen Sandiego?" made the digital version of gamification a profit center for the burgeoning gaming industry.[8] 1978 saw the first multi-player game in which the players shared a virtual experience. Primitive by today's measure, a MUD (Multi-User Dungeon), developed by Richard Bartle and Roy Trubshaw of Britain's University of Essex, was a text-based game similar to the genre including "World of Warcraft." Bartle refined the game, now titled MUD1, to include more competitive situations and actions with more tasks available to the players. Bartle coins this "gamification."[7]

The 1990s saw exponential growth of the computer game industry. Sony's first home console, Playstation, debuted in 1994 and sold more than 100 million units over the next decade. A four billion dollar industry in 1990 grew to fifteen billion by 1996. In 2003, gaming was included in the political arena. The Howard Dean presidential campaign commissioned the design of the first well-known U.S. presidential election video game. The game was titled "Howard Dean for Iowa Game" by Persuasive Games. It helped to organize support for the Dean campaign by providing a visualization of grassroots operations. It was estimated that the game was played 100,000 times in the month preceding the election.[8]

Establishment of Collaboration

The idea of collaboration between the Thesis and Game Design students and faculty came about as the result of a conversation between the dean, School of Architecture and Construction Management, and the university's Vice President for Academic Affairs about possible collaborations amongst the university's programs. In fact, it was the VPAA that suggested there was a potential symbiosis between the idea of concept, program, and design in the disciplines of Architecture and Game Design.

Parallel conversations were taking place between the Coordinator of the university's Computer Game Design and Development program, a Thesis studio professor in the Architecture program, and the dean of the school. The conversations seem to always return to alternative possibilities for presenting the physical design information of a 5th year Architecture Thesis project at the university and how that effort could benefit the Computer Game Design and Development students as well as the Architecture Thesis students.

The Architecture Thesis level of studios at the university's Architecture Program allows considerable latitude in project selection and presentation technique and media. Similarly, the university's Computer Game Design and Development program is a Capstone effort executed in the fourth year of the major and encourages innovative design and creative presentation. Ultimately, two faculty instructors from Architecture Thesis, a design instructor and the dean, joined with the coordinator of the Computer Game Design and Development, to develop the concept for the initiative in the summer of 2012. Students from Computer Game Design and Development and Architecture Thesis joined the collaborative in fall 2012.

Since the Architecture Thesis professors had students willing to participate in such a collaborative and the Game Design and Development coordinator was interested in how the Architecture

students could contribute to the game image, concept, and assets, the prospects looked positive for a successful collaborative effort. Each of the three faculty collaborators brought their individual strengths to the collaborative. One of the Architectural Thesis instructors is knowledgeable in computer 3D modeling and animation and, in fact, built a successful private practice doing animations from 3D virtual models for architects contractors, and developers. The Game Design and Development instructor coordinates the Game Design effort, is an expert in game design and game design software and coordinates the Game Design Capstone project, and the dean of Architecture and Construction Management, was able to manage some of the scheduling and logistical challenges.

Soon after the faculty commitment to the project, Thesis instructors and two Architecture Thesis students made a "pitch" video to solicit interest in their concept from the Game Design students. The pitch was successful in gaining the interests of several of the Game Design students, as well as the president of our institution, volunteering to serve the team as a consultant for the geology of Mars, the location of the first game design. The university's VPAA also signed on as the team's chemist. The president's PhD is in geology (Mars geology) and the VPAA's PhD is in chemistry.

The pitch was successful and so with faculty from Architecture Thesis, Game Design and Development, two students from Architecture, and eight students from Game Design, the collaboration began in fall 2012. The collaboration grew to four Architecture students and ten Game Design students in spring 2013.

The fall 2012 and spring 2013 collaboratives maintained a web presence to archive the original "pitch" and provide a central location for game assets. Also, the web presence helped to maintain a constant visual "brand" as the collaborative passed from one semester to the next with new designers entering the collaborative as others graduated.

This ongoing collaboration is intended to examine the design and production process of each discipline, observe and reflect on the efficacy of that process and seek that interstitial area between the two disciplines - the "overlap" - and make meaningful reform to the next collaboration. After two semesters, from fall 2012 to spring 2013, the faculty and student collaborators found substance in the overlap, frustrations in the process and sufficient value in the effort and product to justify continuing the investigation in the next academic year.

Learning Outcomes

In searching for the overlap in the learning outcomes for Archi-Gaming, the instructors began with a comparison of syllabi for the Computer Game Design and Development Capstone course, CGDD 4814 and the Architectural Thesis course, ARCH 5999T. It was quickly apparent that the courses, while sharing design principles, were not going to overlap in the conventional sense of the fulfillment of learning outcomes. In fact, the computer gaming design Capstone course states in the syllabus in the way of advice to the students, "*Your job is not to design art. Your job is to develop things - especially code.*" On the architectural side of the collaborative,

the design of the "art" of architecture is fundamental and the design of code, except for the recent emphasis on computer scripting in architectural design, is not a consideration.

With little overlap with regard to learning outcomes in the most conventional and conservative sense, the instructors looked more closely at those outcomes that were more implicit in the syllabi of the courses. The game design Capstone course has a syllabus mandate that challenges the student to create a project that says to a future employer, "This is the best I could do." Surely, that broad statement leaves some room for creative interpretation. The architectural Thesis syllabi is crafted on a series of "Student Performance Criteria (SPC)" set forth by the program's professional accrediting board.

There are several learning outcomes pertinent to the architectural Thesis that, although not overlapping with the game design Capstone, could be demonstrated, in part, by a successful collaboration with the game design students:

1. Communication Skills: This is a broad category of traditional communication in writing, speaking and listening. The instructors broadened this to collaborative communication skills.
2. Visual Communication Skills: This is more narrowly defined to traditional and digital technology skills.
3. Leadership and Practice: This learning outcome includes leadership skills in the collaborative sense as well as business practices.

In summary, there was little in the learning outcomes of either discipline that suggested merely merging the learning outcomes would suffice for the new collaborative initiative. Instead, the instructors and the students decided to implement those learning objectives discussed in this section, but moreover be open to discovery of new ideas and relationships that could be implemented in version 2.0 of the collaborative.

Finding the Overlap

Identification of the middle ground, a search for this interstitial piece between the two disciplines, the zone of intellectual inquiry and application, that added value to each discipline's goals was the first goal. The larger question began to emerge: Would the collaboration yield more than the sum of the parts?

Degrees in Architecture are established and have well-defined academic requirements and processes. Computer Game Design and Development (CGDD), on the other hand, is a relatively new academic area. Consequently, there were several initial challenges that stem primarily from differences in terminology, expectations and constraints.

Initially the Architects were interested in revealing more about their architecture than was gained through typical representational means with a desire to understand the link that visualization can have on design decisions. The Gamers needed assets to populate their games allowing them to focus on interaction. Each group had independent criterion for academic success.

John Dewey was one of the initial voices promoting "learning by doing". Throughout his life Dewey continued to argue that education and learning are social and interactive processes.[9] In 1991, Blumenfeld and others defined the project based learning model as "a comprehensive perspective focused on teaching by engaging students in investigation."[10] An analysis of the learning outcomes showed that both disciplines utilized some form of project-based learning for teaching and that each program required a final creative product for student evaluation. The learning objectives of each discipline prescribed an open-ended challenge that was focused on a design project requiring specific skills unique to their discipline. The Architecture students have to convey ideas of environments and space through models and representations. The Game students use interaction and emersion as their media. Within each discipline students are responsible for their own choices and decisions, which incorporates feedback from reviews. Articulation of a final design solution from both programs develops critical thinking and problem solving. Based on this common structure the gaming collaborative would provide an excellent opportunity for project based learning.

In the beginning information exchange was a problem. Though both groups of students used digital technology to communicate ideas there was the danger of data overload and the problem of specificity from the architecture students. Architects use specific terminology and often express ideas via static 2D and 3D images. CGDD students rely heavily on interactivity within a space. As an example of this, architecture students prefer to create highly detailed spaces containing potentially several million polygons (i.e. the triangles and shapes that make up the environment). These scenes can take several minutes to hours to render the final image. However, this constraint is not acceptable in the gaming world, in which scenes must be rendered in 1/30th of a second (if not faster). Thus, there is a tradeoff between what architecture students prefer (e.g. the accuracy of models) and what the game development students prefer (e.g. interactivity). Figure 1 below demonstrates an example of this concept. Note in figure 1a that the edges of the sphere with the low polygon count are flattened, while the sphere on the right is considerably smoother.

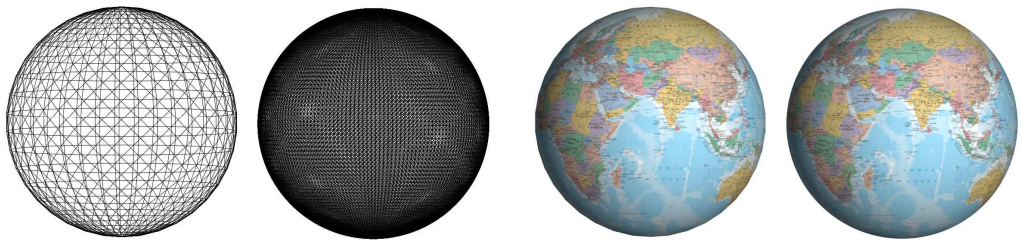


Figure 1. A textured sphere, high and low polygon counts

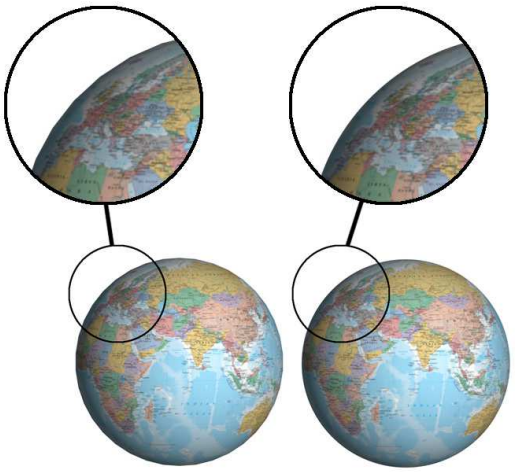


Figure 1a. Notice the edge condition, though subtle the globe to the left has a faceted edge due to low polygon count verses the smooth edge on the right with a greater polygon count, but requiring more processing time. Because the architecture students typically produce static images rendering times are not a concern, so they model with many polygons.

While these requirements initially present barriers to collaboration, there *is* noticeable overlap between the two degrees in that both typically require a Capstone portfolio experience and much of what both groups produce manifest as something *visual*. Further, while Architecture portfolios often include 2D orthographic (i.e. "flattened") view of their designs, they often work and think in the 3D space.

These technical challenges lead students to communication successes as the students developed catalogs that documented architectural assets including specific technical data. Students began to talk about game genres and architectural styles as interchangeable references. Representation from the Architecture students who rely on flat 2D abstractions of orthographic projection systems to communicate space began to employ sketching and perspective views to express ideas.

Presented with a realistic project students were confronted with the struggles of fulfilling the central concepts and principles of each discipline while maintaining a commitment to the larger project. Within the collaborative, faculty only played a facilitator role in the process. Working collaboratively required more than problem solving as students found working in a community requires sensitivity to others. Separately the Architectural thesis students concluded their work with formal presentations of design solutions represented through projection systems and physical models. The game design students concluded their semester with an interactive game. The final outcome of the collaborative resulted in a design product that embodied both Architecture and interaction with a series of online games.

Examples from first collaboration: Mars Colonization

During the first semester of collaboration, two senior architecture students were willing to participate in the pilot of this concept and were asked to talk with the gaming students during the first week of classes. One architecture student had a strong interest in architectural structures for the colonization of Mars, while the second was investigating foldable structures that could be easily transported. These students took the liberty of creating a plot for the games, which included a rogue cyborg who served as the games' antagonist. While the design of the games had tradi-

tionally been left to the gaming students, many seemed willing to adopt this theme and design games around it. Using the same pool of assets, four games were created based on the colonization of Mars. These included *Cyborg Assault, Red Protocol, MT-18* and *Colony 43*; here we describe the first three.

In each of the three examples, the objective was to reveal the architectural design through game play (gamification). In concept, familiarity of the physical design of the building or buildings, interior spaces when required, and exterior environments would be discovered and rewarded as the player reached levels or goals. The examples demonstrate interaction between the computer game design and the architectural design depending on the type of game, as each study discusses.

In *Cyborg Assault*, the player assumes the role of a space marine that finds himself inside a large futuristic structure and is tasked by the captain to investigate locations within this space. During the investigation, the player is required to explore the ship and destroy an alien infestation. The game is a First-Person Shooter (FPS); however, the main camera hovers above the marine to provide a near-FPS view (see Figure 2). Other than the animated characters that appear in the game, all structures were made by the architecture students, including a captain's bridge, hallway units, and a cargo bay.

Figure 2. The hallways of Cyborg Assault (left), and the cargo bay (right)

Red Protocol is a First-Person platformer (i.e. a game containing many platforms, requiring the player to jump) in which the player is initially tasked with exploring a very dark environment to find a power generator for the city. During the game, the player is expected to solve simple puzzles and collect items to restore the city to a functional state (see Figure 3). Over time, the city became increasingly brighter. Other than the platforms, all structures were designed by the architecture students.

Figure 3. The platforms in Red Protocol

Finally, *MT-18* is a "reverse tower defense" game in which the objective is to safely guide a convoy of ships along a pre-defined path in the Martian terrain. Originally, this was done by equipping each ship in the convoy with appropriate upgrades. Further, this initial version of the game contained a static, overhead view of the terrain, similar to the mini-map in Figure 4. As discussed later, the view was changed to a first-person point of view and enabled the player to shoot enemy turrets along the path. The view also contained several visual elements to indicate the status (e.g. health, shields, etc.) of each ship in the convoy.

Figure 4. MT-18's first-person view and overhead mini-map

In trying to satisfy the constraints of both architecture and gaming, students needed to be clever. Architecture students expressed interest in seeing their models not only from a specific viewpoint (~ 5 to 6 feet above the ground), but were also interested in visualizing the models in their entirety. All groups used different approaches for this constraint, but were able to integrate these

concepts seamlessly into their games. For example, *Cyborg Assault* is a FPS (satisfying constraint #1), but also includes a "Gallery" room where all major structural units appear in miniature, serving as a map to the player. After visiting the gallery, the player is provided with a mini-map that eventually appears in the lower-right corner of the player's view (see Figure 5).

Figure 5. The gallery (left) which later provides a mini-map (right)

The other two games attempted to satisfy these constraints as well. Though it was never implemented, *Red Protocol* was originally designed to contain a room with orthographic projections of the structures showing the locations of the items, similar to a museum. Not only would this serve as a guide to the player, it would convey the structural layout in a manner consistent with the ways that architects communicate. *MT-18*, on the other hand, included a significant amount of architecture, yet originally contained a third-person overhead view. The game was later changed to include a first-person view that could change between ships in the convoy. Consequently, this enabled the player to have a more interactive experience while providing the correct architectural perspective. In addition, the game included an introductory birds-eye view of the terrain and structures, as well as tight, rotating views of the vessels to demonstrate their architecture as well as in-game capabilities (see Figure 6).

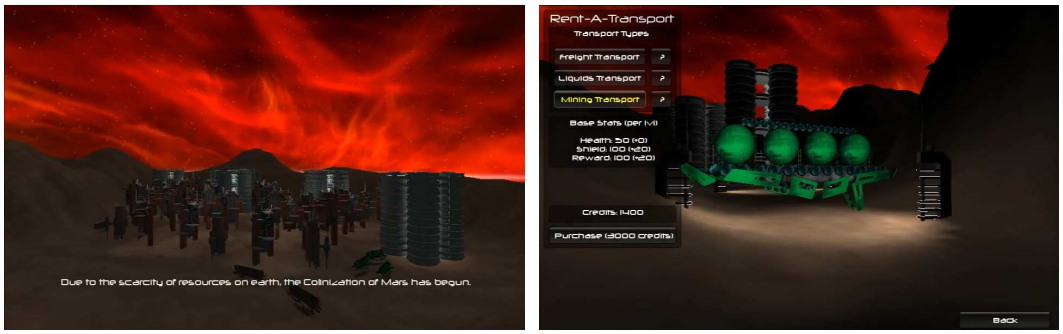


Figure 6. The introductory scenes (left) and the close-up view of the vessels (right)

Examples from second semester collaboration: China Revitalization

The successful collaboration of the Mars colonization project continued into the following semester, but also encouraged participation from additional gaming and architecture students. The new architecture students had interest in the revitalization of existing structures in China,

including the preservation of religious structures and the redesign of an industrial complex. This was a significant departure from the previous semester that provided the gaming students a design challenge. From these projects, two new games emerged, namely *Evocation* and *District 751* – the original names of the architectural theses.

Evocation is an educational-serious game where the player solves simple puzzles while discovering artifacts in Chinese history and culture. The game is located within a city museum that contains a religious temple on the top floor. Throughout their experience, the player is guided by helpful spirits that appear in locations that need to be explored in order for the player to make progress in the game. For example, inside a room is a bucket of water that is needed to extinguish a large fire that blocks a doorway (see Figure 7). Because the development team included one of the members from *Red Protocol*, the concept of hanging architectural renderings within the space carried into this project.

The original architectural vision for *District 751* was significantly different than the game that ultimately emerged. The architecture students had painstakingly recreated an existing decrepit industrial plant in China, intending to repurpose the site as a green space and art museum. However, the gaming students saw the original "assets" in their current state in how they could be used in a horror game. With the permission of the architect, the gaming students developed the horror game across two semesters, in which the player investigates the disappearance of coworkers in *District 751* (see Figure 8). The game includes disappearing and reappearing objects, creatures that crawl on the underside of catwalks, objects that vanish quickly into the background, and an unexpected ending.

Figure 7. *Evocation* that includes a spirit and architectural renderings

Figure 8. The player uses a flashlight in *District 751*

Student Opinions

After all projects had been completed, students were asked to complete a survey asking them to describe their experiences and any challenges they encountered when working with those outside of their own discipline. Eight students participated in the survey, with six from gaming and two from architecture.

When asked if they found it difficult to collaborate with those outside of their own discipline, only two participants (in gaming) stated no difficulties. Some stated challenges in scheduling and availability as well as challenges with importing the architecture into a game engine. One architecture student commented that gaming majors had difficulty understand the "big picture". When asked specifically about challenges in communication (e.g. terminology), all but two respondents described some kind of barrier. Some groups communicated purely through email, causing delays and miscommunication. Others described the difficulties in trying to understand the project from a different "point of view" and how collaborators from outside their discipline struggled to understand theirs. One student commented, however, that communication became easier with time.

Of interest was whether or not the collaboration influenced their designs (either game design or architectural vision). All respondents stated some kind of change to their own design was necessary to accommodate the design of their collaborators. One architecture student stated that the collaboration initially "*threw a wrench*" into his design and the other stated that, given that the design space had a back story and theme, it helped "*solidify the look and feel of my thesis*". A few of the game students commented on the need to reconcile ideas, and how to integrate the expectations of the architects (such as the integration of architectural plans, point of view, and model visualization). Two game majors commented that they would have like additional models to support their design, and for the updates to those models to be more frequent. When asked explicitly if the collaboration *improved* their designs, most students suggested that it did, though

two students commented that the collaboration forced them to examine the project in a higher detail than working alone.

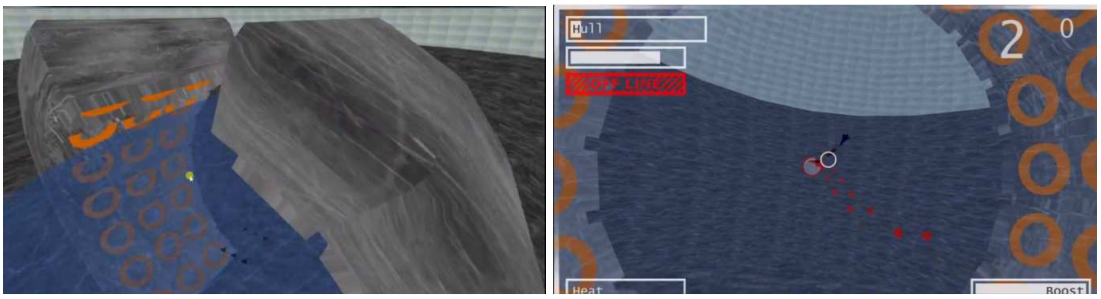
Participants were asked if the collaboration created additional learning opportunities, causing them to learn things not directly related to their course outcomes. All respondents claimed that additional learning occurred, with the most common response referring to how the collaboration gave a "real world" atmosphere during project development. However, one response was not entirely positive, commenting that he learned "*much can be lost in translation*".

As a summative question, students were asked if they would collaborate in this manner again, and if they had any final comments. Five students responded they would continue these kinds of collaborations, that they were interesting, and that "*This needs to happen more*". Of the two who responded with the answer "maybe", one commented that it was interesting, but that the collaboration needed better communication; the other suggested that the collaboration worked well, but there is a need for the modeling of animated characters. For the one respondent who did not wish to collaborate, there was no further comment.

Successes and Challenges

The success of the collaborative far outweighed the difficulties and occasional setbacks of the effort. One challenge was, since the Thesis course for Architecture and the Game Design course had their own catalog numbers, there wasn't a common meeting time. As a result, the struggle for the students to coordinate their time outside of class was challenging. Also, the Architecture students generally met at the scheduled class time of the Game Design students since the Game Design students required a classroom with sophisticated computing resources. Further, the Architecture instructors had to meet not only at their required Thesis class time, but at the Game Design class time. This is something that can be resolved in the future through course cross-listing or creating a special topics course. Overall, the most intense challenge to the collaboration was one of simple logistics.

We believe the collaboration was a genuine success. The students of both disciplines learned to respect the design protocols and production procedures of the other discipline and the product of both disciplines was seamlessly integrated into a unified, single presentation. Obviously, each discipline of the collaboration had its own rubric and specific learning objectives, but the students worked together to satisfy the collaborative product as well as answering responsibly to their own course objectives. Though subjective, we believe that the collaboration resulted in 1) a more professional-looking game than in previous semesters where no collaboration occurred and 2) a more natural way and interactive way for architects to convey their vision. As an example, the figure below (Figure 9) shows a project from a previous semester in which assets were either made by the game developer, or found for free on the Internet. While the space-shooting game played very well, the structures were visually lacking.



Figures 9 a) a distant view of an arena and b) inside the arena

Conclusion

Why collaborate? Our institution has long had a reputation of using project-based education as an effective method of teaching and learning. Our institution has also had a culture of collaboration across disciplines. This collaboration involving Architecture and Game Design was a result of the realization that our students face complex problems in the professional world that are best resolved through thoughtful collaboration with other disciplines. In this collaboration, Architecture students benefit from new and engaging ways to help others understand their designs, and Game Design students have the ability to provide that engagement and, essentially, "gamify" the physical design presentation of architecture. The Game Design students, likewise, have the need of exciting and original assets and aesthetics for their game design that Architecture students can provide. It is this synergy that results from each discipline contributing to the success of the other that makes for a better overall product that is both a unique architectural presentation and a visually exciting and engaging game design.

Current Status and Future Plans

As of this writing, we are entering the last weeks of fall semester 2013 and planning for the "pitch" in spring 2014. Although the plans for the pitch are still fluid, the concept of the collaborative will continue to acknowledge the synergy from our unique perspectives and to continue to emphasize the importance of a team-approach in the design and production of the architectural product and game design product. We are faced with the challenge of celebrating the work as a team effort, but face the reality that each discipline has learning objectives within the discipline.

As we look to presenting the work of the collaborative to peers and students, we anticipate the presentations will actually be in two parts; one presentation by the Game Design students taking the leading role in presenting to Game Design and Architecture faculty, with the Architecture students in a supportive role. The second part of the presentations will be with the Architecture students leading the presentation to a panel of Architecture and Game Design faculty with the Game Design students in a supportive role.

One significant challenge to the collaborative is to maximize its exposure to, and adoption by, more faculty in the Architecture and Game Design departments. If gamification of architectural Thesis projects potentially expands the experiential nature of understanding and appreciating ar-

chitectural design (and the authors believe it does), then the university setting provides an excellent opportunity for advancing this unique form of gamification. For the Game Design students, there is the advantage of designing games with assets that are discipline-specific, thus extending certain games beyond the singular goal of entertainment. The authors obviously believe the benefits to both disciplines are substantial and the opportunity to advance knowledge in "the overlap" is exponentially increased with more participants - both faculty and students.

The authors believe the pursuit of this form of gamification does not efficiently benefit from the conventional model of one instructor teaching how to gamify a physical design. The process is best taught with small groups essentially having an "instructor-coach" for each team and an appreciation of discovery in the process. The numbers will grow as others see tangible evidence of the benefits of this approach to enriching the understanding of a design and concept.

At the 3rd International Architectural Education Summit, held in September 2013, there were seven lessons discussed by Amelia Taylor Hochberg with regard to the present and future of architectural education. Lesson seven was summarized by Taylor-Hochberg given with reference to the comments made by Mette Ramsgard Thomsen, Head of the Center for IT and Architecture in Copenhagen who stated, "And while there may have been a generational bias present in the panelists, it was generally conceded that students who have grown up with the internet tend to be more responsive to new computing technologies and languages. So if students may be better versed in the language of digital design than their professors, the autonomy of the design space dissolves into a more dynamic, collaborative research model. Whether this approach is sustainable remains to be seen, but it certainly challenges the academic model based on hierarchical student-teacher relationships. Thankfully, rendering technologies and other digital media of architectural representation weren't subjected to that false dichotomy trap, and respectfully put out in the "exciting frontiers" of new media." Our collaborative believes in the "autonomy of the design space" benefits from explorations amongst those participating in a non-hierarchical student-teacher relationship.[11]

The future of the collaborative is clear, we will do it again. Feedback from the Architecture students and the Game Design students has been positive. Gamification of applicable courses, or portions of courses, can be an exciting, engaging, and meaningful learning method for students and the Architectural Thesis / Game Design Capstone seems a valid candidate for gamification.

Perhaps the best outcome of the collaborative was that students were afforded a glimpse into each other's world, working with those outside their respective domains as they would in a professional setting. Students and faculty have been fortunate to participate in this first collaboration between Architecture and Game Design and those lessons learned will benefit version 2.0 of the collaborative.

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