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A New Undergraduate Major: Interactive Media and Game Development

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ABSTRACT

We describe a new major at WPI in Interactive Media and Game Development. We discuss the requirements and courses of the new major, and how it will interact with the existing programs in Computer Science and Humanities & Arts at WPI.

1. INTRODUCTION

The number of academic programs in game development is growing. The 2003 Game Developer Magazine's *Game Career Guide* [1] listed 64 academic programs in game development; the 2004 Guide [2] lists over 100. We have observed increasing student interest in game development, both among current students and potential applicants.

As a result of this increased interest, many colleges and universities are wrestling with the questions of whether and how to teach courses in the development of video and computer games. Should we consider game development a threat to our existing programs, or should we consider game development an interesting new area of academic study and a possible source of new enrollments? If we do teach game development, what courses should we offer and what should be the structure of the curriculum in game development?

This paper describes the response to these questions of a group of faculty at Worcester Polytechnic Institute (WPI) from the Departments of Computer Science and Humanities & Arts.

2. INITIAL CONSIDERATIONS

Worcester Polytechnic Institute (WPI) is a private university with approximately 2700 undergraduate students and 1000 graduate students, primarily majoring in science and technology. In August, 2003, the faculty was challenged by the administration to propose new academic programs that would allow WPI to broaden its offerings.

We identified game development as a area of academic work that would expand our offerings, but fit in well with our strengths in technology. WPI also has a tradition of strong offerings in the humanities and arts, and this strength could provide the resources to offer the non-technical courses necessary for teaching game development.

The first consideration was to set the goals of the program. The primary goals of the program were to expose students to a rigorous academic study of interactive media and game development, and to prepare them for jobs in the games industry and related areas and for graduate study. We view offerings in game development as a means to continue attracting and retaining students who might have considered programs at other institutions. We also believe that there is the potential to attract students who might not otherwise have considered a university with a primarily scientific and technological reputation.

The next consideration was the structure of the new courses we would propose. We considered the following structures:

- A cluster of courses. With this approach, we would teach some isolated game development courses in Computer Science and Humanities and Arts without any formal degree designation
- A concentration. Some majors at WPI offer concentrations, which allow students selecting specific options within the major to receive a degree designation noting their concentration.
- A minor. At WPI, a minor is a program of six courses.
- A major.

After some debate, we decided that a full-blown major would best meet our needs. It seemed to us that while a cluster of courses would allow students to study game development, it was unlikely to attract new students, and unlikely to provide students with adequate background for careers in game development or for further study. Although both the concentration and the minor provided the students with official recognition of the study of game development, they still would not have sufficient depth for the students we hoped to attract to the program.

3. DESIGN OF THE MAJOR

The high-level academic objectives for our program are:

- Provide a well-rounded general education,
- Provide education in state-of-the-art theory and practice of game development,

- Give students exposure to both artistic and technical aspects of game design and the opportunity to concentrate in one of them, and
- Allow sufficient flexibility in the program so that students could tailor the program to their own interests and career goals.

In order to avoid creating a large number of new courses, we wanted, as much as possible, to use courses currently taught at WPI for the new major. Fortunately, our rich offerings of courses in Computer Science and Humanities & Arts allowed us to achieve this goal.

In terms of the specific courses to include in the major, we made use of the International Game Development Association's Curriculum Framework [3].

Another issue we considered was whether we should have separate majors for the students interested in the artistic aspects of game development (art, storytelling, music) and students interested in the technical aspects (programming, computer graphics, animation). Many of the existing programs [2] in game development are designed for only one of these kinds of students. We decided that we wanted to have a single major for all these students, with enough flexibility in course selection within the major to accommodate both artistic and technical students.

There were several reasons for this decision. First, several members of our industry advisory board emphasized to us the importance of artists and programmers learning to work with each other. Having our artistic and technical students in the same major seemed like the best way to accomplish that goal. There will be many opportunities for these students to work together, both in courses and in projects. (See Section 4.5 for a discussion of projects at WPI.)

Second, we didn't want students to have to choose between an artistic track and a technical track too early in their academic careers. In our major, all students begin with the same core courses, and many of the early course requirements are common for the artistic and technical students. All technical students take some artistic courses, and all artistic students take some technical courses. There is sufficient flexibility in the program for students to focus in the artistic area, or to focus in the technical area, or to take nearly equal numbers of courses in the two areas. This approach is in keeping with WPI's philosophy of empowering students to make their own educational choices.

One difficult issue was what to name the new major. There was some support for avoiding the word "game" in the title of the major, favoring a name like Electronic Entertainment or Interactive Media, hoping that we might avoid some resistance on the part of parents to allowing their students to select a major with the word "game" in the title. We finally selected the name Interactive Media and Game Development (IMGD); Game Development because that would be the current focus of the program, and Interactive Media because we saw the program growing to include non-game applications like distributed environments, interactive music, performance, and as yet unknown media. In addition, having "Game" in the title would make the focus of the program immediately apparent to prospective students.

While we certainly have not come to definitive answers to the questions we raised about the relationship of Game Development

and Computer Science, the faculty in the Departments of Computer Science and Humanities & Arts have decided how to proceed at WPI. Our examination of this topic has convinced us that Game Development has a deep and interesting set of problems to study, and is worth studying at the undergraduate and graduate levels.

It's difficult to predict the effect of our new major on majors and enrollments in Computer Science. It's possible that we will see some drop in the number of Computer Science majors as students select IMGD instead. But it's also possible that additional students will be attracted to WPI to double-major in Computer Science and IMGD, leading to some additional Computer Science majors. On the issue of Computer Science course enrollments, IMGD majors in the technical area will take almost as many Computer Science courses as a CS major, so the new major may not have a significant impact on enrollments in Computer Science courses.

The big benefit of the new major to WPI is its potential to attract students who would not have previously applied to WPI. Artistic students with an interest in Game Development may be attracted to our program by the opportunity to study and work with more technically-oriented students and faculty, which they would not have at an art school game development program. They may also find better career prospects than with a purely artistic background. Technical students interested in game development may be attracted by WPI's reputation for excellence in technical programs and our project-oriented curriculum.

4. DESCRIPTION OF THE MAJOR

This section describes the distribution requirements for the Interactive Media and Game Development major. We also describe the general university requirements at WPI.

There are four major categories of distribution requirements in the IMGD major: Core Requirements, General Requirements, the Area Requirement, and Electives. Figure 1 illustrates the relationship among these degree requirements and with other WPI requirements. A more formal description of the degree requirements can be found at [4].

4.1 Core Requirements

All students in the IMGD major are required to take two of the three courses: Critical Studies of Interactive Media and Games, The Game Development Process, and Storytelling in Interactive Media and Games. They are also required to take one of the two courses: Social Issues in Interactive Media and Games, and Philosophy and Ethics of Interactive Media and Games. These courses will generally be taken early in the student's program, and are designed to ensure that students have a common background in the fundamental ideas of IMGD and have an exposure to social and ethical issues related to the major. These courses are described in more detail in Section 5.

4.2 General Requirements

All students are also required to take at least one course from each of the following areas: Mathematics, Science, English, Computer Science, Computer Art, and Computer Music. These requirements differ from the Core Requirements in that they are general university courses and not specifically IMGD courses. These requirements are designed to ensure that technical IMGD

majors have some exposure to artistic courses and that artistic majors have some exposure to technical courses.

4.3 Area Requirement

Each student in the major chooses a focus area, and satisfies the Area Requirement by taking ten courses in Humanities and Arts (called the Artistic Area) or ten courses in Computer Science (the Technical Area). While the students have wide choice in choosing the courses to satisfy the area requirement, there are restrictions. For example, students in the Technical Area will need to take at least four 4000-level (senior level) Computer Science courses from a list of game-related courses. Students will need to select lower-level courses for their area requirement to study the necessary background for the advanced courses they wish to take.

Students will also need to take two advanced courses in IMGD from a set of advanced technical courses and advanced artistic courses. We expect that students will generally take courses in the same area as their area requirement. The goal of these courses is to provide specialized material in the area as it relate to games. For example, students may take a general Computer Science course in Computer Networks, and then an advanced technical IMGD course which will discuss networking issues related to games. Having these advanced courses in the program allows us to offer the IMGD major without offering specialized game-related courses in all areas of computer science, such as Computer Networks and Games, or AI in Games.

4.4 Electives

There are six elective courses in the major. Students will have a wide choice of courses to take as electives, although three courses must be in the same area. There are two goals for the elective courses. First, students might use their electives to get necessary background for other courses in the major. For example, students who want to study Computer Graphics as one of their Computer Science courses will need to take additional Mathematics courses. Second, students may use the elective courses to pursue interests related to specific types of games. For example, a student interested in social simulation games might want to study Social Psychology as an elective course.

4.5 General University Requirements

In addition to the specific requirements of the IMGD major, each IMGD student needs to complete the WPI's general degree requirements. Since these requirements will have an effect on meeting the goals of our program, we describe them here.

Projects: Each student at WPI completes three major projects, typically in their second, third and fourth years. The second-year project, called the *Sufficiency*, comprises six courses of work. Each student takes five thematically related courses; the sixth course is a Sufficiency project, related to the theme of their set of courses. IMGD Technical majors will pursue a Sufficiency in the Humanities and Arts. IMGD Artistic majors will pursue a Sufficiency in a technical area. Thus the Sufficiency will provide additional breadth in the student's education

The third-year project is called the *Interactive Qualifying Project* (IQP), is equivalent to three courses in effort, and is typically performed in a team of 3 or 4 students. The IQP focuses on examining an aspect of the relationship between society and technology. While the IQP is not necessarily related to the

student's major, we anticipate that many IMGD majors will use the IQP to examine social issues related to games and interactive media.

The fourth-year project is called the *Major Qualifying Project* (MQP), and is also equivalent to three courses in effort, and performed in a team. The MQP is a high-level project in the student's major. The MQP is an critical part of the IMGD major. It will give students an opportunity to work on a large-scale problem for an extended period of time. Teams will be formed to include both artistic and technical students, giving students an opportunity to work with students from the other IMGD area.

We recognize that it's important for IMGD students, especially students in the Artistic area, to develop a portfolio of work they have done. The MQP will provide a significant addition to the student's portfolio.

Social Science Requirements: WPI students also have a requirement of two courses from the Department of Social Science and Policy Studies. While these courses are not necessarily related to the student's major, we believe that many IMGD majors will use these courses to study social science topics that are related to game development. Coursework in Economics, Psychology, Sociology, and System Dynamics would all be relevant to the IMGD major.

5. THE IMGD COURSES

The core courses, discussed in Section 4.2, provide IMGD students with a common background in key areas of Interactive Media and Game Development. Catalog descriptions for these courses are given in Table 1.

The course *Critical Studies in Interactive Media and Games* is designed to give students tools for analyzing games. The students study critical approaches used in other disciplines, such as literature and film studies, as well as critical approaches to games, and apply those approaches to the study of games and interactive media. The students do extensive writing about games in order to apply those tools.

The Game Development Process is a study of the process used in developing games. The emphasis is not on creating artistic elements of games or on programming games, but how the artistic and technical efforts fit together in the game development process. The students will work on projects using pre-existing art resources and no-programming game development tools (like The Game Factory [5]) to get practice in the game development process and experience in working with students with different backgrounds.

Storytelling in Interactive Media and Games will study how interactivity has impacted the narrative form. Students will examine various ways of conveying linear stories in a nonlinear medium, and will create their own narratives in various interactive structures.

Social Issues in Interactive Media and Games and *Philosophy and Ethics of Computer Games* both address non-technical aspects of game studies. The goal is that these courses will sensitize the students to these issues revolving around game development and game play, and the experience will allow the students to consider these issues in their own efforts to develop games and other interactive media.

In addition to these core courses, there are also advanced IMGD courses in technical and artistic areas. The catalog descriptions for the advanced IMGD courses are given in Table 2.

On the technical side, *Technical Game Development I* and *Technical Game Development II* are advanced courses in technical Computer Science aspects of game development, with a focus on the programming of computer games and advanced Computer Science topics as they impact game development.

On the artistic side, *Artistic Game Development I* and *Artistic Game Development II* focus on challenging artistic aspects of game development, including 2D and 3D models and animation and level design, with a focus on the integration of the artistic elements used in game development.

For all the advanced IMGD courses, students develop games or parts of games, demonstrating application of IMGD skills, methods and knowledge.

6. CURRENT STATUS AND FUTURE PLANS

The IMGD major was approved by the WPI faculty in November, 2004, and the major and the new courses were offered starting with the 2005 – 06 academic year. Most of the courses described above have been offered this year. In most cases, the courses reached their enrollment limits; in several cases, additional sections had to be opened in order to satisfy the student demand.

At the end of the 2005 – 06 academic year, there are about 70 students enrolled in the major, mostly first-year students, although there are some advanced students as well. We expect that the steady-state enrollment for the major will be about 200 students, making IMGD one of the larger majors at WPI.

One surprise in the student enrollment is the relative number of technical and artistic majors in the program. Because of WPI's historical role as university of science and technology, we expected most IMGD majors to choose the technical area of the major. However, these are a substantial number of students choosing the artistic area; they report that they were attracted to WPI's program by the opportunity to combine their artistic interests with a technical program.

A second surprise is the number of non-IMGD majors taking the courses we introduced to support the IMGD major. We added

several visual art courses to support the major, and a large number of students in those courses are not IMGD majors. Thus our new major has the added benefit of providing wider course opportunities for all students at WPI.

We see several directions in which these efforts in the area of IMGD will grow in the future. One is in the area of enriching the course offerings. Specifically in IMGD courses, if student demand justifies additional course offerings, we may wish to propose additional courses in the artistic and technical areas of IMGD. But we also foresee additional courses related to IMGD being offered by other departments. WPI may wish to develop specialized courses in Mathematics, Physics, Social Sciences, Management, and Engineering that will address aspects of Interactive Media and Game Development in those disciplines.

We also see additional degree programs related to IMGD. Students have already asked if we will offer a minor in IMGD. We believe that a minor would certainly be popular among students, although it remains to be seen if we can define a coherent set of course to form a minor.

We have also considered the prospect of a graduate program in Interactive Media and Game Development, and a graduate-level research program as well. A large number of graduate programs exist in game-related areas [2], and we are convinced that the IMGD area is sufficiently rich to support a program of graduate studies and research. We plan to address this issue very soon.

7. REFERENCES

- [1] Game Developer Magazine, *Game Career Guide 2003*, San Francisco, 2003.
- [2] Game Developer Magazine, *Game Career Guide 2004*, San Francisco, 2004.
- [3] International Game Developers Association, "Curriculum Framework", http://www.igda.org/academia/curriculum_framework.php, February, 2003.
- [4] Worcester Polytechnic Institute, "Interactive Media and Game Development Major", <http://www.cs.wpi.edu/+IMGD>, April, 2006.
- [5] Mark Overmars, *Game Maker*, <http://www.cs.uu.nl/people/markov/gmaker/>, April, 2006.

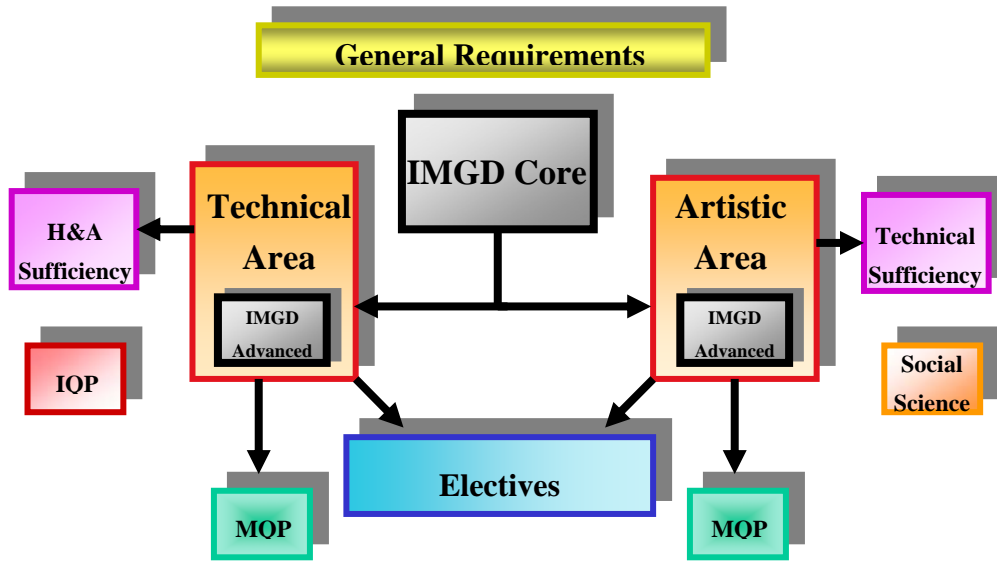


Figure 1: Overview of the IMGD major

<p>IMGD 1000. CRITICAL STUDIES OF INTERACTIVE MEDIA AND GAMES.</p> <p>This course introduces non-technical studies of computer-based interactive media and games. The course develops a vocabulary for discussing games and other interactive media, and tools for analyzing them. Students are expected to provide written critiques using the critical approaches presented in the course. The games and other interactive media critiqued may be commercially available or under development.</p>
<p>IMGD 1001. THE GAME DEVELOPMENT PROCESS.</p> <p>This course discusses the process of game development. It examines the roles of different participants in the development process and how the technical development and the artistic development proceed in tandem. Group work is emphasized, especially the importance of collaboration between technical and artistic efforts. Students are expected to participate in game development using appropriate game development tools.</p>
<p>IMGD 1002. STORYTELLING IN INTERACTIVE MEDIA AND GAMES.</p> <p>This course explores different types of story within gaming and other interactive media. It delineates between linear, branching, and emergent storytelling, identifies hybrids, and finds new modes of making compelling narrative. A variety of games are discussed, including early text-based adventures, role-playing games, shooters, and strategy games. Students will construct characters, situations, and narratives through game play and scripted cut scenes. Students will explore and use visual storytelling techniques.</p>
<p>IMGD 2000. SOCIAL ISSUES IN INTERACTIVE MEDIA AND GAMES.</p> <p>This course provides students with a realistic assessment of the potential and problems related to interactive media and games, especially computer games, and their effects on society. Topics include individual and group behavior, diversity, human responsibility, ethical and legal issues, and intellectual property. The course examines the issues from various points of view, and discover the political, social, and economic agendas of the people or groups championing those points of view. Students will write papers, participate in discussions, and research related topics.</p> <p>Recommended background: IMGD 1000.</p>
<p>IMGD 2001. PHILOSOPHY AND ETHICS OF COMPUTER GAMES</p> <p>This course introduces students to some of the political and ethical dimensions of the new entertainment modalities. Students will explore such issues as representation and power (e.g., gaming and disability, and race stereotyping in games), the phenomenology of virtual reality, capitalism and the commodification of leisure, gender and sexual violence, and cyberspace and democracy. Students will also develop critical tools for evaluating the ethical and social content of their own and others' games. In addition to writing several analytical papers on the critical theory of technology, students will be encouraged to work on game designs exploring philosophical or social themes.</p> <p>Recommended background: IMGD 1000.</p>

TABLE 1: IMGD Core Course Descriptions

<p>IMGD 3000. TECHNICAL GAME DEVELOPMENT I</p> <p>This course teaches technical Computer Science aspects of game development, with the focus of the course on low-level programming of a computer games. Topics include 2D and 3D game engines, simulation-type games, analog and digital controllers and other forms of tertiary input. Students will implement games or parts of games, including exploration of graphics, sound, and music as it affects game implementation.</p>
<p>IMGD 4000. TECHNICAL GAME DEVELOPMENT II</p> <p>This course focuses on the application of advanced Computer Science topics as they impact game development. Networking and distributed systems issues are addressed, including scalability and latency compensation techniques, for designing games for a online multi-player environments. AI, graphics and physics techniques specific to game development are discussed. Students will implement games or parts of games that apply advanced Computer Science topics.</p> <p>Recommended background: IMGD 3000.</p>
<p>IMGD 3500. ARTISTIC GAME DEVELOPMENT I</p> <p>This course focuses on the unique problems presented to the artist when working in game development. Students learn to work with 2D sprite-based art, including tiling and simple animation. They then explore 3D architecture, level design, texturing, and environmental animation. Students will use art to create compelling game experiences through environments by designing their own levels in both 2D and 3D games.</p>
<p>IMGD 4500. ARTISTIC GAME DEVELOPMENT II</p> <p>This course focuses on the integration and organization of the various artistic elements used in game development. The course examines user interaction, interface design, and existing paradigms in current games. Students will combine elements of level design, animation, music, sound, and writing to create an aesthetically appealing game.</p> <p>Recommended background: IMGD 1002 and IMGD 3500</p>

Table 2. IMGD Advanced Course Descriptions