THE MUTABLE BODY: EXPLOITING A CAMPUS THEME TO PUBLICLY PROFILE COMPUTING STUDENT AND FACULTY RESEARCH

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Abstract — In an effort to encourage campus and community dialog, Indiana University South Bend sponsors an annual campus theme supported by a series of events and designated readings. The university encourages faculty to incorporate this theme into their relevant courses. While often overlooked by technical disciplines, these events can act as a conduit to profile both student and faculty work for the liberal arts community. This paper constitutes a case study integrating the campus theme: "The Mutable Body" into a summer intensive course in biologically-inspired computing, and the subsequent design and implementation of a student-faculty seminar based on those, and other, projects.

Index — Biomorphic Computing, Computer Education, Mini Conference, Public Dissemination

INTRODUCTION

In an effort to encourage campus and community dialog, Indiana University South Bend has adopted a "thematic year" built around a designated book, coordinated events, and relevant classroom activities. Using a paradigm modeled on the "One Book -- One Campus" concept, the program is designed to engender a campus-wide dialog across disciplines and culture. This is an especially important component of a liberal arts education, and is an integrated component of the university's General Education program.

While the campus themes, selected through a campus-wide voting process, are always interesting, they are not always easily informed by the technical disciplines. This, in turn, can limit participation of technology students and faculty, while denying the university at large their perspectives.

As one step toward engaging the technical and non-technical campus communities, Indiana University integrated the 2005-2006 theme, "The Mutable Body" into the biologically inspired "Biomorphic Computing" course. The "Mutable Body" theme engages the metaphor of the body, its transformation, and its evolutionary potential. To inspire dialog Philip K. Dick's "Do Androids Dream of Electric Sheep?" was selected as the designated reading, the Biomorphic Computing class, the development and management of student research, and the subsequent planning of a public seminar featuring both student and faculty projects.

THE CAMPUS THEME

As described in the introduction, dialog on the campus theme centered around Dick's "Do Androids Dream of Electric Sheep". This book, through science fiction, explores the sense, theme, or question of what it means to be human. Having developed intelligent "machines" to provide life-like companionship, including human forms, humans found themselves threatened by these creations and employ a bounty hunter to "retire" them. Woven into the story are ethical and emotional considerations distinguishing humans as fundamentally different from non-human forms.

Coincident with the campus theme, the Computer Science department offered the Biomorphic Computing class. This class, open to graduate students and senior level undergraduates, explored biological metaphors for computing. These themes included models such as artificial neural networks, genetic algorithms, genetic programming, artificial immunological systems, and DNA computing. Also included were models based on social interactions, such as ant colony optimizations and swarm algorithms. It also considered computer versions of various human sensory experiences such as vision. Collectively, these experiences were embedded in a discussion of their relevance to "mutable", or changeable bodies -- human, animal, and in the case of robots, inorganic.

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A substantial component of this class was establishing, and managing, student defined and implemented projects. Projects ranging from applied Swarm Intelligence to genetic evolution were developed, and reported to the class in both oral and written form. As an integral part of our campus theme, students were then invited to present their projects, along with those of faculty and other invited participants, in a public seminar called "Biomorphic Computing and the Mutable Body".

**PEDAGOGY**

While the primary objective of the campus theme was to provide a forum for interdisciplinary dialog, effective pedagogy was also an important consideration. Seminar events have been used in undergraduate education and as a model for CS graduate education. Musicant and Ondich describe project based capstone experiences for their students [1]. Forming student teams, they specified projects ranging from web search engines to human-computer dialog systems. In their model, students attended frequent meetings, participated in peer evaluations, and underwent individual interviews, culminating in presentations at a "mini-conference". They report positive results, with student evaluations commenting on both the material learned, and the interpersonal skills developed.

This type of forum is being adopted at the graduate level as well. For example, Seyed-Abbass describes the use of class presentations culminating with poster presentations as a method for promoting research in graduate courses [2]. Sivilotti et.al. take the concept a step farther forming a mini-conference to present project results [3]. Specific objectives included developing skills for reading, writing, critique, oral communication, and citizenship. They conclude that the mini-conference is an effective tool for structuring graduate courses, and provides a "microcosm of academia".

Our approach, in contrast, builds on a standard graduate/undergraduate seminar class which emphasizes projects. It addresses the interpersonal communication skills outlined above through in-class presentations and project reports, then provides an additional post-course opportunity for voluntary mini-conference participation. In fact, since this event was strictly voluntary, and so that students would not feel any pressure to participate, responses to the invitation to participate were accepted only after the course had concluded. This has the effect of allowing participating individuals the opportunity to continue to refine their project in anticipation of the seminar, thus enhancing their learning experience.

**SEMINAR ORGANIZATION**

The Biomorphic seminar was organized under the auspices of the university Campus Theme committee, and received sponsorship from the Indiana University South Bend student chapter of the Association for Computing Machinery, the Computer Science department, and the Intelligent Systems Laboratory.

In order to create an environment for ideas to flourish, and to foster effective communication among the participants, we engaged the participants in a series of organizational meetings. These meetings established times, dates, location, budget and advertising, and the distribution of responsibilities among the participants. These meetings included all stake holders, students, faculty, and sponsors.

Ultimately, this committee established the following guidelines for the seminar:

- It was to take place in one afternoon/evening during the Autumn semester.
- The seminar was divided into two sub-events. The first, featuring poster sessions of the various projects, and hands-on demonstrations of computing applications related to the campus theme. The second sub-event were oral presentations of the various projects.
- Oral presentations would be limited to ten minutes followed by a five minute question and answer window typical of Computer Science and Engineering conference presentations.
To foster audience participation, an informal reception including finger food and drink was also provided.

**Seminar Contents**

Ultimately, the mini-conference included nine presentations. Of these, there were eight oral presentations and ten poster presentations, with one individual giving only an oral presentation, and one only a poster. Each presenter provided a title and abstract which was included in the promotional brochure, but no proceeding or other publication was produced. Sponsors were also invited to provide promotional materials, such as the poster displayed in Figure 1 for the Intelligent Systems Laboratory.

<table>
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<tr>
<th>Title</th>
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<tbody>
<tr>
<td>&quot;A Swarm Intelligence Approach to Counting Stacked Symmetrical Objects&quot;</td>
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<td>&quot;Genetic Evolution of a Neural Controller&quot;</td>
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<td>&quot;Application of Self-Organizing Maps to Texture Visualization and Analysis&quot;</td>
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<td>&quot;Handwritten Character Recognition&quot;</td>
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<td>&quot;Image Data with a Trained Neural Network&quot;</td>
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<td>&quot;Motorcycle Simulation and Automatic Piloting&quot;</td>
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<td>&quot;DNA: A Universal Molecular Language and a Computational Biologist's Dream&quot;</td>
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<td>&quot;A Physiologically Inspired Motif Generator for Genetic Art&quot;</td>
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<td>&quot;Enhancing Left-Ventricular Short-Axis Echocardiographic Cineloops with a Pulse-Coupled Neural Network&quot;</td>
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<td>&quot;A Fuzzy Logic Controller for Robot Maze Traversal&quot;</td>
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<td>&quot;Enhancing the Computing Curriculum with Hands-On Assembly Language Programming&quot;</td>
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**Table I**

**Presentation Titles**

The titles for the presentations are shown in Table 1. Each presentation was accompanied by a question session to allow for audience participation. Time was also provided for in-depth discussions during a corresponding poster session for the presenters.

The seminar also included live demonstrations of projects considered relevant to the campus theme, but not directly a part of the project presentations. The demonstrations included using fuzzy logic to guide Khepera robots through mazes as shown in Figure 2, with its corresponding poster shown in Figure 3. Also demonstrated were self-balancing, inverted-pendulum robots exploring a contained environment shown in Figure 4, and haptic interfaces for human-computer interaction. These demonstrations allowed the public to directly interact with students, faculty, and the computers themselves, thus encouraging the interdisciplinary dialog intended by the "One Campus" concept.
As is often the case in academia, appropriate space and budgets were a concern. Finding temporary, public, space that can have use suspended for essentially an entire day during peak times was challenging. Fortunately, due to the importance placed on campus theme events, the university was able to accommodate the event.

Funding for the seminar was shared between the Computer Science department and the Campus Theme budget, with food and facilities expenses being provided by the theme committee and poster printing provided by the department. Ancillary expenses were also shared.

It is difficult to assess the success of an event like this in quantitative terms. Informal feedback indicated genuine interest from those who attended the talks, as well as those who were only interested in the interactive displays and posters. Feedback, again informal, from the participating students was also positive.

From a pedagogical perspective, it provided a realistic professional experience within the confines of a familiar setting. This is important for building confidence toward participating in professional conferences in the future. And, perhaps, the best indicator that the content was appropriate for the forum is that several of the student projects were subsequently reviewed and published in established professional forums.

### Conclusion

We have presented a case study profiling the integration of a campus theme: "The Mutable Body" into a summer intensive course in biologically-inspired computing, and the subsequent design and implementation of a student-faculty seminar based on those, and other, projects. We believe that experiences like these provide a valuable opportunity to involve students directly in the research-dissemination process and to introduce the public to the diverse interests of the university for the academic technical community, thus engendering the intellectual and personal dialog intended in the campus theme.

### References


