

Simulated Environments and Gaming

Executive Summary

Simulated environments and video games represent an increasingly significant sector of the national and international economy. Application of related technologies covers a broad-range of areas including video games, education, marketing and training. As this media form becomes more prevalent in daily lives both at work and play, the ethical and moral content it portrays become irresistibly integrated into our behaviors and attitudes. The supporting technologies for this industry are not well served by higher education. Baylor is well positioned to equip graduates with both the technical competence to succeed in this highly competitive industry and the moral and ethical framework to exert a positive influence.

Program Overview and Goals

The Computer Science department at Baylor is developing a specialized curriculum and research program focusing on key technologies and content areas relevant to simulated environments and gaming. The intent is to offer:

1. A world-renowned undergraduate program, producing well-rounded graduates
2. A high-impact, industrially relevant research program
3. Improved visibility for Baylor University and participating academic units
4. The ability to attract new, high-quality students

Achieving this requires development of new technical and non-technical courses. The standard Computer Science curriculum must be supplemented with courses specializing in three-dimensional graphics and sound, real-time simulation and the development cycle employed by the game industry. The proposed curriculum requires the development of two new Computer Science courses and leverages one existing course that currently serves as an elective. One of the new courses will be developed in cooperation with the gaming industry and will feature a capstone project with obvious real-world relevance. New faculty, with relevant expertise and commercial experience are also required. One new full-time faculty member with a relevant research area and one adjunct faculty member with current industry experience are needed. Finally, instructional and laboratory space along with suitable equipment, software and development tools must be committed.

This program is being developed in cooperation with the Film and Digital Media Division of Communication Studies, and leverages existing media course offerings in order to expand the scope of the program beyond the underlying computing technologies. Cooperation with the Film and Digital Media Division makes it possible to add valuable coverage of related technologies, visual aesthetics, production, social impact, ethics, and other gaming content issues. Because the media courses already exist, this program is a part of Film and Digital Media's operational plan, not the School of Communication Strategic Plan, but the program will definitely be a plus for a School of Communication should one be approved. This collaboration between two Baylor departments/schools is

an excellent example of the synergy and benefits of a transdisciplinary approach. Computer science students will benefit; media students will benefit; and ultimately society will benefit.

Justification

Baylor is well positioned to move quickly to establish a successful, nationally-recognized program in simulated environments and game development. Strong connections across academic units at Baylor and world-recognized game development companies in Dallas and Austin permit us to offer a credible program that covers more than just the relevant technical material. The existing Computer Science curriculum offers much of the necessary technical foundation and permits us to offer an appropriate technical preparation with few additional courses. Interest level is high among prospective students and in the industry that will hire them when they graduate. Finally, since this application area was not previously taken seriously by academia, few programs exist. By moving quickly, Baylor has the opportunity to establish a highly visible program with valuable, long-term industry connections and no small share of the academic expertise.

Budget

The budget for this proposal covers costs for personnel, equipment, program marketing, and travel. Personnel requirements include a tenure-track research faculty position, an adjunct faculty member from industry, and graduate teaching assistants. Equipment costs include initial startup for labs and demonstration areas as well as maintenance and upgrade costs. Gaining national notoriety requires an aggressive marketing campaign to attract students and establish reputation. To maintain contacts and relevance, faculty and key students need to travel to approximately 3 key conferences each year.

Assessment

This program is intended to meet an industry need, give Baylor and the Christian community a greater presence in this increasingly significant branch of the media and attract a previously untapped source of highly qualified students. Success will be measured by the placement rate of our graduates, their starting salaries and the willingness of industry partners to participate in the capstone experience. Success in attracting new students should yield an increased enrollment across the existing Computer Science majors and the new gaming specialization. Success in related research will result in externally funded research projects, publications and joint projects with government and industry.

Simulated Environments and Gaming Proposal Narrative

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Statement of Need

Baylor's mission focuses on educating leaders in areas of significant societal import. Simulated environments in general and video games in particular represent a major commercial interest and have a pronounced influence on our culture. Baylor is well

positioned to develop specialized program for training graduates to enter this industry and to become leaders. In addition, Texas is a major player in the gaming industry, hosting many major development studios including Gear Box, NCSoft, etc. This will capitalize on the interests of Baylor undergraduates and prospects, many of whom were drawn to technical disciplines because of an interest in video games. It would also help Baylor to fulfill its commitment to positively impacting society through its graduates.

Simulated environments have a significant influence on culture. Consider just the video game arena. In 2004, video game revenue surpassed Hollywood at \$7 billion and sales grew much faster than the general economy, around 4.5% per year from 2000-2004. Gaming continues to appeal to an ever increasing segment of the population. Although male teens may have once been the primary audience, according to the Entertainment Software Association, 75% of heads of households play video games, the average gamer age is 30, and gamer gender is almost evenly split. Participation in online virtual environments is skyrocketing. The Massive Multiplayer Online Role-Playing Game (MMORPG) industry is expected to reach \$4 billion in revenue by 2008. These systems are beginning to blur the boundary between virtual and physical as demonstrated by the billion dollar market in virtual goods. Thus, these products have a direct commercial impact through sales and subscriptions and an indirect impact through their own virtual economies. The development and impact of simulated environments is still in the initial stages. Several factors are converging to open up a wide range of future directions for simulated environments including the recent push for online communities, the aggressive push for new gaming consoles (e.g., Microsoft Xbox 360, Sony PS/3, and Nintendo Wii), the recent proliferation of portable gaming (e.g., cell phone, Sony PSP, and Nintendo DS), and the rapid deployment of residential high-speed Internet access. Baylor graduates of this program will have the opportunity to participate in and even influence future direction in the gaming industry.

In addition to leadership in the gaming mainstream, our proposed Baylor program provides the opportunity for application of these technologies in a Christian vocation. Christian niche markets have long existed in music and literature. The Christian movie industry is rapidly expanding, so much so that Fox Entertainment has created FoxFaith productions to produce Christian content. Efforts in the gaming industry are just beginning, mostly focused on providing Christian alternatives to stereotypically violent video games. Graduates of this proposed program can apply their skills directly to this nascent, niche industry.

Baylor's Computer Science degree is a broad preparation for students wishing to enter the software development industry or to continue on to graduate study. As such, it includes much of the foundational material necessary for employment in game development. Preliminary meetings with professionals in the industry indicate that our students have strong credentials that satisfy many of the need of this demanding industry. However, a typical Computer Science graduate lacks preparation specific to design and implementation of games and digital media. Although they could succeed without this application-specific preparation, our students would be much more competitive and

would be much better suited to leadership positions with the additional coursework and project experiences proposed here.

Relevance to the Vision

Simulated environments and gaming impact a broad spectrum of our technological society; consequently, these environments will exist and have enormous impact with or without input from Baylor graduates. With this proposal, Baylor has the opportunity to be a leader in this high-impact area, add its voice to the discussion, and influence direction. In addition, many of the top US universities are just beginning to recognize the importance of this area, including MIT, Stanford, and CMU.

The proposal also helps to fulfill several of the Vision 2012 imperatives:

- **Imperative I** Establish an environment where learning can flourish
The proposed undergraduate specialization is a challenging academic program. The hope is that, by connecting academic topics to an application area that is familiar and of great interest, students will take a more personal interest in their studies and will dedicate more out-of-class time to mastering the material.
- **Imperative III** Develop a world-class faculty
At present, programs of this type have been developed at comparatively few universities. However, many highly ranked schools are beginning to take this technology and this application area seriously. By acting quickly, Baylor has the opportunity to establish itself as a leader in the area and to attract some new faculty with outstanding potential.
- **Imperative IV** Attract and support a top-tier student body
The technology behind simulated environments and video games is surprisingly sophisticated. Although many students like to be consumers of these products, fewer have the aptitude to be producers. Students who succeed in this area are likely to be among the most outstanding in the university and are likely to raise the level of academic discourse across many academic areas.
- **Imperative V** Initiate outstanding new academic programs in selected areas
Baylor is well positioned to develop an strong, industrially relevant program in gaming. Existing connections between key departments on campus and with world-recognized industry leaders in Austin and Dallas give us the opportunity to create a program that few other universities can easily duplicate.

Environmental Assessment

We have several internal strengths that would contribute to the success of this project:

Existing BSCS Program: The proposed undergraduate program already exists in large part within our BSCS program. We have strong faculty in a variety of areas of computing, and our program has a well-established reputation and track record for success. Only two, gaming-specific course additions are required.

Existing Communications Program: The Digital Media and Film program already includes all of the required, non-computing courses. This program has already established a strong reputation in the production aspects of gaming. In addition, faculty in this program have well-established industry ties to assist with developing internship experiences, collaborating on capstone projects and refining the program itself.

International Collegiate Programming Contest (ICPC): Baylor is the headquarters of the ICPC, the premier programming competition involving 1700 universities in 84 countries. ICPC focuses on education through competition in technology and receives an estimated 1 billion media contact points during the year. In fact, the official website for the ICPC is hosted at Baylor, <http://icpc.baylor.edu>. Its strong association with the ICPC gives Baylor a great deal of visibility and name recognition among students who are some of the strongest prospects for this program. Our experience working with global student competitions gives us some expertise in areas relevant to modern gaming and distributed, virtual environments.

Competitive Learning Initiative (CLI): The Computer Science Department houses the CLI, which focuses on the use of competition for computing education. We already have significant recognition and funding through this initiative.

Baylor Core: The Baylor core curriculum represents a well-rounded education to provide graduates with broad exposure. Although technical skills are the most evident requirements for success in game development, professionals in the industry appreciate the value of a broad education and the ability to communicate effectively.

Gaming impacts a broad range of areas, creating opportunities to leverage other potential strengths of the university including expertise in education (teaching methodology with gaming), psychology (use of simulated environments to treat ailments), sociology (impact of virtual societies), etc.

The weaknesses all fall in the category of needs including faculty, facilities, and funding; however, much of what is needed to create an excellent program is already in place.

The increasing commercial significance of the gaming industry, coupled with the rarity of specialized programs make now a critical time to act in developing our program. Externally the opportunities for the proposed include:

- Opportunities
 - Gaming has major societal impact.
 - Programs in this area are few and have only limited development. We are positioned to influence and capture a good share of credibility.
 - Because of the visibility and broad appeal of gaming, success in this area will bring heightened media recognition for the department, school, and university.
 - Significant government funding is available to support research and development in simulated environments and gaming for education.

- o A large industry base already exists in the US to provide graduate placement and potential funding. Locally, Baylor is well connected in this industry.
- Threats
 - o Technology programs exhibit significant variation in demand. As a result, enrollment in this program can be expected to vary by a factor of two or more across a five-year period.
 - o The pace of innovation requires significant resources to stay timely and relevant.

Many existing computing programs offer one or two classes in gaming; however, these present little competition as these classes are simply electives, not part of a focused program. In addition, these programs offer little in the way of instruction in production. A few full-fledged gaming programs exist. Many of these programs focus too heavily on either computing or production; our program offers a well-balanced approach so our graduates will be much more valuable and likely to enter leadership positions. In addition, the number of quality, dedicated program is very small relative to demand.

Goals and Assessment

Our proposal focuses on three main goals:

1. Develop a marketable program with strong industrial ties.
 - a. Graduate Placement : 90% placement in industry by 2011
 - b. Salaries : Average within 10% of top industry salaries at competing universities by 2011
 - c. Industry Buy In : Industry involvement in the capstone project by 2010, sponsored capstone project by 2014, involvement in program development and eventual donation of technology.
2. Identify external research and funding opportunities
 - a. Prestigious publications : Equivalent to comparable programs when normalized by number of faculty and teaching/service expectations by 2010
 - b. Graduate research : Engage selected graduate students in relevant research projects/activities by 2012
 - c. Governmental/Industrial Funding
3. University/Program Visibility
 - a. Recognition : Inclusion among the top 25 gaming in a national survey by 2016.
 - b. Media Contacts : Large number of media contact points relating to program

Action Plan

<i>Steps</i>	<i>Dates</i>	<i>Responsible Party</i>
1. Introduce BSCS Program	2007	CS Department faculty
2. Develop Infrastructure	2008-	CS Department faculty

✓ Lab	2010	
✓ Hardware		
✓ Software		
✓ Demonstration Area		
3. Add faculty member	2009	CS Department faculty
4. Add adjunct faculty member	2009	CS Department faculty
5. Integrate new courses	2009	New faculty member
6. Advance research agenda	2009-	New faculty member
	2015	
7. Explore interdisciplinary opportunities	2010-	New faculty member
	2015	

Budget Narrative

Success in this area requires faculty with relevant expertise and suitable facilities. The cost of this program principally reflects new faculty hires and technology for specialized instructional and research spaces. The accompanying budget provides for three lab spaces. A development lab includes development systems for current game consoles. These systems would normally include a state-of-the-art game console, a desktop computer, development environment software and accompanying documentation. As technology changes rapidly, this equipment would be updated on a two-year schedule. The demonstration lab provides a showcase for current technology and student projects and will play a key role in attracting potential students and external funding. This space will be updated on an irregular schedule as some items like furnishings require less frequent replacement. A third space, the experimental lab, provides a hands-on environment where students and visitors have access to current technology. This will help to maintain interest in the program and to make sure students are literate in current systems and software. The budget provides for regular update of experimental lab technology and regular acquisition of current software.

Startup funds for the new full-time faculty member will provide research equipment, summer salary for the first two years and research assistant stipends. Starting in the third year of employment, these expenses will be compensated by externally funded research.

The most significant revenues are through student tuition, anticipated research funding and cooperation with industry. With targeted promotion, we expect this program to attract 15 new freshmen into the school each year. To help recruit these students, the budget includes a generous allocation for marketing in the initial years. As with other programs in the school, we anticipate some attrition as each class progresses through the program. The accompanying budget presumes that 10 students will remain for the sophomore year, 8 for the junior and 6 for the senior. However, as this program shares much of the introductory coursework with the Computer Science degree, we expect that some of these students will gravitate to other degree programs in the school even if they leave the gaming program.

Admittedly, increased enrollment in Engineering and Computer Science does not equate to financial gains for the university. To the extent that overall enrollment is to remain constant, increases in ECS must be balanced by reduced enrollment elsewhere. Also, students in this program are likely to have strong academic credentials and will generate reduced tuition revenue. To its credit, the proposed program does make good use of existing coursework and faculty and accommodates the additional students with few additional resources.

The proposed hire of one full-time faculty member and one adjunct is offset by the anticipated research funding and industry support. Geographic proximity and personal connections to several internationally-recognized industry leaders gives Baylor a distinct advantage in developing this program. Cooperation with these industry partners will enable us to offer a comprehensive capstone experience with clear commercial relevance. The budget includes eventual industrial support for the capstone project.

This program provides for the eventual addition of three new graduate students to the existing master's program. One of these will serve as a teaching assistant for the additional courses. Two others will serve as research assistants and will help to achieve the critical mass necessary to compete for external funding. The budget permits the research assistants to be initially paid using start-up funds. As the program develops, these positions are eventually supported externally.

The existing ECS budget will provide a substantial amount of support for new students in the proposed program. For most of their technical coursework, these students will share instructional and lab facilities with existing Engineering and Computer Science Students. The school is also committed to providing the needed space for the proposed research and instructional laboratories.