A New School of Design
with implications for the National Science Foundation

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In the fall of 2000 the University of California, Irvine embarked on a process targeted at creating a new School of Design [1]. The proposed school, when established, will have 40 faculty, 200 graduate students, and 800 undergraduate majors. The focus of this effort is not a variation on the many fine arts schools or the appreciceship/trade schools that focus on topics such as furniture design, but rather capturing something new, exciting, intellectually rich, and deep. The faculty providing the impetus for this effort are convinced that a revolution in design is occurring and that revolution calls for a novel consideration of how design is viewed, investigated, and taught.

The broad scope of UCI's proposal encompasses product design, spatial design (architecture, landscape, urban design), interaction design (which is broader than just HCI), and design studies. Design studies engage the full range of humanistic and scientific enquiry into design, exploring the interrelationship of culture and design, the processes of design, and how designs are evaluated. This exercise at UCI, which is currently in a campus-wide review stage, offers some insights, we believe, for the NSF with its interest in establishing a "science of design" in the CISE directorate.

The most important insight is in the character of design itself. More than ever before designers in the academic community are required to investigate and articulate the principles and methodology behind designs through systematic research, experimentation, intellectual inquiry, and theoretical speculation. They are expected to communicate their findings and contribute to a body of knowledge that constitutes the basis for an emerging academic discipline and a true science of design.

From this perspective, design is at a point that recalls the professionalization of medicine and law in the nineteenth century, when these fields were organized and regulated by professional organizations that stressed more systematic training in the conceptual foundations of practice and the direct oversight of educational programs through accreditation and review. The shift also reflects the more recent transformation of engineering from vocational practice to applied science, as suggested in 1930 by the President of MIT, Karl Taylor Compton, who in his inaugural address said that he had studied the curriculum at MIT "to see where training in details has been unduly emphasized at the expense of the more powerful training in all-embracing fundamental principles". These parallels have led some scholars to describe current changes in the field of design as leading toward a "design science" based on practices characteristic of scientific and scholarly disciplines, including:

- methodological self-reflection;
- the explicit articulation of theoretical principles guiding the design process;
- the development of a published body of knowledge that can serve as the basis for future hypotheses; and
- a culture of research that values critical inquiry and the solution of generalized problems beyond those associated with a specific project.

Nigel Cross [3] provides a brief history of this interest in design science and methodology, starting with the design methods movement of the 1960s that culminated in Herbert Simon's now canonical The Sciences of the Artificial [5]. Simon called for universities to establish a "science of design": "a body of intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrine about the design process".

The issue of science and methodology in design has also been a prominent theme for conferences over the past two decades, beginning with the meeting of the Design Research Society in 1980 on "Design:Sci-

ence:Method" and continuing through "Doctoral Education in Design" at Ohio State University in 1998, "Design Thinking Research Symposium" at MIT in 1999, and "Foundations for the Future" at La Clusaz, France in 2000. It has also been the subject of numerous books and articles from many countries, including Nigel Cross's *Developments in Design Methodology* [2].

Development of this research culture in design will require designers to have more extensive academic training, approaching design not only as a specific problem to be solved but also as a field of inquiry, scholarship, and critical debate. That training will focus less on the dramatically diverse products of design and more on the processes of design leading to their production. These processes have many common elements that can be the focus of research and a coherent educational program, such as the issues, techniques, and agents involved in creating and evolving artifacts, processes, and institutions, and the strategies for satisfying constraints on these objects that are imposed by their purpose, their users, and their environment. The major intellectual elements of design include methodological principles and aesthetics, techniques and methods, tools, history, and various kinds of physical and social constraints, and each of these topics offers rich opportunities for research, experimentation, and theoretical speculation in an academic setting.

Design in this broader sense — the task of joining function, form, methodology, and context — involves major intellectual issues that demand serious academic study and forms a proper focus for a National Science Foundation program.

The intellectual roots of design extend into the arts, humanities, sciences, and engineering, and all of these disciplines contribute to the theory and practice of design, broadly construed. The combination of these perspectives provides new understandings, enables much more effective design practice, and opens doors to new lines of intellectual inquiry. For example, management offers designers insights into markets, marketing, production practices, and cost/value insights. The social sciences offer insights from cognition, perception, psychology, anthropology, and sociology that may be applied to the design of everything from automobile dashboards to social services and public policy to software. Engineering provides innovative enabling technologies. The humanities provide historical and critical perspectives on design, multicultural understanding of aesthetic and philosophical issues, and a sophisticated grasp of issues in the communication and dissemination of new ideas and products.

We believe such a broad, interdisciplinary, and integrative approach to design offers much promise, even when focused on designing software. Creating an interdisciplinary vision requires, however, the constituent older disciplines to abandon claim to exclusive and constricted control over the term "design" – a painful and incomplete process on our own campus.

Lastly, creating the School of Design proposal yielded insights in the role of representation. All types of designers are concerned with representations and tools to manipulate them. It appears, though, that computer scientists are particularly advantaged in such discussions, however, as for us there is no ultimate "ground representation." Vehicle designers ultimately produce cars and planes; architects build buildings, but for software engineers the absence of an ultimate, tangible representation enables the development and use of multiple, interrelated and novel abstractions, giving us substantial freedom to explore new approaches to design.

[1] http://www.evc.uci.edu/growth/design/SoD-proposal.pdf

[2] Cross, Nigel (Ed.). (1984). *Developments in Design Methodology*. New York: Wiley.

[3] Cross, Nigel. (2000). Design as a Discipline. In Durling, David, and Friedman, Ken (Eds.). (2000). *Doctoral Education in Design: Foundations for the Future. Proceedings of the Conference at La Clusaz, France, 8-12 July 2000*. Staffordshire, England: Staffordshire University Press.

[4] Friedman, Ken. (1997). Design Science and Design Education. In McGrory (Ed.), *The Challenge of Complexity*. Helsinki: University of Art and Design: 21.

[5] Simon, Herbert A. (1981). *The Sciences of the Artificial* (2nd Edition, revised and enlarged). Cambridge, MA: MIT Press.