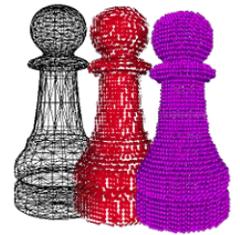


RESEARCH & TEACHING STATEMENT OF BRENT M. DINGLE

SIMULATION, GAMING, AND PEOPLE



1 Introduction

This document provides a brief description of my research and teaching interests. It demonstrates my interests in both, and the relationship between the two endeavors. Discussion begins with my research areas and applications. It then moves into a short description of how the research relates to students. From there it touches on some teaching aspects and concludes with a plan forward and potential sources of funding. It is noted this paper is heavy on the research side. For further details on my teaching style and philosophy I would direct the reader to my Teaching Statement.

2 Research Area

My general area of research is *Simulation Design and Development*. The intent is to investigate new and better ways to create and use simulations. This covers a large number of areas in computer science but can be summarized as a combination of *Software Engineering, Computer Graphics, and Human Computer Interaction*. This means much of the research covers the visual aspects of computing, but also addresses programming methodologies that include, or consider, the user as well as the customer in the design and development process. This research can easily involve undergraduate and graduate students and is inherently multi-disciplinary.

3 Motivation

Programming techniques and methods of solid, robust implementation are critical to software design and development. Meeting the needs and desires of the users has been, and remains, a long-standing development goal. However a program can be written to do even more. We can improve the technical aspects of designing simulations, making them more robust, adaptable, and realistic. We can also make them more useful and more beneficial in educating, training, and influencing humans and their behavior. To accomplish this requires the design and development of visually intuitive ways to present and manipulate large quantities of data and information. Further, an exploration of better ways to develop visual and likely touch-based user interfaces will need to be performed. Such interfaces will be needed to allow the user to explore and understand the simulated world created by the data and information. The creation of these types of programs requires an understanding of humans be placed into the design and development process.

The ability to perform research requires it to appear interesting and be seen as a potential source of income. To accomplish this, my interests lead me to graphics and gaming applications. In this context there is certainly interest and potential income. But an explanation of how it relates to simulation design and development is a more appropriate starting point.

4 Simulation and Gaming

In simplified terms, games are less rigorous implementations of simulations. But really they are designed for different purposes. Simulations must be accurate, whereas games need not be. Simulations are for the rigorous study of systems and data. Games are for entertainment and diversion. But there is no reason a game could not be made to be accurate. Nor is there any reason a simulation could not be entertaining.

In my research and teaching I tend to emphasize gaming and graphics rather than simulation for reasons of perception. Simulations are by many thought to be boring, scientific tools that produce streams of numbers. While this is of enormous interest to some, they do not inspire many. Yet games get attention. Games are fun. Games can make money. Graphics can be all about cartoons and movies and special effects and that is exciting. Thus the combination of graphics and games is fun and exciting, and worthy of interest and investment. So while my research area is in Simulation Design, the application is often in graphics and games. But even in application the areas of software engineering, computer graphics, and human computer interaction stay active.

Game requirements can change daily, if not hourly, and occasionally will be self-contradictory. To manage this mandates agility in design and development processes. It requires the ability to predict and plan for the future needs of clients and the flow-down thereof. It also requires the ability to work as part of a team. Graphics in gaming and simulation allow an exploration of visually intuitive user interfaces and highlight the presentation of data and information for human user consumption. Note these interfaces are not restricted to just visual displays but could include interactive components involving cameras, motion sensors, or robotics. In sum simulation ties to gaming which holds strong ties to software engineering, graphics, and human computer interaction. Thus all are areas I have a large amount of experience in, and that I might find need and interest in doing research to support my interest in simulation design and development.

5 Students and Research

Students entering college today have grown up with technology at their fingertips, literally. Two-year olds can manipulate iPads better than some adults. The generations to come are going to have very user-centric views. If guided properly their thoughts and ideas could unleash a world of change in how and what computers can accomplish. Unfortunately capturing and holding their attention can be difficult. But, on the plus side, they also have been trained to play games. They are quite good at it.

So the *game* to be offered is one of games. The *game* begins by flashing a little bit of bling and hinting at the promise of fame and fortune that gaming, and computer science, holds. Just enough of this must be done to attract the students into the introductory material – to give them a reason to try. The best part of this is that our own culture has already done most of the work. The students may not directly use what they think they didn't learn, but they were at least exposed to it. And some will be hooked. For those that are, the *game* continues, and there will be rewards along the way.

As current interest is high in mobile gaming, the research begins from that perspective. This allows for interdisciplinary efforts and gives the research strength not found in many areas: it provides ample opportunity for undergraduate participation. This will give the students the chance to apply basic computer science principles, and gain notable experience in simulation and game development. It also allows the research to stay current with the expectations of younger generations, both in terms of design methodology and usage. At the same time it can influence the younger perspective to include what has already been tried. And this leads into some aspects of my teaching interests.

By directing the application of this research towards graphics and gaming the opportunity to teach from that perspective arises. This is useful in showing the applicability of material as well as maintaining interest in the material. This is not a statement that everything must be related to graphics or gaming. I merely mean occasional reference provides a hook on which to hang information and tie it together from one class to the next. In similar fashion, by the occasional reference towards gaming or animation, students outside the field of computer science may find ways to relate to the material being taught. This in turn is useful for encouraging cross discipline understanding and interaction.

6 Research and Teaching

I enjoy teaching. My background and interests make me willing and able to teach a variety of CS courses, plus some. Introductory courses are nice as they establish fundamental principles. Programming language courses are fun as they can offer perspective and understanding of how fundamental principles might manifest in different ways, and how a given program may be easier to write in one language than another. Courses in data structures and usage can be fun. I also enjoy web design and development courses as they touch on user interfacing and may introduce the complexity of designing for different viewing devices.

My work experience has given me a strong appreciation for instilling in students an understanding of software engineering, particularly in requirements, agile methods, testability, and code control. My personal interests are in graphics and animation related courses. I also like robotics, artificial intelligence, data structures, algorithms, computer vision, user-interface design, and modeling courses. As a side note I also enjoy math courses such as algebra, geometry, linear algebra, modern geometry, discrete math, logic, numerical analysis, pre-calculus, and calculus.

7 Plan Forward

Investigating new ways to create and use simulations and games may take many directions. One avenue I have already explored is in the way to model and display objects. I used particles for everything – matter and energy. Doing so allows for some clever effects and there are other unique ways to extend this concept. This was well explored in my dissertation and is discussed briefly in my TPCG 2005 paper [1]. Another avenue is the presentation and interactivity of information. How information is presented and how the user is allowed to manipulate the data and information defines and limits what the user may see, do, and discover. With regard to this I have done some work and experimentation. One example is the CHIPLAY 2014 paper I and several students wrote [2]. This leads to a third avenue of exploration related directly to human aspects of games. This extends beyond just the technical aspects of coding a program and more into its design and purpose. Along this avenue, the goal of the game and the information presented in it can be setup to influence its players, or accomplish grander goals, outside the game. A fourth option may include the investigation of using *helpers* to guide humans through a process of understanding and discovery.

Along each of these avenues is also the opportunity to explore the design methodology itself. In this other aspects of software engineering and human computer interaction come into play. This too I have experience in, not just with my work in industry (CDC, Raytheon, and Kihon Games) but in the classroom as well (UW-Stout: GDD 325, 450, and 451 courses). Some items of interest are planning for and adjusting to dynamic changes in requirements, organizing the programming and development effort into manageable pieces, reusability of work, and designing tools and user interfaces to make the development process easier. All of this can be summarized as *designing for development*.

These are all areas in which students can be involved (graduate or undergraduate). The complexity and difficulty of the application and research in these areas also can scale to accommodate various needs, desires, and abilities. This is of course a brief summary and other ideas can easily be applied to extend this effort.

8 Funding

There are a variety of sources funding may come from for this research [3]. These include grants from the National Endowment for the Arts, and from the National Science Foundation such as the \$1.5 million given to CU-Boulder in 2012 [4]. There are also grants from private companies such as AMD's in 2011 [5]. There are occasionally competitions, such as the Game Designer Challenge and there is the possibility of the games themselves earning revenue. This is just a brief summary to illustrate the interest and opportunity for funding.

9 Summary

The general area of my interest is again in simulation design and development. Much of the work covers the visual and human aspects of computing. The context of the research and its application falls largely into the areas of graphics, software engineering, and human computer interaction. These directly relate to gaming, which ties things together nicely. Also of serendipitous nature is the popularity of mobile gaming, which provides an abundance of interest and potential resources.

My inclination, with mutual benefits, is to incorporate undergraduates into my research efforts. This begins by teaching the basic skills needed for graphics, simulation, and gaming. After which specifics of simulation, gaming, modeling, and mobile devices may be introduced. This leads to implementation efforts and paper submissions. This optimistically leads to gains in reputation and students. Note also, this is not limited to just computer science students.

10 References

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