Meeting the Challenges in Industrial Design Education at NCSU
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Where design education goes from here

Industrial design can play a pivotal role in helping the university system successfully respond to the challenges that confront our nation in the rapidly advancing global economy. As a member of the industrial design faculty in the College of Design at North Carolina State University, I have had a front row seat in observing the changes that the global economy has brought to the region where I teach. As a result of loosened international trade restrictions and technological development overseas, the state of North Carolina has, over the past ten years, suffered overwhelming job loss in both the textile and furniture manufacturing industries. During this time, as a faculty member and more recently as department chair, I have been in contact with numerous alumni and colleagues in the region who have lost design jobs in traditional manufacturing areas. And most recently, our region has recently received the news that North Carolina’s Research Triangle Park division of IBM, employing several thousand of area residents, has been sold to the Chinese company Lenovo. The American middle class, and the standard of living that comes with it, is largely the result of our ability as a country to design and produce innovative new products and services. The imbalance created by our current trade deficit is a serious threat to our national well-being. Major erosion of the American middle class, as the result of exporting little except consumption, is an unsettling prospect.

The regional news, however, has not all been negative. In the midst of the dislocations in traditional spheres of North Carolina industry, there has been an influx of newer firms, such as Bosch/Siemens, Insight Product Development, and HumanCentric Design. It is worth asking the question… what makes these firms successful, competitive, and able to flourish in the midst of conditions that are overwhelming others? The answer appears to be that the ‘low hanging fruit’ is gone, and that only firms that are able to embrace the complexity of a highly competitive global marketplace can now endure. Across the US, there is ample evidence that jobs focused on the design and production of ‘run of the mill’ goods intended for saturated markets, are vanishing under the pressure of global competition. Witness GM’s recent announcement of a pending 250,000-person layoff. And recently, ‘off-shoring’ and job dislocation has begun to occur beyond the factory floor, in the white collar/professional sector, affecting such fields as chemical and mechanical engineering, architecture, and computer programming—fields that are central to the research and teaching missions of American universities. A faculty colleague who is a Distinguished Professor of Chemical Engineering at NC State told me recently that for most of his career, students graduating with a professional degree in chemical engineering could reasonably expect stable employment with a large chemical firm like BASF. ‘That’s no longer the case, those jobs are going elsewhere, and we are telling our students that they have to be innovative, they have to be entrepreneurial, and in order to do that they have to collaborate with other fields.

In his recent book, *The World Is Flat* (2005), Thomas Friedman makes the case that “the playing field is being leveled. Countries like India are now able to compete for global knowledge work as never before and America had better get ready for this.” Friedman goes on to point out that “In the flat world, more and more business will be done through collaborations within and between companies, for a very simple reason: The next layers of value creation—-whether in
technology, marketing, biomedicine, or manufacturing—are becoming so complex that no single firm or department is going to be able to master them alone. ... The best companies are the best collaborators.” Friedman is optimistic, however. He believes America is going to see hard times, but the difficulty “will be good for America because we are always at our best when we are being challenged.”

Though frequently mischaracterized as stylists, industrial design has long been good at, and valued for, its role in a collaborative product development process. It was the South Korean Government’s use of industrial design through the ‘Korea Institute for Design Promotion’ that forged the enormous export success of Kia, Hyundai, Daewoo, and LG Electronics. By treating industrial design as national strategy, despite being a country with a natural resource equivalent of the Sahara desert, they became a country with the third-largest financial reserves in the world.

Industrial design is the discipline that is most fluent at synthesizing, expressing, and refining the collective vision of a complex collaborative product development process. With this in mind, the NCSU Department of Industrial Design has undertaken initiatives to use ID as a means of promoting collaboration within the university. Collaboration is old news in industries that still remain viable, but it has not penetrated consistently within the American university system. One reason for this is that tenure is still awarded by individual academic units and departments, a situation which narrows where faculty focus their efforts and receive their rewards. The result is a university system that excels at basic discipline-specific research, but often leaves for others the benefits of the crucial and complicated last step—carrying the hard won discoveries of research into the market.

In order to enable the university to benefit from this potential revenue stream, the Department of Industrial Design has engaged in campus collaborative initiatives. This work has two parts, one in product research and development, and the other in teaching.

The Campus Collaborative: Research and Development

The Research and Development aspect of the initiative evolved through the development of personal relationships with faculty in the scientific disciplines who recognized the value of combining forces. After several years of trial and error, we have arrived recently at a team that has begun to function well, both in terms of receiving funding, and in the synergy developed in carrying out the work. The current team members include faculty and doctoral students from mechanical engineering, industrial engineering, electrical engineering, and robotics, working with faculty and graduate students in industrial design. The project is a three-year grant from the National Institutes of Health, to develop robotically assisted heart surgery tools, in conjunction with East Carolina University’s College of Medicine.

The goal of the project is to reduce the amount of time it takes a robotically assisted heart surgeon to repair a malfunctioning heart valve. Robotically assisted heart surgery has the advantage of repairing heart problems without the trauma associated with splitting the sternum, as is required in conventional open-heart surgery. By using 8 mm diameter robotically manipulated arms, which are controlled through extremely sensitive joysticks, the surgeon is able to enter the chest via a relatively small incision between ribs and perform surgical procedures while viewing the progress through an endoscopic camera. In the past, patients had to be relatively young to qualify for robotic surgery, because working remotely is inherently slower. Survival rates for older patients decrease as a function of how long the heart has to be stopped for surgery, with the body supported by means bypass circulation equipment. As a result, older patients are forced to have the traditional sternum-splitting procedure. By reducing the time involved and improving the efficiency of the procedure, the benefits of robotic surgery can be
available to older patients, for whom recovery from traditional open-heart surgery is extremely difficult.

The process of collaborating on this project has been thrilling. By having immediate access to such a broad range of expertise, complex questions are answered fast. An hour-long meeting results in a significant volume of sketches for new directions as ideas are discussed by the team. By utilizing several labs around the campus, the broadest range possible of materials and processes are available for application, from experiments with the shape memory effects of nitinol to electron beam rapid prototyping in metal. And surprisingly, the designer’s familiarity with traditional machining and fabrication of prototypes has added significantly to the speed of concept development, even in a technology rich environment. Having reached the milestone of the first year report on the project, the team has already filed 5 patentable invention disclosures with the university’s office of Technology Transfer.

The Campus Collaborative: Teaching

Engineering and industrial design both have distinct problems within their curriculum that each is uniquely capable of solving for the other. Engineering typically has a deficit of hands-on application experiences, and little practice in iterative problem solving industrial design has a deficit of the technical knowledge needed to creatively exploit the latest technology that can be a component of a product. Whereas in the past, the typical student applicant to an industrial design program often had a long history of taking apart their toys and, later, fixing their cars, the advent of both Nintendo and fuel injection has created a black box syndrome among some of the incoming students. Although there are a few particularly gifted students who rose to the occasion and learned to hack their way into the hermetically sealed objects of their youth and can now function well in both the design school and the engineering lab, most often this a difficult gap to bridge.

Thanks to a grant from the National Science Foundation, we have begun to develop a curriculum that solves some of the problems of both disciplines. Again this effort has come about as the result of personal relationships between faculty from across the campus who have shared concerns and an appreciation for the need to collaborate. In the fall semester, a group of juniors in ID were selected for the pilot test of a Product Technology Studio. This class level was chosen because during the sophomore year, students complete two 3-credit-hour service courses that deal with methods of manufacturing and the use of materials. One of the expected outcomes of the junior year is that the projects demonstrate the student’s ability to effectively apply what they learned about manufacturing to the design of their projects. The Product Technology Studio, therefore, seemed a good place to include course content related to the technology embedded in the product itself. The studio’s main goal was promoting innovative use of technology by all the students.

The new course began by assigning the students to choose between two projects, a portable CD player, or an electric guitar. The industrial design students were to ‘dissect’ the product they chose as a group, under the guidance of advanced students in engineering. Once they understood the existing product and its underlying operating principles, they were to develop designs for a new version of the product, based on either the current state of the technology, or an informed projection of what would be possible in the foreseeable future.

At the beginning of the semester, students worked mainly in the Product’ Take Apart’ Laboratory, which had been set up in the College of Engineering. The lab proved an essential setting for the projects, as the design students took apart the products and discussed the underlying principles of their operation with the engineering students. After the initial two weeks of gaining familiarity with the existing products, the work moved to the design studio, so that the students would have the desk space necessary to draw effectively, and have proximity to the College of Design computer lab and shop. It was at this stage that the educational experience
began to be reciprocal, because the students from engineering became true collaborators in the process of developing new concepts. An additional influence, which the faculty involved had not taken into account, was the influence of the type of classroom on the experience of learning. The design studio, where each student has his or her own work area, provided a less formal and more creative setting, which was unknown within the engineering school. This flexibility of the space itself allowed the engineering students to work with the design students within both individual and group sessions, and to share ideas between various groups.

In the latter part of the semester, a significant change was noted in the effectiveness of achieving the course goal when the engineering students began to take an active role in the design critiques. The design critique is a setting where feedback is immediate, public, and notoriously honest. In this setting of verbal debate about ideas regarding design and the application of technology, we began to see results that had been unattainable in the past. Student designs in this review were more creative in their use of technology than in the past, and technical feasibility could be proven, disproved, or improved upon, on the spot. It was particularly gratifying to witness that the advanced engineering students were encouraging of the design student’s creativity, even on some of the most radical ideas, and that they had become key players in shaping the details that would make a project work.

I have observed in professional practice, working with multidisciplinary teams on technically oriented projects in robotics, that there is a tendency for barriers to exist between any two disciplines, with negative expectations of the aptitudes and motivations of other disciplines than one’s own taking precedence over actual personal experience. By establishing links between related professions at the university level, the way is paved for more effective collaboration in the student’s future careers. We were quite fortunate in the engineering students who were selected for the pilot test of the course, in that they possessed qualities that we now recognize as essential to the success of the course in the College of Design. These were advanced students, quite knowledgeable in their own field, and also open minded and interested in other disciplines as well. This resulted in an open atmosphere among the students, and made them more willing to explore the overlapping interests between the College of Design and the College of Engineering. It is in this area of overlap that our competitive success in the changing economy is to be found.

The purpose of this paper was to describe a process that enhances the university’s ability to create jobs and products to the benefit of the community it serves. The US Small Business Administration, in its April 2005 National Assessment of Entrepreneurship and Regional Economic Growth and Development pointed out that in today’s increasingly competitive markets, the creation of economic value can only be sustained as firms (1) increase their capacity to generate new marketable ideas, (2) rapidly commercialize those ideas and (3) adjust their competitive offering to changing market conditions. It is with this aim in mind that the collaboration of design schools with the scientific and technical components of university campuses, can achieve both a work force and an application of research that demonstrates to the region and the nation that what Friedman believes is true: That we are at our best when facing a challenge.