The Collaboration of Fine Art & Engineering at the University of Guelph

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Abstract

Fine Art and Engineering view design as a central element, if not the central element, of their respective disciplines. Though engineers and artists offer mutually beneficial insights and expertise in design, these two disciplines routinely exist as separate entities in the development of design curriculum, and build facilities independently in the academic environment.

The School of Fine Art and Music (SOFAM) and the School of Engineering (SOE) at the University of Guelph have increased their collaboration over the last few years. The relationship started with the provision of engineering advice to guide the creation of two large sculptures then progressed to team teaching of a fourth year elective course as the next element in the partnership.

The SOE is currently undergoing a significant expansion. This growth has initiated plans for shared resources and facilities that will support advanced design and fabrication capabilities for engineers and artists alike. Collaboration will promote a cross fertilization of ideas between faculty and students through such initiatives as shared courses and design studios that will combine students from both departments. Successful cross-disciplinary collaboration offers the opportunity for SOFAM and SOE students to be leaders in creative, innovative, and sustainable design.

1. Introduction

Design is the essence of the artist and the essence of the engineer. Artists producing sculptures and engineers producing products often run into converging design problems. These two disciplines have the opportunity to come together for mutual benefits. Artists pursuing the actualization of their conceptual designs tend to push the limits of manufacturing technology. An engineer's focus on function can frequently be aided by increased attention

to form. The design problems that arise while constructing an artist's sculpture tend to be atypical to the normal design problems engineers encounter. It is both challenging and rewarding to be an engineer working with the artists to solve the design problems that arise. The experience pushes the engineer and the artist to look at their design problems differently.

The School of Fine Art and Music (SOFAM) offers academic programs for aspiring art historians, musicians, music scholars and studio artists. SOFAM has close ties to the national and international art scene and a curriculum that has consistently graduated some of the nation's top emerging talent in the visual arts. Experiential learning opportunities are widely used through a range of student-centred activities including: music ensembles, the noon hour concert series, an award winning choir, to student symposia, and a vital student gallery.

The School of Engineering (SOE) at the University of Guelph has a history that dates back to 1874. The School continues to be a non-departmentalized unit as it offers seven engineering programs. The School has had an emphasis on design dating back to the early 1970's when it introduced a sequence of design courses (one for each year of all students program).

The objective of this paper is to share with the engineering education community a growing collaboration between the School of Fine Art and Music with the School of Engineering. The collaboration is centered on virtual to physical rapid prototyping skills to aid the creative design process. It is hoped that this might aid development of similar collaborations at other universities. The paper approximately follows the chronology of the collaboration and ends with a reflection and a look to the future.

2. Beginning – Art aided by Engineering

The collaboration began in 2005 with a Christian Giroux (CG) project to create a one-to-one scale reproduction of early space satellites. CG, a traditionally trained studio artist, was trained to resolve design issues through the combined usage drawings and model making. The space satellite project proved to be beyond this training. The project provided an opportunity to pursue an interest in industrial prototype making. This interest is driven by a desire to make objects that more clearly resembled and partook in a

‘conversation’ with the real world of industrial objects that surround us on a daily basis.

The project and prototyping interest motivated a connection to engineering. CG connected to John Phillips (JP), a design engineer. The two connected as designers. The result was to create ‘IDCSP’ & ‘Alouette’ (Figure 1). The Satellite on which this artwork is based was Canada’s first research satellite that was launched in 1963. A combination of virtual and rapid prototyping tools was used to explore, visualize, analyze and ultimately manufacture the artwork. Eventually a water jet cutter was used to create one repeating aluminum unit that was then folded, powder coated and bolted together.

**Figure 1: IDCSP (Foreground) & Alouette
(photo credit: Tony Hakenshiel)**

The success of ‘IDCSP’ & ‘Alouette’ coupled with the success of the collaboration lead to ongoing conversations. Many of the conversations surrounded providing similar engineering and art opportunities to our students.

3. A New Course

The School of Fine Art and Music has a rotating course ‘*Special Topics in Sculpture*’. This special topics course provided the opportunity to bring the virtual to physical rapid prototyping tools and engineering to the senior sculpture students.

The development of the course included all of the traditional course challenges. Plus, one key additional challenge of bringing in sophisticated engineering tools to artists while ensuring that the course remained at its heart a sculpture course. Fortunately, the University of Guelph’s Learning Enhancement Fund generously provided additional one-time support for the course. These funds assisted development, covered some necessary overtime, off-set the cost of some materials and permitted purchasing some equipment.

Planning included devising the assignments and pretesting them. Computer-aided engineering software and the engineering shop facilities were new to all students. The course was co-delivered by CG and JP with final grade responsibilities falling to CG.

Fine Art students come with a number of advantages. They are comfortable with a hands-on, coaching, studio style learning approach, they are visually skilled, they expect to do the work themselves, and they take ownership of their project. Fine Art students know that the project is their creation. However, they are not engineers. Helping them to master engineering CAD software requires different approaches to deal with different learning styles and different foundation starting point. In the end, they succeeded. They were quite accepting of advice and quickly adopted the virtual to physical rapid manufacturing process.

A final exhibition of the student work was held at the Zavitz Gallery on campus. While the effects of the course on the students was more qualitative than quantitative, CG observed that students undertook more ambitious and technically sophisticated works and that their confidence in their ability to work with on more demanding projects increased as a result of their experiences in the course. Figure 2 illustrates one student’s sculpture – interface between reality and art. In this work, the student used some neat reverse engineering strategies to create the base for the flask. In addition, used the engineering tools to identify the center of mass for balance in addition to being conscious of the aesthetic balance of the art.

Figure 2: Flask Holder
(photo credit: Christian Giroux)

The success of the first year was also evident in the permission to offer the course a second time. The Special Topics course is normally rotated among SOFAM faculty and topics. An uncommon second grant from the Learning Enhancement Fund was also received. Overall financial difficulties on campus have prevented any consideration of the course becoming a regular offering – at least for now.

4. New Facilities

The culmination of our collaboration is the construction of new facilities in the School of Engineering. Doubling student numbers and adding three new engineering programs has led to new building construction and nearly complete renovation of existing facilities.

The new facilities include a doubling of shop space and a new manufacturing lab. Within this complex, there is considerable provision for new rapid prototyping equipment. The overall new complex does not meet the Council of Ontario Universities norms for research space. However, the new engineering complex has protected space for CG's CFI Digital Haptic Lab to be part of our new shop and manufacturing space. The plan is for new engineering equipment and CG's new lab to complement one another for the benefit of engineers and artists. The College of Arts (SOFAM's College) has committed to provide some funding for SOE staff to support rapid prototyping as another indication of a commitment to collaboration. The CFI funded lab will consist of rapid prototyping equipment. A virtual carving tool, referred to as a haptic device, will allow students to shape and mold a virtual piece of clay. The carving stylus is attached to a mechanical arm that provides

sensory feedback to the user. A 3D laser scanner will enable the transferal of real world objects to the virtual world. They can then be transformed virtually using the haptic device. A large format laser cutter and 3D printer will permit rapid manufacturing of virtual creations.

The creation of the rapid prototyping facility at the University of Guelph will compliment a growing network of other fine arts facilities located at universities across Ontario.

5. Reflection and Future

There have been a number of important ingredients that have contributed to the collaboration to date and will likely continue to be necessary for collaboration to deepen.

The collaboration's success has relied on continued mutual respect of the participants for each other and for each discipline. Starting the collaboration with a single project was probably an essential beginning.

The participants each had sufficient academic freedom to pursue an initial collaboration that was not linearly in the mandate of the participants. Increasingly, detailed milestones and metrics are becoming central elements of faculty funding proposals and faculty activities in the name of productivity and accountability. However, these productivity and accountability strategies can kill the broadly desired creativity and innovation if the milestones/metrics are excessively detailed and dogmatically followed. Faculty members most certainly need a vision to guide their efforts but it is essential that this vision stays broadly defined.

The Deans of the College of Arts and the College of Physical and Engineering Sciences together with the Director's of SOFAM and SOE have supported and endorsed the collaboration. It would have been easy for any one or all of these individuals to put up barriers.

The last key ingredient is timing. The satellite project, the special topics course, the Learning Enhancement Fund, the CFI grant and the School's new facilities are all elements that resulted from fortunate opportunities. For a collaboration to succeed it must take advantage of the opportunities that present themselves.

The collaboration has triggered or helped to advance a number of other initiatives. Sketching has been reintroduced into the first year engineering design course. Rapid prototyping has been integrated into the second year design course and contributes to the third year and capstone courses.

Engineers and engineering educators have much to learn from our Art counterparts. Artists are

experienced and comfortable with a studio, coaching learning approach. Art students take creative ownership of their work as a given. Engineering would do well to master these dimensions in their education activities and in their creative work.

The vision for the future is to graduate engineers and artists alike that believe they have the freedom and the skills to create their ideas. A future in which graduates are capable of using the virtual and physical rapid prototyping tools in liberating ways to drive innovation.

Rapid prototyping tools have been and will continue to advance and transform the work for engineers and artists. There are pedagogical questions that need to be asked and explored.

6. Acknowledgements

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