



Why Do We Need Doctoral Study in Design?

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This article makes a case for why design research is important to contemporary design practice and the deepening of the design disciplines, especially at this point in our history. It identifies the pressures on knowledge generation exerted by the shift from a mechanical, object-centered paradigm for design practice to one characterized by systems that: evolve and behave organically; transfer control from designers to users or participants; emphasize the importance of community; acknowledge media convergence; and require work by interdisciplinary teams to address the complexity of contemporary problems.

Further, the text addresses the rather checkered past of design research programs in universities in the United States of America (USA), and the international positions by professional design associations on the development of research cultures. Included in this discussion is data on what American design professionals, faculty, and students think about design research and what this data tells us about growing research activity.

Finally, the article talks about the pre-requisite, institutional conditions for establishing and differentiating research-oriented master's and doctoral degrees. These threshold criteria include: 1) institutional research infrastructure; 2) faculty qualifications to provide curricular leadership in research education; 3) library resources; 4) resources under nascent design research funding models; 5) balance between disciplinary research programs and interdisciplinary challenges; 6) assessment of faculty and student research activity; and 7) research publication and presentation imperatives.

Keywords — Doctoral Education, PhD in Design, Design Research, Research Education, Design Knowledge, Design Education.

Relevance to Design Practice — There is a general lag by college-level programs in responding to major paradigm shifts in the profession; this article attempts to define the role of advanced programs and research in addressing those shifts in ways not possible under traditional models of professional education.

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Introduction

Many of the interviews and presentations I do today address the question: why do we need doctoral study in design? This question most often comes from practitioners and faculty in a field that has only a short history of research and a long tradition of training in know-how, in the craft of solving problems with the information immediately at hand. It is a reasonable question to ask about a field that is not well understood by the public or by popular media that view design mostly in terms of how things look. But ironically, the greatest skepticism about expanding design research programs seems to reside within the discipline itself, where there is ongoing debate about what constitutes design knowledge.

By contrast, the notion of a design research culture does not seem odd to people in fields outside design, where among the defining characteristics of professions, as opposed to trades, are segments of practice in which the sole activity is the generation of new knowledge. There is broad recognition that knowledge generation sustains the evolution of a discipline and particular interest in the value of design research in cross-disciplinary investigations.

In this commentary, therefore, I first make a case for why design research is important to contemporary design practice and the deepening of the design disciplines, especially at this point in our history. Further, I address the trajectory of design research

programs in universities and talk about the pre-requisite conditions for establishing research degrees.

This paper is from the perspective of design in the United States of America (USA), where design research has been especially slow to develop. Discussions of these issues pervade the field worldwide, however, and several working groups have been established to debate these very topics for publication in the coming year.

New Paradigms for Design Practice

The modern practice of design has been the model for design education since the days of the Bauhaus. Defined as an *object-centered* process, the traditional goal of design has been to produce an artifact or environment that solves a problem.

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For academic programs arising from the arts, the beauty and humanity of such objects or environments are important. For programs arising from the sciences and engineering, usability and efficiency are paramount. And in between are the social sciences, where the issues of culture and social interaction reside.

The distinctions within each of these disciplines are not simplistic, but the research paradigms they represent for producing objects and environments clearly have different value systems and methods, and historically, they have argued for very different curricular paths at the graduate level.

The demands on design practice in the twenty-first century, however, are significantly different from those of the past, suggesting that these paradigms may require re-examination. A number of current trends challenge the traditional notions of what we do and, more importantly what we need to know:

Increasing complexity in the nature of design problems:

Christopher Jones (1970) articulates the scale of design problems which exist in a post-industrial society. He described a hierarchy of design problems, beginning with *components* and *products* and extending to *systems* of interrelated products and *communities* composed of interacting systems. Jones asserted that the problems of contemporary society are defined at the level of systems and communities; that design action must address an intricate web of connections among people, activities, objects, and settings. He admonished the design professions arguing that our conventional methods for addressing problems are woefully inadequate at these levels of complexity and better suited to work on components and products.

The chart in Figure 1 shows various problem types, ranging from simple to complex and from artifacts to experiences. The evolution of design practice evidences increasing complexity and greater focus on experience and behavior. We now understand that logos do not mean much if they are not nested within a branding strategy and that software systems succeed or fail on how well suited they are to the broader role of technology and the networked economy in people's lives. This does not mean that work at the experience end of the continuum is devoid of artifacts only that its goal is to engage or mediate some kind of human interaction with a larger context.

As an explanation of this trajectory I compare two presentations of a design problem with respect to their complexity and experience. These presentations were made

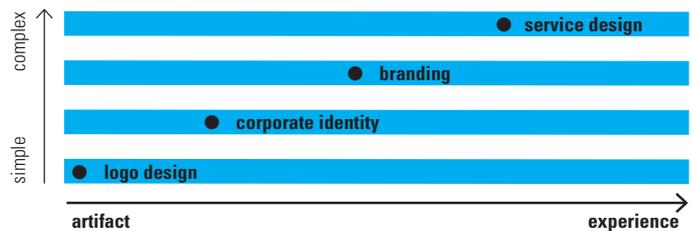


Figure 1. The shift from designing artifacts to designing the conditions for experience.

by graphic designer Milton Glaser and technologist Nicholas Negroponte. These presenters shared the stage at a conference of the American Institute of Graphic Arts (2005). First, Glaser unveiled a poster for ONE.org, showing a human hand, with each finger in a different skin tone, and the phrase “We are all African.” ONE.org is a website that encourages people to lobby politicians on the problems of poverty. Second, Negroponte showed MIT’s \$100 laptop (<http://laptop.media.mit.edu/laptop/>), designed to bring the educational opportunities of the Internet to children in developing countries. Both objects addressed the issues of poverty, but Glaser’s poster reduced an enormously complex, systems-level problem to a phrase and an emotional image distributed on the streets of New York City. Negroponte’s solution, on the other hand, addressed the complexity of poverty as something to be *managed* – not *simplified* – through tools and systems.

More recently, in an article for *Interactions*, design strategist Hugh Dubberly (2008) made a similar argument saying that traditional notions of design thinking and the innovation process are object-centered and organize our work according to mechanical principles. He described an organic, systems-based alternative that seeks to address friction in the relationships among communities, conventions, and contexts. The results of Dubberly’s process are insight and opportunities for change that create value and that may take the form of experiences, extendable platforms, or evolving systems. Unlike the final state of an object-centered process, which seeks to be “almost perfect”, the results of a systems-based approach are “good enough for now,” acknowledging that conditions will continue to evolve (Dubberly, 2008).

This paradigm shift in the focus of the design process from objects to experiences demands new knowledge and methods to inform decision-making. It broadens the scope of investigation beyond people’s immediate interactions with artifacts and includes the influence of design within larger and more complex social, cultural, physical, economic, and technological systems.

The transfer of control from designers to participants:

Computer scientist Gerhard Fischer (2002) writes that as the influence of technology expands, control moves from the designer to the people for whom we design. Design researcher Liz Sanders (2006) argues that designers need to think less about *consumers* and *users*, and more about *participants* and *co-creators*; about designing *with* people rather than *for* them. MIT comparative media professor Henry Jenkins (2006)

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discusses the consequences of media convergence on people's sense of agency or control of outcomes. Spend a little time on facebook, SecondLife, or ebay and you understand who is in charge.

Design is in uncharted territory with respect to emergent systems and many of the current strategies for studying people are neither predictive of, nor responsive to, a rapidly changing environment of new technology and the resulting relationships among people, places, and things. If we accept the position of activity theorists (Nardi & Kapetlinin, 2006) – that design mediates the relationships between people and the activities they use to influence or interact with their environment – then our research strategies have to go beyond testing actions and operations in human factors labs and asking questions in focus groups that separate people from the settings in which relevant behavior takes place.

The rising importance of community:

Design anthropologist Elizabeth (Dori) Tunstall (2008) talks about the role of community in design: that historical consciousness (people's understanding of where they come from); life goals (what matters most to members of a community); organizational structure (how collective decisions are made and how individuals fit in); relationships (the means through which people gain understanding of common values and establish trust); and agency (the degree of an individual's control or influence over things that matter to the community) are important factors in determining the level of *communitas*. In this sense, we can talk about learning communities and communities of practice that may exist only through online interactions. Further, such perspectives signal that globalization and the complicated issues of designing *for* and *within* culture involve more than simply adopting an appropriate visual language.

If design both illustrates the axiology of a culture (i.e. mirrors its highest or most dominant values) and shapes its social interaction (i.e. influences interpretive perspectives and behaviors), then the consequences of design have implications that reach far beyond the immediate consumption of goods, information, and services. And because "community" is no longer defined by geographic location, or even common histories, our understanding of these issues should be re-evaluated through research.

Technological expansion and media convergence:

We now live in a culture of emergent, convergent, sensor, and mobile technology. Traditional object-driven design paradigms, which often result in fixed features and physical attributes, fall short in an experience-oriented world. Networks, tools, platforms, and systems – the means through which people create experience and shape behavior – are the "products" of design efforts in a vastly reconfigured technological world. Design consultant Adam Greenfield (2006) describes ubiquitous computing as "everyware", "the colonization of everyday life by information technology...a situation...in which information processing dissolves into behavior" (p. 33).

Not only does this shift in the output of design challenge the traditional body of knowledge that informs our design decisions, but it also points to a need for research into the very methods by which we design. If the goal of design is to provide an increasingly invisible interface (which may, for example, be comprised of sensors that are activated only by unconscious gestures), what methods replace a design process that has been all about designing visible representations of mechanical and text-based information systems? And by what criteria do we judge success?

The necessity of interdisciplinary work:

The complex scale of problems, diversity of settings and participants, and demand for adaptable and adaptive technological systems argues for work being done by interdisciplinary teams composed of experts with very different modes of inquiry. How such experts collaborate as peers and the roles design can play in mediating collaboration present new opportunities for designers.

To participate at this level of engagement, therefore, designers must deploy team-based strategies that argue successfully for effectiveness as well as efficiency, sustainability as well as feasibility, and human-centeredness as well as technical viability. Nothing about design education in the past explicitly prepared designers for teamwork; most design professionals do it intuitively. How teams of diverse experts innovate and the role designers play in that innovation, although the subject of many claims in the popular press, is another area about which there is little empirical research.

It is apparent from these challenges that the traditional knowledge base of design has its limits and that for design practice to remain relevant in this rapidly changing environment, the field must generate new knowledge and methods. Because design is subject to modulations in the culture, such knowledge seeking must *anticipate* where design is going, not focus only on where it has been.

Further, unlike research in other fields, where the first years of doctoral study are spent surveying what *has not* been done, the question for doctoral students in design is "What is worth doing?" The choices doctoral students and their faculty make in determining dissertation topics have somewhat greater significance in shaping others' perceptions of design research than do topics in more mature research fields. These topics tell professionals, scholars, and the public what issues truly matter with respect to design and set the stage for the kinds of students who will be attracted to advanced study. When there is so little history of design research to cite, the collection of dissertation topics in graduate programs around the world are indicators of priorities in the field.

What Does the Field Think about Research?

In September 2005, *Metropolis* published a survey of 1051 designers, design faculty, and students in a variety of design disciplines on the issue of research (Manfra, 2005). Admittedly, the

survey respondents had varying levels of research understanding and represented only a small portion of the field. But in all of its confusion, this survey still captures some of the challenges facing research professionals.

The first finding was that there is no general consensus about what is meant by the term “research.”

Respondents' ideas ranged from deep investigations of users to selecting color swatches. This equivocation is exacerbated by the association of research with library information retrieval in most undergraduate design programs; ambiguity regarding the meaning of degree titles around the world; and the politics of tenure and promotion in colleges and universities, especially in the USA.

Few undergraduate design students, especially those in single-discipline colleges of art in the USA, engage in original, disciplined inquiry intended to inform design decisions, nor do most learn how to read and apply research findings from other fields. Starting with first-year foundation courses, undergraduate curricula generally infer that the way to begin work on a design problem is by drawing, that solutions reside in an abstract visual language, and that reading and writing belong primarily to the domains of history and criticism. General education is usually *proximate to but not integrated with* design study and depends entirely on the resources and general requirements of the institution. Design faculty rarely make explicit use of content and skills acquired from outside the design curriculum, except to “pour it into formats” as the hypothetical subject matter for design projects. There is often little in the faculty's own educational backgrounds to encourage a deep understanding of how the social sciences can inform an understanding of audience and context.

A small portion of American undergraduate design students eventually enroll in master's programs, where the dominant educational model – borrowed from the studio arts – addresses the refinement of practice-oriented skills and portfolios. The tiny number of students who make it to doctoral programs, therefore, frequently must start from scratch in developing any operational understanding of what constitutes research. In the USA, Ph.D. programs spend a significant amount of time explaining to prospective applicants, especially those for whom R&D means the next product feature or styling iteration, that curricula do not include studio courses.

Practice-based Ph.D. programs are not common in the USA, where all four of the doctoral programs offering admission to graphic and industrial designers reside in research universities and focus on empirical research. In some cases, professional master's degree programs in American colleges and universities carve out practice-based research agendas in which demonstration projects take on theoretical or methodological perspectives, but the goal of these programs is not to produce new knowledge. Rather, they speculate on the practice-based consequences of adopting certain theories about design or they illustrate how such viewpoints may be applied in specific contexts. In the USA, the practice-based agenda is generally reflected in professional doctorates

(Doctor of Arts, Doctor of Architecture, Doctor of Design, etc.), but there is debate about what these degrees really do to advance practice that is not already achieved under the professional master's degree or by very accomplished practitioners. Given that tuition in some American schools is nearly \$40,000 per year, the actual benefit of these degrees to someone's career is a topic of discussion.

Further complicating the definition of research is the reward system for design faculty in many American universities. In an effort to establish credibility for art and design programs within academic research settings and to achieve tenure and promotion, college-level faculty have described an array of activities under the term “research.” Freelance design practice, writing for popular design magazines, expressive investigations in the arts, and supervision of student projects with industry frequently appear in faculty vitae as “research” contributions. While these activities may merit tenure and promotion consideration, they usually do not contribute to the body of knowledge in the field, nor are they routinely subjected to the rigorous criteria for scholarship found in the sciences, social sciences, and humanities. Few bring resources to the institution, and when faculty receive funding for proposed projects it is frequently through internal sources, such as professional development grants for new employees. This dilution of the traditional concept of university research stunts American efforts to launch a research culture in design and distracts faculty from the hard work necessary to move a discipline forward. Design faculty, therefore, spend much of their time making the case that they are *special* rather than *integral* to the overall research mission of the university.

In some institutions, however, there are more mature research cultures and faculty routinely apply for government and foundation grants. In these cases, tenure, promotion, and merit pay may depend on the submission of proposals and the frequency with which faculty are listed as principal investigators. It is not uncommon for such schools to have dedicated research space and support staff. The challenge in these settings is to integrate research activities with the other academic work of the college; to avoid a bifurcated faculty in which research is viewed as the opposite of creative practice.

Ernest Boyer (1990), the late president of the Carnegie Foundation for the Advancement of Teaching and Learning, provided another definition of scholarship in the academy under a 1990 study titled, “Scholarship reconsidered: Priorities of the professoriate” (pp. 16-21). Boyer identified four areas of faculty scholarship: 1) *the scholarship of discovery*, which is consistent with traditional definitions of research as knowledge generation; 2) *the scholarship of integration*, which encourages multidisciplinary work that “is serious, disciplined work that seeks to interpret, draw together, and bring new insight to bear on original research” (p. 19); 3) *the scholarship of application*, which addresses how knowledge can be responsibly applied to consequential problems; and 4) *the scholarship of teaching*, in which teaching is not seen merely as the execution of instruction, but as an activity involving particular knowledge, reflection, and review as a

subject in its own right. Boyer's classifications imply that faculty may conduct research in any of these areas, but that work in each category is accountable to rigorous standards of quality and peer review within that paradigm.

More recently there have been attempts by professional design associations to benchmark research practices through policy statements. The Australian Institute of Architects, for example, published a research policy in March 2004. Its definition of research describes a "systematic inquiry for new knowledge" and the implementation of "credible and systematic modes of inquiry... [documentation of] findings in a form that is publicly verifiable and open to peer appraisal" (p. 2).

The Design Research Society's website (<http://www.designresearchsociety.org/>) states its domain as "ranging from the expressive arts to engineering" and declares one of its three primary interests as "recognizing design as a creative act." The Asian design research societies, such as the Japanese Society for the Science of Design (<http://wwwsoc.nii.ac.jp/>) and the Korean Society for Design Science (<http://www.design-science.or.kr/>), appear to have broad research missions, with some special interest categories strongly encouraging empirical research. Cumulus, an international consortium of approximately 125 schools of art and design, has formed a working group to author guidelines for establishing research programs; the group will distribute a survey this coming year to determine current practices.

While 81% of professionals polled in the Metropolis survey claim to engage regularly in research and 69% of university department chairs say it is a required and integral part of the curriculum, fewer than 70% of professional respondents say they include students in research that is important to their practices (Manfra, 2005).

Consequently, there appears to be no professional infrastructure in the USA for placing students in positions as research assistants in the field, unlike in the sciences, and few links between curricular expectations and the kind of help professionals need in carrying out their research activities. And because there is no unified theory of design, the basis for encouraging a particular research skill set in undergraduate or master's programs is contested among institutions and across the design disciplines.

There is a history of sponsored projects in American schools, focused primarily in institutions that have high records of graduate placement in practice. While these projects frequently boast a "think tank" approach to a problem posed by business or industry, they often come with patent and copyright entanglements, either from the company or the institution. Such problems often discourage implementation of student ideas in real settings. Therefore, it is unclear what companies actually gain from these projects in a research sense. Most typically, students bring fresh ideas to the invention of form, use of materials, or understanding of process, but it is not apparent whether companies see the benefits of such activity as significant to their businesses, as a recruitment

strategy for future employees, or as a philanthropic gesture. The *Metropolis* study would suggest that, for the most part, student researchers are not considered part of a larger business plan.

It is obvious in many institutions, however, that the primary career goal for doctoral students is framed by the curriculum as teaching at the college level. A 2000 conference at the University of Washington, titled *Re-envisioning the Ph.D.*, recommended that doctoral students be provided with a wide variety of career options, not just teaching, and that "departments need to take responsibility for student access to [research] internships and provide visits from professionals outside the University who will share their professional career journeys with students" (Nyquist & Wulff, 2000). Apparently, this practice has yet to be adopted widely by doctoral programs in design, despite the presence of design research firms.

When asked which areas of design are among the highest priorities for research, most respondents (80%+) identified sustainability as a top issue (Manfra, 2005).

Yet these same respondents ranked *systems theory* at the bottom of the list. It is not clear how people can conduct sustainability research without a deep knowledge of systems or how the shift from designing objects to designing systems and tools will flourish if not grounded in such theory.

History and criticism also ranked high in the *Metropolis* poll, attesting to the growth of scholarship in these areas over the last two decades. Clearly, the history/criticism model is one many designers are accustomed to when thinking of design research and there is organizational infrastructure (e.g. Design Studies Forum) to support faculty and student exchange on these topics. There is, however, no evidence that design practice makes use of such research, so its contribution appears to be mostly at the level of the discipline.

The professional associations in the USA have been silent on the matter of research topics, while generally lending moral support to original investigations but not building conference sessions or publications around specific issues of knowledge generation.

Complicating matters is the absence of a dependable research database to support the design fields.

Existing search engines and library catalogs often fail to recognize design-sensitive terms (i.e. a search under "branding" often yields books on "cattle") and too few research practitioners are willing to share findings. 22% of practitioners responding to the *Metropolis* survey said that research outcomes never leave their offices, while 29% present them only at conferences, where proceedings may or may not be available following sessions (Manfra, 2005, p. 132-135). Statistics show that much of the research produced in design offices is considered proprietary, until findings are so old as to no longer be relevant to current practice. And because there are few doctoral programs in design that produce published dissertations, most practitioners appear not to consult universities for original research and relevant literature that may support design practice.

Only 17% of university faculty responding to the *Metropolis* survey said they publish in books, and many of these may be in the areas of criticism and history, not investigations that inform practice directly. Only 4% disseminate research findings online (Manfra, 2005, p. 132-135).

A project at North Carolina State University took on the task of developing a “proof of concept” for a design research database, recommending that a curated portal to dissertations, conference proceedings, and published literature be established under the American Institute of Graphic Arts in New York City. With the support of AIGA, graduate students advocated standardizing formats for thesis and dissertation abstracts and bibliographies and placing preliminary screening of accessible sources and literature in the hands of institutions and researchers with expertise in particular content areas. The proposed system makes visible the debate over keywords and critical frameworks, acknowledging that an emerging research culture must negotiate both its lexicon and research paradigms. Similar discussions have taken place among members of the Design Research Society.

If these complicated issues could be addressed by the availability of master’s programs, it seems the field would have done so by now. Master’s study in design in many countries has at least a 60-year history, although much of it is configured to serve day-to-day practice, not to build theory and knowledge that can be generalized to many projects.

In the USA, the two-year MFA is the “terminal” degree, granting holders many of the same privileges as the Ph.D. in other fields. Some schools offer the MDes and MS as alternatives, but the one-year MA is designated as an “initial” master’s degree by the accrediting body (National Association of Schools of Art and Design) and does not meet tenure qualifications in many American universities. In some cases, particularly in design history, the MA serves as the bridge to the Ph.D.

Very few American students advance to doctoral study. For students in the areas of graphic and industrial design, there are only four Ph.D. programs in the USA. Doctoral study in architecture and landscape architecture has a longer history, but a doctoral degree is not required to teach in these disciplines in American universities.

There is confusion, therefore, regarding what constitutes research and how someone might prepare to participate in an emerging research culture. Further, despite increasing interest in offering doctoral study, schools have few guidelines about how to go about building advanced programs.

Institutional Thresholds for Doctoral Study

The resources for supporting doctoral education are considerable and the decision to offer doctoral study involves significant commitments, both financial and intellectual. In the USA, the

Carnegie Foundation for the Advancement of Teaching (2005) classifies universities as *doctorate granting* on the basis of the following:

- Level of research activity (i.e. R&D expenditures; research staff; doctoral conferrals)
- Confirmation that the institution awarded at least 20 doctorates in 2003-2004

Under previous Carnegie Foundation categories, the level of federal funding (at least \$40 million) and a full range of baccalaureate offerings distinguished *research-extensive universities* from other kinds of institutions. This definition of research universities guides standards within American institutions for how doctoral programs develop and operate. It also presents particular challenges for design.

Financial support for design programs is limited and a model for research funding in design is nascent.

Low teaching loads and high levels of research responsibility generally characterize research faculty in American institutions where research and doctoral programs are high priorities. Such faculty often fund all or a sizable portion of their own and graduate student salaries from sources outside the university. Indirect costs and university overhead can comprise 50% or more of a funding application, making only high-dollar grants capable of supporting doctoral students, who generally expect assistantships and tuition waivers as part of their graduate support plan. At the same time, agencies with sizable grant opportunities, such as the National Science Foundation or National Institutes of Health, typically require principal investigators to hold Ph.D.s. This often means design researchers with the professional master’s degree must piggyback on the applications of their more credentialed colleagues in interdisciplinary investigations.

Because sources for design funding have yet to be developed at levels more typical of the sciences and social sciences, and because design faculty generally have high teaching contact hours per credit in studio-based programs, the time available for doctoral student supervision and the development of research grants is very limited. In American universities, the commitment of a faculty member to an incoming doctoral student involves a close discussion, research, and authoring relationship built through many hours each week over several years, as well as dedication to keeping up with the student’s specific content. It is not unusual for faculty’s weekly contact hours with a single doctoral student to exceed those of the typical lecture class.

Therefore, to get doctoral programs off the ground in the USA with the intention that they become self-sustaining through research grants, the institution must carry faculty and students financially for a period of time until external resources are secured. Once the faculty member has developed funding, it is typical for him or her to buy release time from other curricular instruction, placing the responsibility for replacement hiring on the department.

The faculty who are qualified to provide doctoral education are not necessarily those who are skilled at teaching design studios.

While building a research culture, it is often difficult to find appropriately credentialed faculty (i.e. faculty who hold the Ph.D.). The practice in the USA has been for institutions to worry less about degrees and to look for faculty with deep research histories, however, some experience in doctoral study is necessary to establish policies, protocols, and standards of evaluation. All four American Ph.D. programs employ faculty with research degrees, some from outside the design disciplines and, as they graduate Ph.D. students, there is every expectation that new hires for doctoral supervision will hold Ph.D. degrees.

As an administrator of a Ph.D. program, I quickly learned to separate faculty with *interest* in an applicant's proposed topic from those with *research expertise* in the area. It is important that faculty be better read in the topic than the doctoral student and active in research projects that engage students in robust investigations as assistants. Faculty need to know how to manage a research project and to maintain its momentum through periods of low funding or competing demands. This argues for specific criteria in hiring and affiliating faculty with a Ph.D. program and in determining the match between an applicant and a faculty mentor.

However, such requirements often work against engaging studio faculty in research education and limit the teaching resources for developing doctoral programs. American design departments with bachelor's and master's programs typically search for generalists who can teach professional studios while maintaining their own research interests. Because design education is often under-funded and under-staffed, such programs rarely have the luxury to hire research specialists, thereby limiting their ability to support doctoral students and sometimes creating a bias against doctoral study in studio faculty who see advanced programs as siphoning faculty and assistantship resources from the more populated professional programs.

Access to university faculty in other disciplines provides a real advantage when building the student's network of support for dissertation work. Because design has broadened its scope under new practices, research topics often blur the boundaries between design and other fields. It is unreasonable to expect design faculty to provide all the expertise necessary for such investigations and coursework in the methods of other disciplines frequently grounds design investigations in protocols common to rigorous research in general. In this sense, the potential for doctoral programs residing in a university context have distinct advantages over single-discipline art and design schools.

The library resources of the university must be deep and matched to the research emphasis of the program.

Today it is tempting for an American institution to describe its library resources in terms of its access to inter-library loans. But this means of providing reference material does not

support the browsing and preliminary reviews of literature in which doctoral students need to engage. Therefore, sufficient depth in library holdings is essential for doctoral research and the institution should have some standing among research libraries.

Further, the availability of library reference experts is critical to finding the kinds of resources and developing the search skills that doctoral students require. A good research library will be familiar with indices and databases, as well as protocols for accessing archives and special collections that may serve as primary source material for research. Many offer training in research-compatible software and provide consultation on the fair use of intellectual property.

The institution must have some research infrastructure.

American institutions usually satisfy this requirement by establishing a research office under an administrator who participates at the highest levels of university management. Typically, this office also includes grants and contracts staff who approve, monitor, and track funded research projects; a legal advisor who manages intellectual property issues; and someone in graduate programs who develops fellowship and post-doctoral opportunities for students. Frequently, there is also a system for supporting visiting scholars and research faculty from other countries who enhance research discussions during short-term participation on campus.

In most cases, American universities coordinate policies and approvals for doctoral students from a central office, usually in an institutional graduate school; the basic requirements of preliminary qualifying examinations, oral defenses, and submission of dissertations are usually common to all programs.

Generally, design students and faculty have high motives in undertaking research, however, in doctoral work the bar for ethical behavior is set high enough to require more than good intent. In the USA, the Research Act of 1974 defined the *Institutional Review Board*, an ethics committee that monitors research with human subjects. Developed in response to several high profile research abuse cases in the middle of the twentieth century, IRBs are regulated by the Office for Human Research Protection and may be for-profit entities hired by the institution or committees at the university. Each institution is responsible for establishing a board that reviews proposed studies for the ethical and safe treatment of human subjects and periodically assesses the research practices of the institution. It is typical for American doctoral students in design to learn about IRB procedures in a research methods class and to gain approval and informed consent for any research that involves university students or external audiences for design.

Canada offers an interesting supplement to institutional infrastructure. The Canadian Foundation for Innovation is an independent corporation funded by the government to support research infrastructure (i.e. buildings, labs, and databases) in Canadian universities. Created in 1997, CFI normally funds as much as 40% of project infrastructure costs in partnerships

with institutions and their other funding sources. The total capital investment in university research is expected to exceed \$11 billion by 2010 (Canada Foundation for Innovation, n.d.). With the goal of maximizing the use of resources in Canadian institutions, a recent review of proposals favored design collaborations in which universities partnered. While this process encourages participation by a number of architecture programs in the country, few of the nation's graphic and industrial design programs are in universities and reside, instead, in colleges of art and design.

Programs should balance the disciplinary doctorate with a variety of interdisciplinary challenges.

This recommendation from "Re-envisioning the Ph.D." (Nyquist, & Wulff, 2000), National Studies on Doctoral Education is especially relevant to design, in which the body of knowledge is inherently interdisciplinary and well suited to collaboration with psychology, anthropology, sociology, computer science, engineering, art history, communication and media studies, and a number of other fields. The advice is also testimony to how new research disciplines tend to form. Humanities professor Julie Thompson Klein (1990) argues that a restructuring of knowledge in the twentieth century produced hybrid fields and a "variety of 'unified', 'holistic' perspectives that have created pressures upon traditional divisions of knowledge" (p. 11). Nowhere is such hybridity more evident than in design, especially under emerging paradigms of practice (i.e. service design, experience design, interaction design, etc.) that are likely to define work in the twenty-first century.

Even within the design disciplines, it is increasing difficult to define content boundaries for research. Where do the physical interface end and the graphic interface begin in today's computing environments? Where do sustainable technologies reside – in the built or natural environments? And which design discipline can rightfully claim visualization and information systems?

The history of my own program at North Carolina State University is an example of such pressures on the conventional compartmentalization of knowledge as curriculum. Originally a Ph.D. program with two tracks, one in *community design* (a collaboration between architecture and landscape architecture faculty), and one in *information design* (a collaboration between graphic and industrial design faculty), it became clear that students had little interest in the traditional disciplinary boundaries. Applicants frequently framed their research interests in areas that fell between the cracks of professional disciplinary divisions. Four years ago we re-organized the program around areas of design influence (health and well-being, learning, sustainability, urban context, technology, history/criticism) and found more expansive opportunities for faculty collaboration, within design and across the university, and more interesting student applicants for the program. We also opened new partnerships with other colleges within the university and with institutions elsewhere in our university system (e.g. in building energy and healthy

built environments) that would not have been possible under traditional content designations, thus improving our funding potential and access to research faculty.

National recommendations also argue that doctoral students should have multiple mentors who work under a common set of written guidelines (Nyquist & Wulff, 2000). This recommendation creates some challenges for single-discipline art and design schools, where a limited offering of liberal arts courses usually supports undergraduate education. Universities have greater potential for such collaborations; however, there are obstacles to overcome. How do institutions account for faculty teaching loads and student enrollment in coursework that straddles fields? How do interdisciplinary programs compete for funding in the discipline-driven department structure of a university? Who provides oversight? How is interdisciplinary work acknowledged in a tenure and promotion process that usually includes review by disciplinary peers? And how do students in interdisciplinary programs position themselves for teaching within discipline-defined departments upon graduation?

In many cases, interdisciplinary graduate study grows out of the research collaborations of individual faculty. It is not uncommon in American research universities, for example, for interdisciplinary academic programs to arise from research projects; two or more faculty collaborate across disciplines and then build coursework to feed the growing demand for student research assistance. Students are recruited to these programs specifically to work on targeted projects. The consequence of such targeted programs is that, when funding or faculty interest wanes, or when the collaboration gains greater traction within a more established discipline, the interdisciplinary efforts diminish.

Programs should participate in ongoing assessment, including regular review by external research experts.

Healthy programs engage in rigorous assessment strategies to ensure that programs meet an institutional and national threshold for research practices. It is common for a university assessment office or graduate school to ask for periodic external reviews of research and doctoral programs, in addition to the normal disciplinary accreditation review cycles.

National accreditation reviews in design, however, present challenges to an emerging research culture. The National Association of Schools of Art and Design, the accrediting body in the USA for programs in graphic, industrial, and interior design, has no history of evaluating doctoral programs in design. Its standards address two research disciplines: art education and art history. And its reviewers include no faculty or administrators with Ph.D.s in design. At a recent annual meeting, the organization's membership discussed the merits of building doctoral programs in art and design. Clearly confused about the reasons for engaging in advanced study, many advocates cited "gaining credibility among colleagues in the sciences" as a primary reason for exploring the opportunity to establish programs. Others made the case that there were easier ways to achieve status

than launching a doctoral degree program. It was apparent, however, that the designers within the organization had a more rigorous definition of research, deeper experience in securing external funding, and more measured opinions regarding the task of building a research culture than did the fine artists. In architecture, the National Architectural Accrediting Board is responsible for assessing programs, but its purview is limited to the professional Doctor of Architecture, Master of Architecture, and Bachelor of Architecture degrees.

Therefore, there is little assessment leadership within the design disciplines for the few American research programs. More frequently, programs rely on faculty from comparable research programs at other institutions and are observed by an on-campus, non-disciplinary representative of the graduate school or research office. Some programs import reviewers from abroad in an effort to bolster disciplinary expertise.

Doctoral students should be encouraged to present at conferences, submit papers for publication, and compete for fellowships.

Among the indicators of program success is the ability of doctoral students to compete for presentation and publication opportunities with other students and faculty. This means the institution must encourage and financially support student participation in research conferences and dissertation competitions. It is often necessary to mentor the student in research writing and speaking throughout his or her academic enrollment, especially when the student is working in a second language. American schools may offer writing clinics and ESL courses for general support across the curriculum, but design faculty must take special interest in furthering the student's development as a presenter and guide the selection of appropriate conference or publication venues. Many students begin by co-authoring with their faculty mentors and submitting posters and papers to internal university symposia. It is the role of college administrators to ensure that all doctoral students are notified of conferences and calls for papers.

National and international fellowships present opportunities for students to fund doctoral research. It may be the job of the research office to generate lists and application materials for such fellowships, but faculty should guide students in conducting their own searches for research funding. Some schools offer grantsmanship training for Ph.D. students and faculty, making use of the institution's research office as well as outside experts.

Conclusion

Growing research and research programs in design, therefore, is a necessary but complicated task. It is obvious that the proprietary behavior of design practitioners will not make new knowledge widely available and that universities must take on the roles of knowledge generation and dissemination. At the same time, it is also clear that development in this area will be slow without broader recognition that research matters to the future of the design professions and that the outcomes of design decisions have consequences in society.

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