trialogue on
design (of)

Elizabeth Dykstra-Erickson
Generic Media, Inc.

Wendy Mackay
INRIA

Jonathan Arnowitz
Cambridge Technology Partners

PERSPECTIVE

prologue

This year the SIGCHI Executive Committee appointed two new adjuncts to the Executive Committee: Elizabeth Dykstra-Erickson, Adjunct Chair for Design Policy, and Jonathan Arnowitz, Adjunct Chair for Design Production; both are professional designers who happen to work in high-tech startups, and both teach human factors and design. They helped the CHI2001 co-chairs bring a "design" focus to the CHI2001 conference through the inclusion of two venues: Interactive Video Posters and the Design Expo. The arduous task of defining these venues, encouraging submissions, engaging reviewers, and managing the complex task of production for both analog and digital media is an interesting story in itself. But what we find more interesting is the context and evolution of many conversations begun in mid-1999 that carry forward today on a fundamental topic: what is "design," and how do we define "designers?"

"...for many American designers, there was no conflict between market-oriented and sales-dominated consumerism and design that has been achieved rationally and which performs properly. Nevertheless, a generation of products have emerged ... that look nice but are difficult to use... Such ergonomic failures indicate that good performance remains more elusive than good looks." (Dormer, 1993)

Dormer's criticism of industrial design at the time of the second world war has certainly stood the test of time. Today more than ever, the design of interactive systems and consumerism work hand-in-hand to bring stylish and visually appealing designs to the market. But style alone is not design; design is much more. The field of HCI has boundless opportunities to illustrate to the
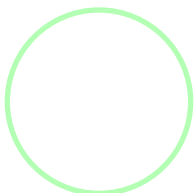
public and the software producing community that good design involves appeal in multiple (and sometimes invisible) dimensions; ease of use is an important measure of marketability, and design is a complex and thoughtful problem-solving activity.

theme

ACM/SIGCHI was created within the academic community by researchers, professors and students from diverse scientific and engineering disciplines. Today SIGCHI embraces this broad academic community and is beginning to get its arms around an equally broad practitioner community.
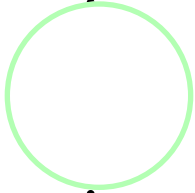
Human-computer interaction, as a field, is interdisciplinary. One of the things that makes our SIGCHI community complex and consequently makes defining "design" a hard problem is that these different academic traditions are based on different goals and value systems, with different methods and criteria for judging success. In our recent discussions and plans for increased awareness of "design" within the CHI community, we have found that the concept of "design" is so broad that usage of the term varies widely. Multiple perspectives are beneficial – having more than one approach makes our language and our communication richer – but it also means that we must learn to distinguish the subtle (and not so subtle) distinctions between these perspectives. We may use different terms to mean the same thing, or the same term to mean different things. We conclude that the word "design" has multiple meanings within CHI. A psychologist or ergonomist developing criteria for usability, an engineer defining an architecture for interactive systems, a graphic designer laying out a computer screen and an interaction designer developing an interaction model may all refer to themselves as "designers" and to their activities as "design." But they do not (and should not) mean the same thing.
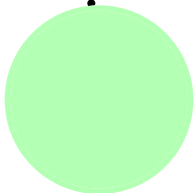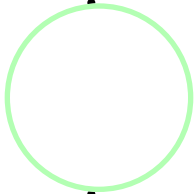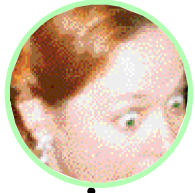
Motivation

We would like to raise the following for discussion, and we invite you to respond:

- How do we raise awareness of the fundamental differences in perspective among people who call themselves HCI designers?
- How can HCI, as a multidisciplinary field, benefit from this diversity?

We offer that a way of communicating across these different design perspectives is to avoid the use of "design" by itself and instead refer to the "design of" something.

The CHI community's foundation is the academic community, principally researchers, professors, and students in various disciplines which, taken together, provide the scientific basis for what we know and understand and seek to learn about humans and their interactions with computers. Computer science, cognitive psychology, anthropology, sociology, cybernetics, ergonomics, human factors, graphic communication, industrial design, linguistics, and library science are all academic areas likely to offer anything ranging from a lecture or two to a full degree program in HCI. Graduates of HCI programs often continue life-long academic pursuits in the domain. Some turn to industrial research firms and commercial product development companies, to conduct research or create the technology, interaction techniques, and user interfaces that the rest of the world use and take for granted. Those schooled in the community of interest that is HCI often remain a part of the CHI community and devote their talents and energies to diverse activities and events sponsored or co-sponsored by CHI. Often, however, practitioners (even very good ones) of design in software and development are self-taught, or taught in entirely other disciplines (such as the applied arts) and are unaware or, worse, dismissive of the CHI community from which they could learn much, and to which they could significantly contribute.

Academics are trained in the scientific method; they design and conduct experiments and carefully present their results, often in SIGCHI's publications, especially the conference Proceedings. Non-academic practitioners such as interaction designers, visual designers, and web architects sometimes come from these same academic roots, but also frequently have a background in applied arts, where process and approach are not essentially "scientific." While there exist multiple important distinctions among the academic components of the SIGCHI community – science is not engineering is not fine arts – there are also various perspectives and traditions in the practice of HCI in the industrial and consumer development environments. Scientists are trained to study pre-existing natural phenomena as objectively as possible, traversing back and forth between theory and empirical observation, focusing on the "why." Engineers are trained to produce solutions to technical problems, focusing on the "how." Practitioners, on the other hand, have widely diverse educational backgrounds, and their focus is on "what" – the production or crafting of HCI artifacts.

Human Interface labs and groups within software (and hardware) development companies vary widely in their practices and their organizational composition (see the rest of this issue, and last year's special issue on design for details of more than two dozen companies' and universities' approaches). Whether a designer has a graduate degree in HCI or a related field, or a completely different educational background, they are likely to find themselves struggling with the same issues from a similar perspective: good design makes a positive and significant difference in every day life. And "good design," when it happens, is nearly a miracle; it's not the design talent that dictates the design -– it is often politics, schedules, budgets, and personalities that greatly affect the end product.

Recently the CHI community leadership has recognized that, lo and behold, there aren't very many of these designers participating in CHI activities – and other societies are creating design-focused events that cross over into the HCI domain. Every year, to be sure, there are paper submissions to the CHI conference that reflect on a particular design; there are tutorials on how to be a consultant; there are workshops and Birds-of-a-Feather activities for designers. At the CHI99 conference, the Visual Design SIG drew more than 50 participants to discuss the topic of design within the CHI community, forming the genesis of the first annual interactions special issue on design. The CHI conference is primarily the domain of researchers; the conference proceedings are an important mechanism for academics to publish and receive professional recognition (and tenure) for their work. But what of practitioners? What does SIGCHI offer them? The CHI conference and its machinations were not designed to meet the needs of practicing designers; but can it? should it? and more importantly, how?

Doing 'design'

Don Norman, in his essay Design as Practiced (Winograd 1996) said "design as practiced is considerably different from design as idealized in academic discussions of 'good design.'" And we can trust that Don spoke from experience – he's had the opportunity to live in both worlds, from his career as an accomplished academic at the University of California San Diego, to his HCI leadership in industry. (In 1996 when his essay was written, Don was the Vice President of Apple Computer's Advanced Technology Group. Apple at that time had one of the most philosophically-saturated design communities in industrial software development.) In his essay Don did an excellent job of drawing out the complexities of 'doing design' in a production environment. Not the least of these complexities is culture. He mentioned that human interface designers are only a part of the design story; engineers, industrial designers, and marketers who develop product plans and requirements are also partners in what eventually emerges as 'design.' But after all, Don's view was as a vice president (and a psychologist), not as a designer. Psychologists, like other scientists, have
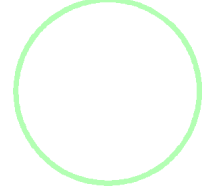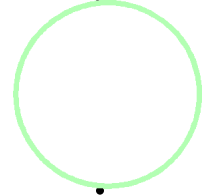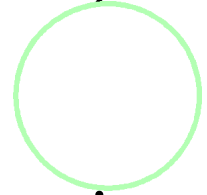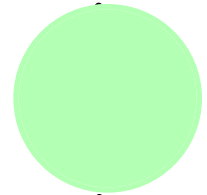
extensive training in how to critique and analyze, but not in how to produce new products. The designers who put pixels to screen, words to documentation, and plastics and mechanics to industrial design view their work as the creative problem-solving that brings technology and people together in a first salvo. Implementation then brings its necessary compromises that must be resolved before a product design is realized.
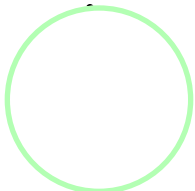
In her essay Design for People at Work (Winograd 1996), Susan Kuhn, a professor and designer from the University of Massachusetts at Lowell, focused her attention on conflicting values, goals, and assumptions that influence the design decisions that produce software artifacts. For Sarah, a strong proponent of sociotechnical design, designers not only need design skills – they also need to deeply understand the human component of HCI. She said further that designers should ascribe to a code of ethics that governs their behavior and encourages their reflection on the impact of their work. [The IEEE did, in fact, issue just such a code of ethics for engineers last year. But while its intentions are good and just, putting it into practice is nearly impossible, as it requires a fundamental change in – you guessed it, values, goals, and assumptions – not the sort of things that can be legislated.]
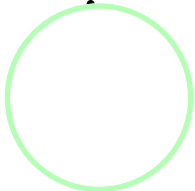
A third perspective on design is offered in the same volume by David Kelley of IDEO, a prominent design firm that produces both hard and "soft" design. In his interview, The Designer's Stance, David said "basically, design has to do with intuition;" it's messy; it requires the confidence to explore; and, importantly, that the word "design" is problematic in part because it has such broad usage. As a product designer, David relates that acquaintances who learn he is a designer tend to ask him for his opinion of the color of their drapes. He likes the broad usage of the term "design" but offers his own: design defines what 'it' ought to be, whereas engineering does it (implementation). He argues that design comprises three activities: understanding (whereby one tries to understand the
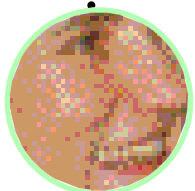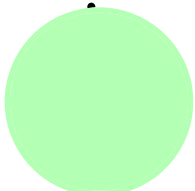
"mess"), observing (how a product will be used), and visualizing (deciding what 'it' is). This is an excellent, broad definition of the discipline of design, but unfortunately, we tend to take the word "visualize" too literally, and perhaps should use the word "realize" instead. Design, in a cognitive sense, and often in the case of interaction design, is not necessarily visual at all (e.g., audio design and voice-based systems don't generally have a visual component; gestural input and haptic feedback systems are just as "designed" as the visual components they complement). And herein lies a dilemma for the CHI community: "design" really isn't something that can be narrowly defined.

We propose, instead, that design which encompasses the many roles and skills required to produce human-computer interaction needs to be further qualified as a design "of" – a transitive verb, requiring an object: design of the user experience; design of the human interface; design of the visual layout, design of… you get the picture - er, concept. There is room at the CHI table, and indeed room for many more tables, as well, to seat a good many practitioners, researchers, and engineers who all 'do' design of, in one way or another. And it is time to encourage the conversation to develop between all designers of to share their tools, techniques, goals, values, and assumptions. Hence the continuing development of "design"-oriented venues at CHI, and our request to you to contribute your ideas, submit to these design venues, and volunteer to be a part of the conversation.

Making Sense (of Things)

Klaus Krippendorff in his essay On the Essential Contexts of Artifacts or on the Proposition that "Design is Making Sense (of Things)" (Margolin and Buchanan 1995) gives us the etymology of design : the Latin de + signare , meaning making something, distinguishing it by a sign, giving it significance, designating its relationship to other things, owners, users, or gods. And, based on this original meaning, Krippendorff says design is making sense (of things). Note, not making things; but making sense, of things.

Augusto Morello, in his essay Discovering Design Means (Re-)Discovering Users and Projects (Buchanan and Margolin 1995) defines design as "a complex of projectual acts intended to conceive products and services as a whole." He draws a distinction between two types of design. This distinction is conceivably at the heart of confusion over what a designer is and does. Analytic design (deprecated perhaps unfairly by Morello as not really design) is a process to research compromises in complicated structures; synthetic design is a process to manage complexity. In simpler terms, analytic design is solving problems; synthetic design is creating solutions in an ill-defined problem space. This echoes the distinction between the engineer's design as a finely crafted technical problem solution, and the user experience designer's design as a synthesis of human needs and solutions. It is this latter role with which we concern ourselves.

Engineers are trained to solve technical problems: however, they are rarely asked to question whether they are, in fact, solving the correct problem. Part of a designer's training is to include analysis of what the problem is as well as an analysis of what the solution might be.

The design of interactive systems isn't a well-established process that follows an accepted set of rules. It is, instead, a multi-dimensional activity with many context-dependent sets of heuristics, or guidelines. In pursuit of "good design" a human factors professional uses rules as a tool for critiquing existing products. A psychologist uses rules to reflect our understanding of how people process and use information. The designer is obliged to articulate the guidelines and explain why they are or aren't followed. Engineers who ask for design rules usually do so only in areas in which they are not trained, for example the guidelines for laying out text on the screen, assuming that they are absolute. An engineer would never expect to write code by mechanically following a set of absolute rules: programming is a creative task that includes many trade-offs and decisions based on strategic and other

concerns. Similarly, there is no fool-proof recipe for developing a good interactive system design. The process involves complicated tradeoffs requiring the collaboration of many different kinds of professionals.

Susan Fowler, in her interview in this issue, claims that 90% of interface design is done by engineers. Agreed! But why? In part because not every development group recognizes the need for a specialized designer; or, they recognize the need but can't afford the budget for design headcount; or, there simply aren't enough qualified designers out there for hire. (This doesn't necessarily mean that the Universities aren't graduating enough technically competent designers; experience is usually more desirable than a directly relevant educational qualification. The dearth of experienced designers tells us that companies with a public presence, particularly in the web domain where browser technology has had some difficulty settling into a standardized groove, have finally begun to acknowledge that usability matters. User experience matters. And there are people who specialize in just such endeavors.) Some engineers are exceedingly sensitive to users' needs, but many are far more engaged in their strong suit – programming – than in the finer points of user experience. It is for this community who care but really just need to get it done that Susan Fowler and Victor Stanwyck wrote their books. The "who" of design, ultimately, is not really relevant; it's the "what" that counts.
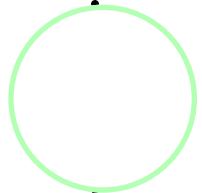
Nigel Cross, in his essay Discovering Design

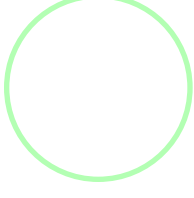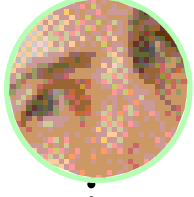**Psychologists/ Human Factors Professionials:** *analyze and critique what "is"*
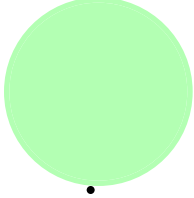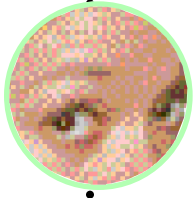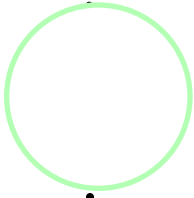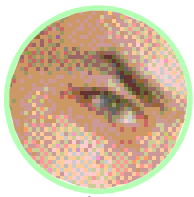
Engineers: *provide technical solutions to a defined problem*

Designers: *figure out the problem definition as part of the design problem*

Ability (Buchanan and Margolin, 1995) believes that there are common themes across designers. Creativity and intuition are important, problems and solutions are closely interwoven, and design progress is stimulated by sketching, drawing, and modelling. Cross summarizes the major aspects of what designers do as:
o produce novel, unexpected solutions
o tolerate uncertainty, working with incomplete information
o apply imagination and constructive forethought to practical problems
o use drawings and other modeling media as means of problem solving

And further, design ability comprises the abilities to:
o resolve ill-defined problems
o adopt solution-focusing strategies
o employ abductive/productive /appositional thinking
o use nonverbal, graphic/spatial modeling media

Cross suggests that design ability can be fostered. By Cross' estimation, design ability is a specialized form of intelligence, and design is not interdisciplinary, it is a discipline in its own right.

Now back to the CHI community. Is design its own discipline? Is it a sub-discipline within human-computer interaction?

In the balance of meaning and aesthetics, the patterns developed through meaning have a more discernable impact than those that are more focused on art. Much like Krippendorff, Mihaly Csikszentmihaly informs us that a design is a pattern that provides an ecology of meaning. In his essay Design and Order in Everyday Life in (Margolin and Buchanan 1995) Csikzentmihaly argues eloquently that data from his studies "suggest that (at least in our culture and in the present historical period) objects do not create order in the viewer's mind by embodying principles of visual order; they do so by helping the viewer struggle for the ordering of his or her own experience." Visual values are not determined by the viewer, they are determined by the culture, and by the meaning the viewer associates with the observed object. Design is not just art;

design is not graphic design or graphic layout; design is the production of meaning involving symbols (whether graphical or not), and it is a collectively determined meaning and familiarity that produces a sense of order. Design is the construction of the user experience, and it comes from many quarters in combination: the visual aspect, the interaction aspect, and positive transference from other experiences balanced against the cognitive load for learning anew. Is design its own discipline? Yes, and with many sub-disciplines itself. And who are the CHI designers? They are those who exercise their design ability to construct the experience of users and computers. Recognizing that "design" is an overly broad term, "design of" helps us discern those sub-disciplines that we should bring, pointedly, into the CHI discussion.

Under-represented in the CHI fold are interaction designers, graphic communication designers, industrial designers, and (not at all least) engineers who write user interface code and build their own windows, dialogs, menu structures, page layouts, alerts and notifications, icons, and other user interface elements. This is an entire community of skills and foci, and a strong designer has skills in more than one traditional academic category. Figure 1 (below) illustrates this community of skills by breaking down the development process into stages with different tools that can be employed in each. Where an academic is likely to focus on one cell of the matrix, a production designer must be conversant with many in order to deliver a design that will produce a successful product.

Let's get connected…

There are many design-oriented conferences; some that are in the art domain and not primarily HCI are of the "synthetic" (using Morello's term) variety and focus on interesting and sometimes improbable graphic ideas. The American Institute for Design this past November presented the Living Surfaces conference that addressed design-qua-HCI issues. The Designing Information Systems (DIS) conferences every two years focus on

design issues. Seminars and workshops on design for usability abound. So why bother introducing design themes to CHI?

We don't necessarily need to grow our membership. We don't necessarily need to become a different kind of community. But we have within our grasp the ability to bridge the gap between research and development, between well-funded and long-term engagement with research agendas and daily design activities that could be of terrific every day value to any one who uses a computer-driven device.

There are some voices within the CHI leadership who feel that designers are sketch-pad-totin' "creatives" with a rather low threshold for understanding (much less leveraging) research, and to attract them we need to create entertaining diversions. Entertainment – good! But certainly not at the expense of more thoughtful and thought-provoking fare, and not because we designers are too hands-on to sit still for a serious discussion.

There are other voices within the CHI leadership who feel that designers are highly visual, have a vastly different vocabulary than academics, and can't be held to high standards for exposing their work. And further, because "designers" are all graphic artists, it's not appropriate for them to be required to use words to explain their designs and rationales. But aesthetics are only part of user experience, and designers are not mute. We do need to create venues that are tailored for interactive experiences and visual demonstrations, but can we afford to dispense with design rationale because we feel we will reduce participation by requiring it? Professional designers' designs are seldom completely unchallenged. But the standards with regards to design work for reviewing and accepting conference submissions must differ in important ways from academic papers that are properly formulated, conducted, and reported experiments. Design submissions should be expected to explain their design rationale, to include the human in the discussion, and to hold up under inspection and questioning by peers. Designers are accustomed to

"design crits" – peer reviews critical of the approach, the execution, and the meaning of the design.

One problem in any multi-disciplinary field is to help people trained in one discipline to appreciate the complexities of another discipline. One of our challenges in teaching people to work as members of interdisciplinary teams is to appreciate and respect the training and skill brought by people from other backgrounds. We hold that SIGCHI has some work ahead of it, to foster more bridging activities and help develop HCI design as a broad and deep interactive discipline. In the coming months we hope to develop more SIGCHI awareness of how valuable the academic world is to practitioners, and how practitioners can be closely tied to research and development from academia. And most importantly we invite you, the reader, to tell us how you see our field.

References

Richard Buchanan and Victor Margolin, Eds. (1995). Discovering Design: Explorations in
Design Studies (University of Chicago Press: Chicago, IL).
Peter Dormer (1993). Design Since 1945 (Thames & Hudson: New York).
Victor Margolin and Richard Buchanan, Eds. (1995). The Idea of Design: A Design Issues Reader (MIT Press: Cambridge, MA).
Terry Winograd (1996). Bringing Design to Software (ACM Press: NY, NY).