

Forum for Integrated Design

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At Rensselaer, we have engaged in one of the first national efforts to overcome these curricular barriers. Through a group of faculty and staff from the five schools at Rensselaer known as the Forum for Integrated Design, we have engaged in a two-year effort to coordinate, nurture, and giving national visibility to Rensselaer's innovative multidisciplinary perspective on design. With funding from the Rensselaer Strategic Initiatives Program, Forum members have meet roughly every three weeks for the last two years for a breakfast talk on some aspect of design given by one of our colleagues. In addition, we have hosted four full day retreats for in-depth discussion of the issues associated with multidisciplinary design.

Through these activities, the Forum has developed an innovative curricular plan aimed at overcoming curricular barriers to multidisciplinary design. Through a Minor in Multidisciplinary Design being inaugurated in the academic year 1995-96, we aim to create a community of faculty, staff, and students that will:

- Provide to majors in design-related disciplines the value-added experience of interacting with and borrowing from the other design-related disciplines.
- Create a haven for a distinctive spirit that is nonetheless observable to the entire Rensselaer community.
- Constantly question the history, cultural traditions, and social implications of the "state of the art."
- Nurture creativity, sense of agency, and willingness to take risks.

In particular, thorough the Minor in Multidisciplinary Design, students in the design disciplines will have access to coursework into other design disciplines, taking 2 design practice courses, 1 design theory course, and 2 design electives outside of their own specialization.

Our initial efforts in sustaining and developing the coursework required by the Minor in Multidisciplinary Design have revealed the second major factor limiting our ability to respond to industrial needs: our own disciplines. Like our students, we have not had the experience of working in multidisciplinary contexts and, even more than our students, we have developed strong traditions limiting our ability to understand, respect, agree, or collaborate with our colleagues.

Our work in the Forum for Integrated Design over the last two years has been aimed at removing these disciplinary barriers, and we have laid a strong foundation for the work ahead. In particular, unlike at most other research institutions, faculty from the design disciplines at Rensselaer now know each other, have developed an essential respect for each other, have developed a set of common curricular goals, and have begun the process of understanding one another's language.

All the changes in the market and in the industrial response to the market have made the need for multidisciplinary design clear and the process of multidisciplinary design complicated. Under even ideal circumstances, large teams spread out in time and space would face coordination problems when undertaking the kind of ill-defined problem-solving which constitutes design. In addition to these normal problems, however, industries face strong cultural traditions which mitigate against successful multidisciplinary design. In particular, the disciplinary differences which have traditionally been the source of strength as developing deep understandings of design problems have also emerged as

problematic in the new multidisciplinary context. Such differences include:

- Differences in language. Each discipline may have developed its own language for describing what it does and what it sees. Such language differences may keep participants on multidisciplinary teams from understanding one another.
- Differences in issues. Each discipline may have developed methods for dealing with its own issues in the product development process. Such issue differences may keep participants on multidisciplinary teams from acknowledging the validity of one another's issues.
- Differences in criteria. Each discipline may have developed its own criteria against which they measure "good" design. Such criteria differences may cause participants on multidisciplinary teams to pursue diverse and incompatible goals.
- Differences in proprietary interest. Each discipline may have developed its own proprietary interest in its contribution to the design. Such proprietary differences may cause participants to withhold information and cooperation in an effort to make their contribution indispensable.
- Differences in prestige. Each discipline may have developed its own sense of the prestige of its activity. Such prestige differences can make participants unwilling to treat each other collegially and can lead to the over-or-under-evaluation of design concepts.
- Differences in location, structure, curriculum

While industries have been trying a variety of local and ad hoc approaches to addressing the problems raised by these disciplinary differences, results of these efforts have not been uniform. In our view, the university must play a key role in addressing these difficulties because most disciplinary differences are rooted in university training. But, as we suggest in the next section, universities have generally been limited in their ability to respond.

Two factors have limited the ability of the university community to respond to the industrial need for multidisciplinary design. Most obviously, curricular barriers exist. Since the second half of the nineteenth century, university education has been divided into two components: first, a component of general education which would provide students with the foundations for general citizenship and second, a component of disciplinary training which would provide the foundation for career activities. Because of its productive character and its reliance on disciplinary technique, design has always been made a part of specialized training in the undergraduate major.

As a result, very few design courses enroll students from outside their respective disciplines. At Rensselaer, for example, students learn architecture design in the design studios for architecture majors; engineering design in the capstone courses for engineering majors; document design in the writing courses for communication majors; software engineering design in the capstone course for computer science majors; the management of technology in courses for management majors; technology policy in advanced seminars for science and technology majors; and 2 and 3 dimensional design in a fine arts service core, with no undergraduate majors.

The problems created by this curricular structure to work in multidisciplinary design contexts are obvious. Participants in multidisciplinary design teams must work from the base of their disciplinary training but must learn how to interact with and borrow from the other design-related disciplines. With strict disciplinary training, students do not have the opportunity to learn how to conduct this interaction or negotiate this borrowing. In fact, they seldom encounter one another once they have passed into their specialized training, and the training often compounds the problem by focusing exclusively on the language, issues, criteria, proprietary interest, and prestige of the students' major disciplines. More specifically, engineers are penalized for wild creativity, architects penalized for not being "creative".

We have just begun taking the next step in developing a truly multidisciplinary approach to design, where a small team of faculty from a broad base of design disciplines have an intense collaborative experience of working together on a common technology and documenting the results as a model case for multidisciplinary design, in this case household technology.

In engineering design, this project represents a visionary extension of the move to integrate design into the engineering curriculum. Though calls for multidisciplinary design have increased over the past few years, ours is the first to meet the industrial need to broaden education to include a sensitivity to practical problems, to teamwork, and to culture and institutions. In addition, because of our plans for the systematic documentation of the design process, our work will represent much-needed original research in the area of design process.

In architectural design, this project represents an advance toward integrating more collaborative approaches into architectural design education. Despite the changing fact of architectural practice, the design studio approach widely used in architectural education focuses on individual, often highly competitive, designers who are more sensitive to criteria for good design established by their own disciplinary community than to those criteria used by their clients or the other disciplines with whom they must cooperate to bring a project to fruition. This model of unusual and individualized practice is not recognized as not particularly well suited to today's climate of large design firms engaging in highly collaborative practice.

In communications design, this project represents an advance toward integrating technical communications specialists into product development teams.

In science and technology studies, this project represents the opportunity to contribute original research on technology as well as to develop policy recommendations for product development.

In software engineering, this project represents an opportunity to extend our understanding of collaborative design and its appropriate technological support.

In management, this project represents the opportunity to develop methodologies for the management of technology in a way that will contribute to accelerated product development life cycles and visionary design.