

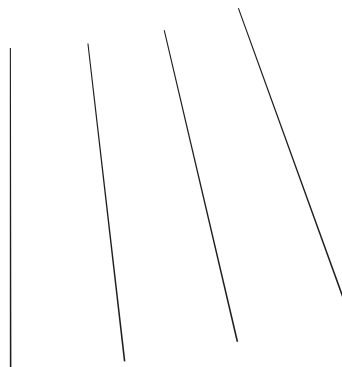
“Normal science” and the  
changing practices of design  
and design education

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Social anthropologist Jean Lave and learning theorist Etienne Wenger described a concept called “communities of practice.” They suggested that learning is not just something we do individually when in school, but socially throughout our lives with people who share a concern or passion for something. These are not mere communities of interest that devote attention to the same subject matter but people who build meaningful relationships through which they learn about their practice from each other. They share experiences, ways of thinking about the work they do, and a network of connections that distinguish them from others. Because they are organized around a domain, they frequently communicate through a common vocabulary and participate in frameworks that have a particular structure (Lave and Wenger, 1991).

This perspective on learning is especially relevant to rapidly changing fields. Communities of practice are typically more agile in responding to new conditions than are formal institutions or established fields of study. Their immersion in concrete situations discourages the abstraction of knowledge often found in academia and the recognized literature of a discipline (Lave and Wenger, 1991). Ideas are judged on the basis of actual performance and are not subject to the constraints of disciplinary or organizational boundaries. Knowledge is co-created and shared through authentic practice.

Science historian and philosopher Thomas Kuhn provided further insight into how knowledge develops through practice. In *The Structure of Scientific Revolutions*, Kuhn described “normal science” as one in which a single paradigm dominates. He warned that paradigms “gain their status because they are more successful than others in solving a few problems that a group of practitioners has come to recognize as being acute” (Kuhn, 1970, p. 23). Practice often extends this knowledge and “matches the paradigm’s predictions by further articulation of the paradigm” (Kuhn, 1970, p. 23). In other words, rather than searching for a new paradigm, the practice simply expands the conceptual territory of the existing paradigm to account for novel problems and outcomes. Kuhn said the aim of normal science is not to call forth new phenomena or theories, especially those that do not fit the paradigm. Instead, normal science relaxes the standards for evaluating work in instances under which the paradigm ceases to be effective. And eventually, the paradigm becomes a criterion for choosing problems that are perceived as having a solution and as appropriate to the practice (Kuhn, 1970, p. 37).

Kuhn argued, however, that science does not progress through the incremental accumulation of knowledge in normal science, but through paradigm shifts (Kuhn, 1970). The failure of something to conform to the dominant paradigm is seen by some as an anomaly, an aberration. As these anomalies build up, they constitute a new paradigm that takes over the old. And the more frequently this happens, the more practitioners recognize potential in inconsistent results. The old paradigm, no matter how elaborated, no longer fits the circumstances.

In this article, I suggest that the current design profession is one composed of very different communities of practice, some challenging the “normal science” of design and operating under new paradigms. By studying these communities of practice, possible futures for the design professions become evident. In the second half of the article, I also raise concerns about the degree to which design education is based almost entirely on the “normal science” of design practice. In this sense, design education is slow to follow paradigm shifts in the field and may have stretched the existing paradigm and knowledge to its limits in addressing the current context for design practice.

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## Diverse communities of practice

The traditional definition of design focuses on the physical attributes of spaces, objects, and visual messages as supporting function and the emotional experiences of consumers or audiences (Dubberly, 2014). The *artifact-driven* goal of design for most of the twentieth century was to make things work and look better. The designer was an expert who controlled forms that best achieved such results, and the profession placed high value on craftsmanship, surface novelty, and individual authorship. As a community of practice, it rewarded members’ accomplishments and confirmed the “rightness” of such values through professional competitions, glossy publications, and exhibitions.

Young designers entered this community of practice from design school as “apprentices” through technical production, eventually earning the right to control form after demonstrating attention to detail and the ability to execute the creative vision of more experienced practitioners. Consumers acquired particular artifacts as expressions of identity and “good taste.” As founder of WikiHouse (an open-source project for designing and building houses) Alastair Parvin says the traditional definition of design was something done *to* people by experts in the field (Parvin, 2013).

Artifact-driven practices were first challenged by a technological context that favored user access to infinitely malleable and constantly updatable information. Beginning in 1998, a group of forty communication designers and technologists — convened by designer Clement Mok under the aegis of AIGA — met to discuss the emerging practice of interaction design. Called the “Advance for Design” (later, the Experience Design special interest group), participants spent several summers debating the role design would play as public access to the internet expanded communication possibilities beyond data sharing by scientists and the military. Because these meetings started before the dot.com bubble burst in 2000, the majority of participants described buying and selling transactions as the goal of networked communication. However, a small group argued that there was

potential for interaction design in supporting activities in leisure, work, learning, and access to the privileges of democracy.

This was clearly a “community of practice” — its sole purpose was to share what people learned through their work and to publish emerging principles that would guide development of the medium. However, participants were conflicted over what the rapidly evolving networked technologies meant for professional practice in communication design. One meeting was spent mostly in authoring job descriptions for designers in work previously dominated by programmers, hoping to ensure a place at the table in the expansion of the medium.

But as meetings progressed, discussions reflected additional differences among participants regarding a paradigm shift, a departure from the “normal science” of design practice. While acknowledging the need to work with experts in human factors and business when designing for online commerce, some *Advance* participants felt interaction design simply represented a new medium for traditional, artifact-driven methods and principles. For these designers, design was primarily about inventive displays of information, which now employed the digital affordances of sound, motion, and user control of pacing and sequencing. Others felt the development of networked communication represented not only a new tool but also a seismic shift in the relationships among content producers, designers, and users — not another *format* but a totally new communication *environment* with as yet undefined rules of engagement.

After several meetings, the group published principles of experience design. Authors reflected new interest in creating the conditions for user experience but tempered their descriptions through some reluctance to let go of priorities in the design of physical artifacts as central to the practice. At the same time, these principles were evidence of continuing concern for the human dimension of design practice, for the user-centered aspects of the dominant paradigm.

Initially a response to the expansion of graphic design practice in internet technology, the interdisciplinary practice of experience design is now defined as:

Influencing designed user experiences through more than the visual attributes of communication, products, and environments;

Viewing users’ interactions with designed objects, environments, and services across entire lifecycles, from the users’ identification of needs or desires, to when they discard the object, abandon the environment, or discontinue the service;

Creating relationships between experiences and individuals, not mass markets;

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Invoking and creating communication, products, and environments that connect with users emotionally and in terms of added valued; and

Building upon the traditional design disciplines but also exploring new collaborations with non-designers, such as experts in computer programming, human factors, cognitive science, business, etc.  
(Davis et al, 2001)

Hugh Dubberly, who participated in the Advance for Design meetings, describes today’s *design for interaction* as changing the focus of practice from spaces, objects, and messages to the design of simulations, tools, and stories (Dubberly, 2014). In a project supported through the Virtual Center for Innovation at Sun Microsystems and titled, *How do you design?*, Dubberly interviewed developers of interaction design practice and mapped their design processes (Dubberly, 2005). While there were variations among these early adopters, the methods for design in the first years of interaction design practice were significantly different from those in artifact-centered communication design offices. With the goal of shaping user behavior and facilitating active engagement with information, today’s interaction designers now routinely involve users, develop personas and scenarios, and prototype technological solutions for user feedback on interactive strategies.

While the stopping condition in the creation of artifacts is “almost perfect,” Dubberly describes “good enough for now” as a threshold for success in interaction design, acknowledging that the functions and attributes of design will evolve organically through use and that new versions are inevitable (Dubberly, 2008). At the same time, he defines many relationships between users and interactive systems as asymmetrical in that the technology typically does not learn from its users. People adapt to the rules of the system and to conventions established by general practices over time. A goal of interaction design, therefore, is to create a match between the perceptions people have of how systems work and the reality of actual operations, to provide feedback but usually not to give people control over the design of the system itself. Design in this sense is something done *for* people, arising from informed understanding of their motives and behavior.

In a small 2014 meeting — organized by AIGA Director Ric Grefe to articulate the diverse perspectives on design practice — Dubberly described an emerging third type of practice he calls *design for conversation*. He distinguishes this practice from interaction design by its symmetrical, collaborative relationship between the designers of systems and *co-creators* who contribute both content and form to the design of services, platforms, and communities of interest.

The design of service ecologies constitutes an increasing

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percentage of professional work. The Bureau of Labor Statistics predicts that the majority of growth in the US economy will be in service providing sectors, reaching almost \$21 trillion by 2022 (Bureau of Labor Statistics, 2013). Gartner, a technology research firm, predicts that cloud-based software-as-a-service will grow to a \$201 billion industry by 2019 (Gartner, 2015). Zipcar has one million users who access a fleet of 12,000 cars in eight countries through an online system, but it makes nothing. Even companies that produce hardware depend on content production and service ecologies as important components of brand loyalty.

Dubberly argues that products haven't necessarily disappeared in the service economy; instead, services have become a way to deliver products and to increase their value (Dubberly, 2016). He quotes former *Wired Magazine* editor Kevin Kelly: "It's not what you sell a customer; it's what you do for them. It's not what something is; it's what it's connected to, what it does. Flow becomes more important than resources. Behavior counts" (Kelly, 1994, p. 27).

Design consultancy Fjord describes new service design challenges facing organizations in the future. "Managing the gaps in consumer experience between the physical and digital channels and across services, devices, and places...reducing the pain of navigating an experience fragmented by specialized services and applications" will be an important trend shaping the evolution of online experiences (Fjord, 2015). In other words, it is no longer enough to have well-designed service components; the design task is to bridge experiences separated by time, place, and sponsor.

Platforms are the systems that support the development of applications and technologies. Dubberly describes platforms as "enabling others to create value" (Dubberly, 2014). At its opening in 2008, Apple's app store offered 800 applications that ran on the Apple platform. Today, there are more than 1.5 million applications, mostly developed by third parties. Because platforms enable or constrain access and the types of applications that can be built, Dubberly cautions that the current concentration of platform development in a few companies (Facebook, Google, Microsoft, Amazon, and Apple, for example) presents opportunities for the design of new systems but also raises concerns over the centralization of content and technology. In a presentation on networked platforms, Dubberly quotes Tim O'Reilly, author of "The State of the Internet Operating System" and open source advocate, as saying, "We are entering a modern version of 'the Great Game,' the rivalry to control the narrowed passes to the promised future of computing" (Dubberly, 2014). It doesn't take much work to find confirmation of O'Reilly's view. An August 2015 article in *Fast Company*, titled, "The Agonizing Slow Decline of Adobe Flash Player," cites a five-year-old essay by Steve Jobs explaining why Flash would never appear on Apple devices (Newman, 2015).

In the design of communities, Dubberly describes design's role as negotiating the rules and frameworks that govern the behavior and

exchange among participants, with provisions for changing rules as the community deems necessary. In a project to reimagine National Geographic as an organization, for example, Dubberly's recommendations encourage returning to its nineteenth-century roots as a membership society interested in geographic expeditions. Under his proposal, technology establishes and supports members as: "citizen scientists" with access to researchers; content generators who develop stories and share photographs; educators who extend the impact of National Geographic resources; and a community of interest in which member profile data enables meaningful connections within and outside the organization (Dubberly, 2013). In other words, this type of design practice brings people together to do something they might not be able to do alone and to share and build insights collectively that move understanding forward; design *with* and *by* people.

Dubberly argues that all three types of practice currently exist: the design of artifacts, design for interaction, and design for conversation. The design of artifacts clearly represents the "normal science" of the profession and there is value in its outcomes. However, it is less likely that artifact-driven practices will produce new knowledge and methods that respond to a changing context of design problems — that is, problems that are increasingly complex and uncertain in their nature, that exist at the level of systems, and that evolve over time. Other than surprising form, therefore, it is difficult to see how the normal science of design can stretch the paradigm much further than current practice.

Donald Norman, now Director of the Design Lab at the University of California/San Diego, provides an alternate view on where the trajectory of design practice can go. Consistent with Dubberly's view, he identifies the historical character of the design professions as arising from the need for a systematic approach to creating products and information for the emerging middle class in Europe and America following the Industrial Revolution. After World War II, says Norman, the focus shifted to appearance, often at the expense of function and performance (Norman et al, 2014). This type of practice depended largely on an arts-based education and individual intuition.

However, the emphasis on appearance often creates problems by complicating the user's perceptions of how technological systems and products work. Norman, once a user experience architect for Apple and Vice President of its Advanced Technology Group, incited the ire of loyal Apple users by an article in *Fast Company* titled, "How Apple is Giving Design a Bad Name."

...when Apple moved to gestural-based interfaces with the first iPhone, followed by its tablets, it deliberately and consciously threw out many of the key Apple principles. No more discoverability, no more recoverability, just the barest remnants of feedback. Why? Not because this was to be a gestural interface, but because Apple simultaneously made a radical move toward

visual simplicity and elegance at the expense of learnability, usability, and productivity. (Norman and Tognazzini, 2015)

Norman and his colleagues in their community of practice identify the misfit between an emphasis on appearance and an emphasis on meeting human needs and abilities, with the latter leading to more satisfying interactions between people and technology. They acknowledge that the methods used by designers in solving problems at this level attract the attention of others who apply them to management and the “large, ambiguous...and fast changing problems facing society” (Norman et al, 2014). But Norman and his colleagues describe design as falling short in its ability to handle problems at this scale of complexity. They list five major principles of modern design that are no longer suited to the nature of contemporary problems:

- 1 Linear causal relationships underpin assumptions that a preferred state can be achieved by fixing a root cause of friction through design.
- 2 Narrowly-defined contexts as problem settings suggest the engagement of relatively few disciplines.
- 3 Independent elements can be addressed one at a time without throwing an entire system out of balance.
- 4 Operating constraints are stable and recurring.
- 5 Relatively few mutually incompatible constraints make it likely that competing priorities can be resolved to some degree of satisfaction.  
(Norman, 2015a; Norman, 2016)

Complex problems, however, involve constantly changing relationships among countless interdependent variables that make it impossible to address one at a time in isolation or through a single discipline. Feedback and unforeseen emergent behaviors destabilize constraints and relationships. Norman and his colleagues call for a sociotechnical approach to design based on research and evidence; rapid experimentation and testing of prototypes that lead to superior results through iterations. They argue that the field needs an emphasis upon evidence-based design and a cohesive, collaborative approach to the development of method and knowledge (Norman et al, 2014).

Rick Robinson, an applied researcher in consumer and material culture studies, has pioneered evidence-based approaches to design

practice, recently in his consulting firm Iota Partners and now in his role as faculty at the University of Colorado Boulder. Robinson cites a profound change in the expectation of a return on the investment in research. He says, “By advocating that design be considered a strategic voice in product development, communications, and marketing, the field has been asked to play by the same rules and be measured by the same yardstick as other principal business activities. Research needs to be justified on an ongoing, long-term basis, not purely on a ‘see what we found!’ case-by-case basis” (Robinson, 2016). Robinson describes friction (either overt or discreetly played beneath the surface) between research that focuses on design and traditional market research. He acknowledges that there are instances where the two work as contributing partners. In most cases, however, there is a lag between design advocacy for iteration and interdisciplinarity and the managerial outlook of a vastly larger marketing research ecosystem that espouses mostly linear views of product and communication development.

Although heavy investment in design research heightens expectations for demonstrating the value of design to organizations, increased complexity in the nature of today’s problems and acceleration in the rate of change also argue for innovation approaches being part of what the design field holds as a central value. But like Norman, Robinson pins increased accountability in design research to the sheer scale of problems. He says, “There are very few design issues that are understood as stand-alone problems today. Contexts are connected and dependencies are everywhere. A systems-level view of the world dominates the way organizations understand what needs to be designed. Scaling design research beyond one-off projects means building an ecosystem of providers and processes, of institutionalizing the research work while remaining open to change” (Robinson, 2016). He cites information overload as being more evident and insistent in the need for research than most other domains. In support of such research, Robinson likens the potential of Google and Facebook as new tools for crafting questions about digital life to the roles audio recording, video, and photography once played in the study of language.

When asked about what kind of evidence is compelling, Robinson had one word, “pattern.” He described current work as “data aware” rather than “data driven” — research starts with patterns in data rather than hypotheses. Off-the-shelf technologies, such as smartphones, assist in this effort. Other sensor-based technologies (such as the Nest thermostat that detects patterns of occupancy and movement through rooms in the home) provide traces of human behavior in particular settings. And companies (such as Facebook and Google) make their vast datasets available. So data at scale is no longer hard to get. Robinson says what we really need are “the tools to surface patterns in that data, discipline in exploring it, and suppleness in building or applying frameworks to its interpretation” (Robinson, 2016). With his colleagues, Robinson talks about “faces, places, and traces” – information on people, information on settings and contexts, and traces

that illuminate decision-making, influence, bias, and many more aspects of interaction. (Robinson, 2016)

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## Design education as “normal science”

So, to what extent do current pedagogical practices in design education address the shifting paradigms that Dubberly, Norman, Robinson, and others demonstrate in their professional work? Does design education chart new pedagogical and curricular territory or merely extend the “normal science” of its traditional artifact-driven, arts-based paradigm? To what degree does the graduate education of design faculty prepare them to address these paradigm shifts and new knowledge in practice? And if the formal preparation of design educators currently fails to acknowledge shifting paradigms, how does the community of practice in design education challenge and re-orient curricular and pedagogical approaches in response to changing conditions?

Educational psychologist Lee Shulman studied *signature pedagogies*: forms of instruction that are characteristic in the preparation of members of particular professions. He suggested that these pedagogies are particularly distinct in professional education because, unlike other academic disciplines, it is accountable for supporting “accomplished and responsible practice in service of others” (Shulman, 2005, p. 53). As president of the Carnegie Foundation, Shulman investigated the essential contradictions inherent in the multiple roles of practitioners in various disciplines and the implications for teaching and learning. He compared two types of classes in engineering. In a classroom on fluid dynamics, all desks faced the blackboard, the professor faced the class to introduce the lesson, and the remaining time was spent with the professor writing on the blackboard and students copying the material for later discussion in their self-organized study groups. There was little connection between knowing and doing, and it was not the “signature” of engineering (Shulman, 2005). In the engineering design studio, students grouped in activity areas with no obvious orientation to the front of the room. They engaged with physical models and computer visualizations, collaborating, building things, and critiquing others’ work. The instructor circulated but was not the only source of information. Architecture, industrial design, and communication design faculty would recognize this model of instruction.

Shulman says signature pedagogies are important because they are pervasive and define how knowledge is “analyzed, criticized, accepted, or discarded” in professional education (Shulman, 2005, p. 54). He further describes signature pedagogies as having three dimensions. The *surface structure* represents the operational aspects of teaching: the teacher-controlled demonstrating, questioning and answering, and interacting with students. The *deep structure* is the locus of theory and how to think like a

professional. It is driven by assumptions about how to pass on knowledge and know-how. The *implicit structure* is a set of beliefs about professional attitudes and values (Shulman, 2005).

With the exception of courses in history and theory, the typical *surface structure* for teaching and learning design is built around faculty-defined studio projects and “making.” Students receive faculty-authored written or oral briefs that define the investigation, much as the design practitioner receives the scope of work from a client. The criteria through which faculty and peers judge design responses are reflected, either explicitly or implicitly, in the brief. Process extends from these expectations. Discussions generally arise from a quest to understand the nature of the assignment, principles expressed in its articulation, and prescribed methods for investigation. Across a four-year professional education, courses generally repeat this pedagogical structure with the goal of reinforcing core principles and building a repertoire of process-oriented approaches for future application in similar contexts.

The *deep structure* of communication design pedagogy is reflected in the content and the organization of curriculum. In some cases, a cafeteria of experiences based on segments of practice or communication formats comprise the course of study — publication design, package design, interaction design, motion graphics, and so forth. The underlying assumption is that formats represent meaningful distinctions in the application of the design process and that understanding of core principles is transferable but not necessarily scaffolded. In other instances, courses defined by medium organize the types of know-how faculty see as essential to practice — typography, photography, or web, for example. While in some programs more integrated problem solving occurs in other courses, the theoretical basis of this division by technology implies that various media have characteristics that are best understood in isolation. In other programs, course titles signal a continuum of some kind — beginning, intermediate, and advanced — typically beginning with abstraction and moving toward more applied work. Under all three strategies, the tendency is to sequester single concepts in beginning work and add complexity and context as students progress toward graduation. The curricular theory is that students learn to manage complexity incrementally, but in the absence of explicit process-oriented instruction or tools for dealing with interdependent variables.

As part of the *implicit structure*, design critiques reinforce the values and general priorities of the field. Lave and Wenger, in their studies of apprenticeship, say, “the purpose is not to learn *from* talk...but to learn *to* talk” as a participant in the work of the domain (Lave and Wenger, 1991, p. 109). Even more than through overt classroom instruction, students learn the values of the profession — and by extension, of its dominant paradigm — through the signature pedagogy of critiques. Faculty can lecture on a range of theories and concepts, but if comments in critiques are inconsistent with lectures, students gravitate to the priorities expressed in the public evaluation of work.



Schulman warns that while pedagogical traditions and habits are good for imparting complex patterns of behavior, they are also “dangerous sources of rigidity” that can encourage repetitive responses and distort learning in some respects (Shulman, 2005, p. 56). He cautions that they often persist “even when they begin to lose their utility, precisely because they are habits with few countervailing forces” (Shulman, 2005, p. 56). Because college-level design faculty rarely receive direct instruction in teaching, they tend to model teaching on the basis of their own education, thus reinforcing established pedagogical traditions.

Although the signature pedagogies of design education receive increasing attention from other fields as effective models for teaching and learning in a variety of subjects, there are associated values and practices that appear somewhat at odds with emerging paradigms in the profession. The prevailing model in the more than 2500 programs that teach communication design in the United States is one overwhelmingly characterized by an art-based, artifact-oriented paradigm, despite an increasing percentage of professional practice that falls outside this perspective. Even when programs add interaction design or service design to the course of study, the experiences leading to them and criteria for evaluating them generally reflect artifact-centered values.

Further, faculty typically frame the problems for students’ design investigation and often strip the assignment of any competing priorities that interfere with foregrounding a particular visual or technical principle. Norman describes the contribution of “design thinking” as “the ability to step back and reconceptualize the issues...as bringing a new framework upon which to view the world” (Norman, 2015b). Students, however, have very little influence over the scale or complexity at which problems are defined and as a result, in practice, often rely on professional problems to be fully articulated by the client. Recent design graduates frequently comment that the assignments at work are less interesting than student projects, not understanding that analyzing the problem — that is, recognizing the challenges and opportunities — is part of their responsibility as professionals. While some college programs require an undergraduate “thesis” or “capstone” project in which students exert some control over scope, instruction in the years leading up to these projects rarely asks them to position investigations within larger social, cultural, technological, or economic systems and settings. Graduate education in design generally follows a fine arts model of studio-based work with opportunities to pursue individual explorations but little instruction in framing researchable problems. Therefore, there are limits to the level of problem complexity, types of research, and diversity of analytical methods and tools through which students prepare for professional practice. In these courses that emphasize independent work, students often begin by identifying an artifact they would like to make or struggle for many weeks in defining a problem territory — typically social or technological — for which they have little knowledge and few skills for addressing systems-level concerns.

Both Dubberly and Norman emphasize the importance of understanding systems. The normal science of design education, however, often interprets “systems” as a set of interrelated physical or virtual artifacts: a visual identity system, an ensemble of publications, the organization of individual displays of website information. Dubberly calls these “nodes” without consideration for the larger networks or ecologies of which they are interdependent parts. In a 2014 presentation in Oslo, he advocated that systems literacy become part of any design education, outlined the vocabulary and content of systems thinking, and reminded the audience that systems theory was a regular part of the curriculum at the Ulm School of Design in the 1960s (Dubberly, 2014).

There is also a general assumption under the signature pedagogy that all students in the class need to be doing the same thing at the same time and that the nature of the class predetermines the format of a problem solution. For example, a web class must produce websites and a publication design class must produce printed publications. As a result, investigations often become solutions in search of problems. Of course, it is important that students learn about various ways through which people encounter information and achieve some technical competency; however, time in these media-centered projects is generally spent in analyzing the nature of the information rather than the nature of the problem.

The traditional design studio environment also tends to reward individual performance over collaborative behavior. When collaboration is present, it is frequently among students in the same discipline and at the same level of education, usually classmates in design. There appears to be little instruction in how to work in interdisciplinary groups and few grading strategies for evaluating the ability of students to collaborate. Group studio projects usually involve a hierarchical division of labor and faculty often evaluate collaborative outcomes by the degree of conflict experienced by the team in executing its work, rather than the effective use of expertise. Rarely is the content of general education coursework incorporated in design activities; study in the social sciences, for example, is *proximate* rather than *integrated* with studies in design.

Under the signature pedagogy, research is something done at the front of the design process and generally focuses on the subject matter of the investigation or technical means of production. Students rarely use technology for more than search engine retrievals and the generation of form. Rick Robinson describes his program in the College of Media, Communication, and Information as looking at recent interest in everything computational — computational biology, computational journalism, computational interaction research — and predicts future computational design research in which analyses of the “digital exhaust” of everyday life play an important role in understanding people and settings for design action (Robinson, 2016). He believes education needs to build on digital natives’ outlooks and skills, producing not only consumers of technology and media

but shapers as well. He sees an explosion of new research and practice as a likely scenario at the graduate level, especially among the schools that accept students with strong programming and computing technology backgrounds.

Norman is clear that the field still needs classically trained designers. In an article titled, *Why Design Education Must Change*, he asserts:

“We must not lose the wonderful, delightful components of design. The artistic side of design is critical: to provide objects, interactions, and services that delight as well as inform, that are joyful...We must not lose the special talents of designers to make our lives more pleasurable.” (Norman, 2010)

He cautions, however, that work on organizational structure and social problems involve complex issues and that designers are under-educated for the application of knowledge and procedures in the social and behavioral sciences. He describes designers as “thinking they know but don’t,” as believing in a “naïve psychology” that comes from observation as plausible explanations of behavior that have little or no basis in fact (Norman, 2010). Robinson concurs and longs for research that “displaces the watered-down ethnography that now dominates professional practice” (Robinson, 2016).

At the same time, Norman cites the dilemma of deciding exactly what courses to teach and what methods are particularly appropriate to design issues. He calls for a new form of design education, rather than a copy of the existing courses in the behavioral sciences, technology, and business. In other words, the problem of matching a design education to the changing world of design problems will not be solved by merely expanding the inventory of general education coursework, but through experimentation with coursework and methods that are particular to design.

This need for a design education that addresses new forms of practice also raises issues about the preparation of the professoriate. Not only does the field continually replicate the signature pedagogy through graduate teaching assistantships but also through communication design master’s curricula that are almost exclusively based on an artifact-driven paradigm. Not all programs need to have the same curricular focus for the field to address emerging paradigms; a few schools, such as Illinois Institute of Technology and Carnegie Mellon University, have defined different agendas with impressive results. But the nascent quality of doctoral study and the MFA as the terminal degree in the United States means that few faculty arrive research ready for their academic positions. And the frequent location of design programs in schools and departments of art make it difficult for faculty to develop alternate approaches to coursework and research in environments where standards are mismatched to emergent practices. These circumstances make it difficult for faculty to participate as equal partners in the interdisciplinary work through which new knowledge and methods

emerge. It will take deliberate efforts to explore new curricular strategies, not only on the part of institutions, but also in collaboration with the field of practice.

Design has much to contribute to the solution of contemporary problems but there is a narrow window of opportunity to demonstrate that the profession is prepared for the challenges presented by a complex world. Other disciplines are anxious to partner in work in projects of scale not easily addressed by single field. There is little evidence, however, that the “normal science” that dominates today’s design education can renew practice through graduates ready for these challenges. It is time to rethink how knowledge develops in design.

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## Author

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